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Text Part Number: 78EE117C99-1210344518
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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/PrematureChannelClosureException.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ClassLoaderClassResolver.java

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/LineBasedFrameDecoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/UnsupportedMessageTypeException.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ByteToMessageCodec.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/LineBasedFrameEncoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/base64/Base64Decoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/base64/Base64Encoder.java
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 */
/**
 * A decoder that splits the received {@link ByteBuf}s dynamically by the
 * value of the length field in the message. It is particularly useful when you
 * decode a binary message which has an integer header field that represents the
 * length of the message body or the whole message.
 *<p>
 *{@link LengthFieldBasedFrameDecoder} has many configuration parameters so
 *that it can decode any message with a length field, which is often seen in
 *proprietary client-server protocols. Here are some example that will give
 *you the basic idea on which option does what.
 *
 *<h3>2 bytes length field at offset 0, do not strip header</h3>
 *
 *The value of the length field in this example is <tt>12 (0x0C)</tt> which
 *represents the length of "HELLO, WORLD". By default, the decoder assumes
 *that the length field represents the number of the bytes that follows the
 *length field. Therefore, it can be decoded with the simplistic parameter
 *combination.
 *<pre>
 *<b>lengthFieldOffset</b>   = <b>0</b>
 *<b>lengthFieldLength</b>   = <b>2</b>
 *lengthAdjustment    = 0
 *initialBytesToStrip = 0 (= do not strip header)
 *</pre>

*BEFORE DECODE (14 bytes) AFTER DECODE (14 bytes)
*------------------------*------------------------*
* | Length | Actual Content |---| Length | Actual Content |
* | 0x000C | "HELLO, WORLD" |   | 0x000C | "HELLO, WORLD" |
*------------------------*------------------------*
</pre>
 *
*<h3>2 bytes length field at offset 0, strip header</h3>
 *
*Because we can get the length of the content by calling
*{@link ByteBuf#readableBytes()}, you might want to strip the length
*field by specifying <tt>initialBytesToStrip</tt>. In this example, we
*specified <tt>2</tt>, that is same with the length of the length field, to
*strip the first two bytes.


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* lengthFieldOffset = 0
* lengthFieldLength = 2
* lengthAdjustment = 0
* <b>initialBytesToStrip</b> = <b>2</b> (= the length of the Length field)
* "HELLO, WORLD"   
* BEFORE DECODE (14 bytes)    AFTER DECODE (12 bytes)
* +--------+----------------+      +----------------+
* | Length | Actual Content |----->| Actual Content |
* | 0x000C | "HELLO, WORLD" |      | "HELLO, WORLD" |
* +--------+----------------+      +----------------+
* </pre>

* In most cases, the length field represents the length of the message body only, as shown in the previous examples. However, in some protocols, the length field represents the length of the whole message, including the message header. In such a case, we specify a non-zero lengthAdjustment. Because the length value in this example message is always greater than the body length by <tt>2</tt>, we specify <tt>-2</tt> as lengthAdjustment for compensation.

* lengthFieldOffset = 0
* lengthFieldLength = 2
* lengthAdjustment = -2  (= the length of the Length field)
* initialBytesToStrip = 0
* BEFORE DECODE (14 bytes)    AFTER DECODE (14 bytes)
* +--------+----------------+      +--------+----------------+
* | Length | Actual Content |----->| Length | Actual Content |
* | 0x000E | "HELLO, WORLD" |      | 0x000E | "HELLO, WORLD" |

* The following message is a simple variation of the first example. An extra header value is prepended to the message. lengthAdjustment is zero again because the decoder always takes the length of the prepended data into account during frame length calculation.

* lengthFieldOffset = 2  (= the length of Header 1)
* lengthFieldLength = 3
* lengthAdjustment = 0
* initialBytesToStrip = 0
* BEFORE DECODE (14 bytes)    AFTER DECODE (14 bytes)
* +--------+----------------+      +--------+----------------+
* | Length | Actual Content |----->| Length | Actual Content |
* | 0x000E | "HELLO, WORLD" |      | 0x000E | "HELLO, WORLD" |
This is an advanced example that shows the case where there is an extra header between the length field and the message body. You have to specify a positive lengthAdjustment so that the decoder counts the extra header into the frame length calculation.

Before decode (17 bytes)

<table>
<thead>
<tr>
<th>Header 1</th>
<th>Length</th>
<th>Actual Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xCAFE</td>
<td>0x00000C</td>
<td>&quot;HELLO, WORLD&quot;</td>
</tr>
</tbody>
</table>

After decode (17 bytes)

<table>
<thead>
<tr>
<th>Header 1</th>
<th>Length</th>
<th>Actual Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xCAFE</td>
<td>0x00000C</td>
<td>&quot;HELLO, WORLD&quot;</td>
</tr>
</tbody>
</table>

This is a combination of all the examples above. There are the prepended header before the length field and the extra header after the length field.

Before decode (17 bytes)

<table>
<thead>
<tr>
<th>Length</th>
<th>Header 1</th>
<th>Actual Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00000C</td>
<td>0xCAFE</td>
<td>&quot;HELLO, WORLD&quot;</td>
</tr>
</tbody>
</table>

After decode (17 bytes)

<table>
<thead>
<tr>
<th>Header 1</th>
<th>Actual Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00000C</td>
<td>0x0xCAFE</td>
</tr>
</tbody>
</table>

3 bytes length field at the beginning of 5 bytes header, do not strip header.

2 bytes length field at offset 1 in the middle of 4 bytes header, strip the first header field and the length field.

This is a combination of all the examples above. There are the prepended header before the length field and the extra header after the length field.

Before decode (16 bytes)

<table>
<thead>
<tr>
<th>HDR1</th>
<th>Length</th>
<th>HDR2</th>
<th>Actual Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xCA</td>
<td>0x000C</td>
<td>0xFE</td>
<td>&quot;HELLO, WORLD&quot;</td>
</tr>
</tbody>
</table>

After decode (13 bytes)

<table>
<thead>
<tr>
<th>HDR2</th>
<th>Actual Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xFE</td>
<td>&quot;HELLO, WORLD&quot;</td>
</tr>
</tbody>
</table>
2 bytes length field at offset 1 in the middle of 4 bytes header,
strip the first header field and the length field, the length field
represents the length of the whole message.

Let's give another twist to the previous example. The only difference from
the previous example is that the length field represents the length of the
whole message instead of the message body, just like the third example.
We have to count the length of HDR1 and Length into <tt>lengthAdjustment</tt>.
Please note that we don't need to take the length of HDR2 into account
because the length field already includes the whole header length.

<pre>
  lengthFieldOffset = 1  
  lengthFieldLength = 2  
  initialBytesToStrip = 3  
  lengthFieldOffset   =  1  
  lengthFieldLength   =  2  
  lengthAdjustment   = -3  (= the length of HDR1 + LEN, negative)  
  initialBytesToStrip =  3  
</pre>

BEFORE DECODE (16 bytes)                       AFTER DECODE (13 bytes)
+----------------+----------------+------+
| HDR1 | Length | HDR2 | Actual Content |
+----------------+----------------+------+
| 0xCA | 0x0010 | 0xFE | "HELLO, WORLD" |
+----------------+----------------+------+

@see LengthFieldPrepender
*/

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  /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources.jar/io/netty/handler/codec/LengthFieldBasedFrameDecoder.java
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*/
/**
 * Enumeration of supported Base64 dialects.
 * <p>
 * The internal lookup tables in this class has been derived from
 * <a href="http://iharder.sourceforge.net/current/java/base64/">Robert Harder's Public Domain
 * Base64 Encoder/Decoder</a>.
 */

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jar/io/netty/handler/codec/CharSequenceValueConverter.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
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/**
* Utility class for {@link ByteBuf} that encodes and decodes to and from
* <a href="http://en.wikipedia.org/wiki/Base64">Base64</a> notation.
* <p>
* The encoding and decoding algorithm in this class has been derived from
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* Base64 Encoder/Decoder.</p>
*/

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1.14 ssl-client 1.32.1-r6

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1.16 netbase 5.4

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1.17 six 1.16.0

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immerrrr again
Alexander Artemenko
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Lee Ball
Ben Bariteau
Ned Batchelder
Wouter Bolsterlee
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* /opt/cola/permits/1151699853_1617964999.68/0/camel-jaxb-3-0-0-sources-jar/org/apache/camel/converter/jaxb/NamespacePrefixMapperFactory.java
* /opt/cola/permits/1151699853_1617964999.68/0/camel-jaxb-3-0-0-sources-jar/org/apache/camel/converter/jaxb/NoopXmlStreamWriterWrapper.java
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class=org.apache.camel.converter.jaxb.FallbackTypeConverterLoader

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* /opt/cola/permits/1151699853_1617964999.68/0/camel-jaxb-3-0-0-sources-jar/META-INF/services/org/apache/camel/TypeConverterLoader

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* /opt/cola/permits/1151699853_1617964999.68/0/camel-jaxb-3.0.0-sources-jar/META-INF/maven/org.apache.camel/camel-jaxb/pom.xml

1.20 controller-runtime v0.7.2

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  jar/io/netty/handler/codec/socksx/v4/Socks4ServerDecoder.java
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  jar/io/netty/handler/codec/socks/InitRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
  jar/io/netty/handler/codec/socks/SocksMessage.java
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  jar/io/netty/handler/codec/socks/SocksAuthRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
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  jar/io/netty/handler/codec/socks/SocksAuthRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
  jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthResponse.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
  jar/io/netty/handler/codec/socks/SocksMessage.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
  jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
  jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
  jar/io/netty/handler/codec/socks/SocksCmdRequestDecoder.java
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  jar/io/netty/handler/codec/socksx/v5/Socks5InitialRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
  jar/io/netty/handler/codec/socksx/v5/Socks5InitialRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
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1.23 gosnmp v1.29.0

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1.24 xxhash v2.1.1

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1.25 hibernate-validator 5.0.1.Final
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1.26 protobuf v1.25.0

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Go support for Protocol Buffers - Google's data interchange format

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Anton Povarov <anton.povarov@gmail.com>
Brian Goff <cpuguy83@gmail.com>
Clayton Coleman <ccooleman@redhat.com>
Denis Smirnov <denis.smirnov.91@gmail.com>
DongYun Kang <ceram1000@gmail.com>
Dwayne Schultz <dshultz@pivotal.io>
Georg Apitz <gapitz@pivotal.io>
Gustav Paul <gustav.paul@gmail.com>
Johan Brandhorst <johan.brandhorst@gmail.com>
John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
Laurent <laurent@adyoulike.com>
Patrick Lee <patrick@dropbox.com>
Peter Edge <peter.edge@gmail.com>
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Sam Nguyen <sam.nguyen@sendgrid.com>
Sergio Arbeo <serabe@gmail.com>
Stephen J Day <stephen.day@docker.com>
Tamir Duberstein <tamird@gmail.com>
Todd Eisenberger <teisenberger@dropbox.com>
Tormod Erevik Lea <tormodlea@gmail.com>
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1.27 proto-google-common-protos 2.0.1

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* /opt/cola/permits/1127519988_1611825907.91/0/proto-google-common-protos-2-0-1-jar/google/api/http.proto
* /opt/cola/permits/1127519988_1611825907.91/0/proto-google-common-protos-2-0-1-jar/google/api/context.proto
* /opt/cola/permits/1127519988_1611825907.91/0/proto-google-common-protos-2-0-1-jar/google/api/quota.proto
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  jar/google/api/launch_stage.proto

# 1.28 annotations 4.1.1.4

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* /opt/cola/permits/1135864606_1613618178.74/0/annotations-4-1-1-4-sources-1-
  jar/android/annotation/SuppressLint.java
* /opt/cola/permits/1135864606_1613618178.74/0/annotations-4-1-1-4-sources-1-
  jar/android/annotation/TargetApi.java

# 1.29 x-crypto v0.0.0-20200220183623-bac4c82f6975

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1.30 gax-go v2.0.5

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1.3.1 firebase-performance 3.12.0

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This file contains a list of people who have made large contributions to the public version of Protocol Buffers.

Original Protocol Buffers design and implementation:
Sanjay Ghemawat <sanjay@google.com>
Jeff Dean <jeff@google.com>
Daniel Dulitz <daniel@google.com>
Craig Silverstein
Paul Haahr <haahr@google.com>
Corey Anderson <corin@google.com>
(and many others)

Proto2 C++ and Java primary author:
Kenton Varda <kenton@google.com>

Proto2 Python primary authors:
Will Robinson <robinson@google.com>
Petar Petrov <petar@google.com>

Java Nano primary authors:
Brian Duff <bduff@google.com>
Tom Chao <chaot@google.com>
Max Cai <maxtroy@google.com>
Ulas Kirazci <ulas@google.com>

Large code contributions:
Jason Hsueh <jasonh@google.com>
Joseph Schorr <jschorr@google.com>
Wenbo Zhu <wenboz@google.com>

Large quantity of code reviews:
Scott Bruce <sbruce@google.com>
Frank Yellin
Neal Norwitz <nnorwitz@google.com>
Jeffrey Yasskin <jyasskin@google.com>
Ambrose Feinstein <ambrose@google.com>

Documentation:
Lisa Carey <lcarey@google.com>

Maven packaging:
Gregory Kick <gak@google.com>

Patch contributors:
Kevin Ko <kevin.s.ko@gmail.com>
* Small patch to handle trailing slashes in --proto_path flag.
Johan Euphrosine <proppy@aminche.com>
* Small patch to fix Python CallMethod().
Ulrich Kunitz <kune@deine-taler.de>
* Small optimizations to Python serialization.
Leandro Lucarella <llucax@gmail.com>
* VI syntax highlighting tweaks.
* Fix compiler to not make output executable.
Dilip Joseph <dilip.antony.joseph@gmail.com>
* Heuristic detection of sub-messages when printing unknown fields in
text format.
Brian Atkinson <snairb774@gmail.com>
* Added @Override annotation to generated Java code where appropriate.
Vincent Choinire <Choiniere.Vincent@hydro.qc.ca>
* Tru64 support.
Monty Taylor <monty.taylor@gmail.com>
* Solaris 10 + Sun Studio fixes.
Alek Storm <alek.storm@gmail.com>
* Slicing support for repeated scalar fields for the Python API.
Oleg Smolsky <oleg.smolsky@gmail.com>
* MS Visual Studio error format option.
* Detect unordered_map in stl_hash.m4.
Brian Olson <brianolson@google.com>
* gzip/zlib I/O support.
Michael Poole <mdpoole@troilus.org>
* Fixed warnings about generated constructors not explicitly initializing
  all fields (only present with certain compiler settings).
* Added generation of field number constants.
Wink Saville <wink@gmail.com>
* Fixed initialization ordering problem in logging code.
Will Pierce <willp@nuclei.com>
* Small patch improving performance of in Python serialization.
Alexandre Vassalotti <alexandre@peadrop.com>
* Emacs mode for Protocol Buffers (editors/protobuf-mode.el).
Scott Stafford <scott.stafford@gmail.com>
* Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.
Alexander Melnikov <alm@sibmail.ru>
* HPUX support.
Oliver Jowett <oliver.jowett@gmail.com>
* Detect whether zlib is new enough in configure script.
* Fixes for Solaris 10 32/64-bit confusion.
Evan Jones <evanj@mit.edu>
* Optimize Java serialization code when writing a small message to a stream.
* Optimize Java serialization of strings so that UTF-8 encoding happens only
  once per string per serialization call.
* Clean up some Java warnings.
* Fix bug with permanent callbacks that delete themselves when run.
Michael Kucharski <m.kucharski@gmail.com>
* Added CodedInputStream.getTotalBytesRead().
Kacper Kowalik <xarthisius.kk@gmail.com>
* Fixed m4/acx_pthread.m4 problem for some Linux distributions.
William Orr <will@worrbase.com>
* Fixed detection of sched_yield on Solaris.
* Added atomicops for Solaris
Andrew Paprocki <andrew@ishiboo.com>
1.32 go-retryablehttp 0.5.4

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1.38 go-openapi-swag v0.19.14
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1.40 c-robinson-iplib v0.3.1

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1.41 json-iterator-go v1.1.8

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1.42 kasa-storageserver v0.0.0

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```yaml
{{- $global := default (dict) $.Values.global }}
{{- $dataPlaneNamespace := include "aegis.namespace.dataPlaneNamespace" (list $) }}
{{- if ($global.platform | eq "azure") }}
  {{ include "kasa.licensebroker.storageAzureDisk" (list $ "azure-disk-sc") }}
{{- else if ($global.platform | ne "aws") | and ($global.platform | ne "eks") }}
  {{ include "kasa.licensebroker.storageLocal" (list $ "broker") }}
{{- end }}
---
```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: {{ template "aegis.metadata.fullname" (list $ "server") }}
  labels: {{ include "aegis.metadata.standardLabels" (list $) | nindent 4 }}
spec:
  accessModes:
    - ReadWriteOnce
  volumeMode: Filesystem

  {{- if ($global.platform | eq "aws") | or ($global.platform | eq "eks") }}
    storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */}}
  {{- else if ($global.platform | eq "azure") }}
    storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc") }} {{/* example yaml has 'managed-csi' as the name which is vague af */}}
  {{- else if ($global.platform | eq "kind") }}
    storageClassName: "standard" {{/* Kind has a default 'standard' StorageClass so reusing it here */}}
  {{- else }}
    storageClassName: {{ include "aegis.metadata.fullname" (list $ "broker") }}
  {{- end }}
  resources:
    storage: {{ $.Values.licenseServerStorage }}

---

{{- define "kasa.licensebroker.storageLocal" -}}
  {{- $ := first . -}}
  {{- $storageName := last . -}}
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  {{ template "aegis.metadata.standard" (list $ $storageName) }}
  provisioner: kubernetes.io/no-provisioner
  reclaimPolicy: Delete
  volumeBindingMode: WaitForFirstConsumer
  {{- end -}}

---

{{- define "kasa.licensebroker.storageAzureDisk" -}}
  {{- $ := first . -}}
  {{- $storageName := last . -}}
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  {{ template "aegis.metadata.standard" (list $ $storageName) }}
  provisioner: disk.csi.azure.com
  parameters:
  reclaimPolicy: Delete
Open Source Used In kASA v1.5

volumeBindingMode: WaitForFirstConsumer
allowVolumeExpansion: true

{{- end -}}
{{- define "kasa.validate.eula" -}}
{{ $ := first . -}}
{{ $acceptValues := list "yes" "agree" }}
{{ if $.Release.IsInstall | and (not ($acceptValues | has $.Values.global.acceptEULA)) -}}
{{- $.Files.Get "eula/EULA.txt" }}
{{- end -}}
{{- end -}}

package services_test

import (
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

package listeners_test

import (  
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensing "css.cisco.com/licensing/client-agent"
  "github.com/golang/mock/gomock"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
  "k8s.io/client-go/tools/record"
  "signs.k8s.io/controller-runtime/pkg/client"
  "signs.k8s.io/controller-runtime/pkg/client/fake"
  "signs.k8s.io/controller-runtime/pkg/event"
  logf "signs.k8s.io/controller-runtime/pkg/log"
var _ = Describe("Deregistration Listener Test", func() {

    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

    var listener licensing.DeregistrationListener
    var fakeClient client.Client
    var mockCtrl *gomock.Controller
    var recorder *record.FakeRecorder

    var smartLicense *v1.SmartLicense
    var notifier chan event.GenericEvent

   BeforeEach(func() {
        smartLicense = &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
            Spec: v1.SmartLicenseSpec{
                Action:      v1.Register,
                LicenseType: licenseType,
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Registered,
                LicenseState: v1.InCompliance,
                ErrorReason: "",
            },
        }
        mockCtrl = gomock.NewController(GinkgoT())
        fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
        recorder = record.NewFakeRecorder(1024)
        notifier = make(chan event.GenericEvent, 10)

        listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger{}, recorder, notifier)
    })

    AfterEach(func() {
        mockCtrl.Finish()
    })

    It("should update SmartLicense status on deregistration event", func() {
        listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")

        Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
        Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
    })

})
Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
Expect(smartLicense.Status>ErrorReason).Should(Equal("License Server automatically deregistered the platform. Reason: something happened"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response to out-of-band event from License Server")))
Expect(notifier).Should(Receive(&event.GenericEvent{
    Object: smartLicense,
}))
}
}
package controllers_test

import (  
    "context"  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
    "css.cisco.com/kasa/license-broker/controllers"  
    "css.cisco.com/kasa/license-broker/controllers/mocks"  
    "github.com/golang/mock/gomock"  
    . "github.com/onsi/ginkgo"  
    . "github.com/onsi/gomega"  
    appsv1 "k8s.io/api/apps/v1"  
    autoscalingv1 "k8s.io/api/autoscaling/v1"  
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
    "k8s.io/apimachinery/pkg/apis"  
    "k8s.io/client-go/kubernetes"  
    "k8s.io/client-go/tools"  
    "k8s.io/utils/pointer"  
    ctrl "sigs.k8s.io/controller-runtime"  
    "sigs.k8s.io/controller-runtime/pkg/client"  
    "sigs.k8s.io/controller-runtime/pkg/client/fake"  
    logf "sigs.k8s.io/controller-runtime/pkg/log"  
)

const (  
    epHpaName = "epHPA"  
    initialHPAMaxReplicas int32 = 3  
)

var _ = Describe("HPA License Controller Test", func() {

    hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}
    var (  
        reconciler *controllers.HPALicenseReconciler  
        fakeClient client.Client  
        mockCtrl *gomock.Controller  
        hpa *autoscalingv1.HorizontalPodAutoscaler  
    )
BeforeEach(func) {
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    recorder = record.NewFakeRecorder(1024)
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)
    reconciler = &controllers.HPALicenseReconciler{
        Client: fakeClient,
        Log: logf.NullLogger{},
        Recorder: recorder,
        ReplicasCalculator: replicasCalculatorMock,
    }
    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1.SmartLicenseSpec{
            Action:           v1.Register,
            LicenseType:      licenseType,
            MinLicenseCount:  &minLicenseCount,
            MaxLicenseCount:  &maxLicenseCount,
            ScalingFactor:    &scalingFactor,
        },
        Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
    }
    Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())
    deployment := &appsv1.Deployment{
        ObjectMeta: metav1.ObjectMeta{
            Name: "ep",
            Namespace: defaultNs,
        },
        Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
    }
    Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())
    hpa = &autoscalingv1.HorizontalPodAutoscaler{
        ObjectMeta: metav1.ObjectMeta{
            Name: epHpaName,
            Namespace: defaultNs,
        },
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
MaxReplicas: initialHPAMaxReplicas,

Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())
}

AfterEach(func() {
Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
})

It("should skip if HPA does not exist", func() {
Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
})

It("should skip if HPA SmartLicense does not exist", func() {
Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if SmartLicense is in deregistered state", func() {
smartLicense.Status.RegistrationState = v1.Deregistered
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if registered SmartLicense has enough licenses", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(initialHPAMaxReplicas, nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
})
Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Spec.MinReplicas).Should(BeNil())
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))
})

It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

hpa.Spec.MaxReplicas = 10
hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(*hpa.Spec.MinReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas, MinReplicas] to 2 ")))
})

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
smartLicense2 := &v1.SmartLicense{
    Spec:    smartLicense.Spec,
}
Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())
smartLicense3 := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
    Spec:    smartLicense.Spec,
    Status:  v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
}
Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))

---
apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
    annotations:
        controller-gen.kubebuilder.io/version: v0.4.1
    creationTimestamp: null
    name: smartlicenses.sfcn.cisco.com
spec:
    group: sfcn.cisco.com
    names:
        kind: SmartLicense
        listKind: SmartLicenseList
        plural: smartlicenses
        singular: smartlicense
    scope: Namespaced
    versions:
        - additionalPrinterColumns:
            - jsonPath: .metadata.creationTimestamp
              name: Age
              type: date
            - jsonPath: .status.registrationState
name: Registration State
type: string
- jsonPath: .status.licenseState
name: License State
type: string
- jsonPath: .status.licenseNumber
name: License Number
type: integer
- jsonPath: .status.accountDomain
name: Domain
priority: 1
type: string
- jsonPath: .status.accountName
name: Account
priority: 1
type: string
name: v1

schema:
openAPIV3Schema:
  description: SmartLicense is the Schema for the smartlicenses API
  properties:
    apiVersion:
      description: 'APIVersion defines the versioned schema of this representation
      of an object. Servers should convert recognized schemas to the latest
      internal value, and may reject unrecognized values. More info:
      https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#resources'
type: string
    kind:
      description: 'Kind is a string value representing the REST resource this
      object represents. Servers may infer this from the endpoint the client
      submits requests to. Cannot be updated. In CamelCase. More info:
      https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'
type: string
  metadata:
type: object
  spec:
    description: SmartLicenseSpec defines the desired state of SmartLicense
    properties:
      action:
        description: Action is the desired state of the Smart Agent license
        registration.
        enum:
        - REGISTER
        - DEREGISTER
type: string
      licenseType:
        description: LicenseType defines the type of license to request/release,
        usually the SKU of the license. The default value is a SFW license
tag being able to handle 1vCPU.
tag: string
type: string

maxLicenseCount:
  description: MaxLicenseCount is an optional value, the maximum number
  of licenses SFCN can reserve for the product. The default value
  is equal to MinLicenseCount.
  format: int32
  type: integer

minLicenseCount:
  description: MinLicenseCount is a minimum number of licenses SFCN
  reserves for the product. The default value is 1.
  format: int32
  type: integer

calcingFactor:
  description: ScalingFactor is a factor to increment or decrement the
  number of licenses SFCN reserves for the product when scaling up
  or down. The default value is 1.
  format: int32
  type: integer

scalingRef:
  description: ScalingRef is a reference to the scaled resource managing
  Enforcement Point pods. Deployment and HPA resources are supported.
  properties:
    apiVersion:
      description: API version of the referent
      type: string
    kind:
      description: 'Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-
architecture/api-conventions.md#types-kinds”
      type: string
    name:
      description: Name is unique within a namespace to reference a
      secret resource.
      type: string
  required:
    - kind
    - name
  type: object
tokenSecret:
  description: TokenSecret is a reference to a Secret that holds `token`
  for Cisco Software Central authentication.
  properties:
    namespace:
      description: Namespace defines the space within which the secret
      name must be unique.
type: string

- tokenSecret

type: object

required:

status:

description: SmartLicenseStatus defines the observed state of SmartLicense

properties:

accountDomain:

description: AccountDomain is the account domain in Cisco Software

Central.

type: string

accountName:

description: AccountName is the name of the virtual account in Cisco

Software Central.

type: string

contextId:

description: ContextId is an internal identifier uniquely defining

platform registration.

type: string

coresPerLicense:

description: CoresPerLicense is number of cores per one requested

LicenseType.

format: int32

type: integer

errorReason:

description: ErrorReason specifies the error due to which the the

SFCN product was not registered in Cisco Software Central.

type: string

estimatedMaxReplicas:

description: EstimatedMaxReplicas is maximum count of ep pod replicas.

It is calculated based on MaxLicenseCount and CoresPerLicense.

format: int32

type: integer

exportControlled:

description: ExportControlled is a flag indicating whether the export-controlled

functionality was enabled while generating the token on Cisco Software

Central. If true, this indicates a Strong Encryption (3DES/AES)

license.

type: boolean

licenseNumber:

description: LicenseNumber is the amount of licenses SFCN has registered

for the product at particular time.

format: int32

type: integer

licenseState:

description: LicenseState is the state of the reserved licenses.

enum:
- PENDING
- UNLICENSED
- IN_COMPLIANCE
- OUT_OF_COMPLIANCE
- OVERAGE
type: string

registrationState:
  description: RegistrationState is the registration status of the SFCN
  product in Cisco Software Central.
enum:
  - PENDING
  - REGISTERED
  - REGISTRATION_FAILED
  - Deregistered
  - Deregistration_FAILED
type: string
type: object
type: object
served: true
storage: true
subresources:
  status: {}
status:
  acceptedNames:
    kind: ""
    plural: ""
    conditions: []
  storedVersions: []
FROM dockerhub.cisco.com/asac-dev-docker/css-golang:v1.16 as builder

WORKDIR /workspace
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"]
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates/"]

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ../pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api/ api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13

WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot
USER nonroot
ENTRYPOINT ["manager"]

---
title: "Monitoring Status"
weight: 3
description: >
Learn how to monitor the ASA operational status and critical license events

### Smart License Status

When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

```yaml {linenos=table,hl_lines=["18-25"]}
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
tokenSecret:
  name: cssm-token
  namespace: cisco-systems
licenseType: "" # omitted to use default value
```
### ASA Licensing State

The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are:

* `AwaitingLicense` (Warning)
* `LicenseCommunicationFailed` (Warning)
* `LicenseGranted` (Normal)
* `LicenseVerified` (Normal)
* `LicenseRevoked` (Warning)

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.

When the ASA comes up successfully, the Manager tries to obtain a license for the [number of cores](#core-calculation) the Pod uses. During this period, the Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For instance, when the ASA came up for the first time and operating at reduced throughput, this event would read something like:

```markdown
Warning     AwaitingLicense     ASA operating at reduced throughput because it was not licensed, requesting for a new license
```

And, if the ASA came up and operating at full potential, then:

```markdown
Warning     AwaitingLicense     ASA operating at full potential but not licensed, requesting for a new license
```
The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could not communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a LicenseCommunicationFailed warning event with the reasoning behind the failure.

```
Warning    LicenseCommunicationFailed    ASA operating at reduced throughput because of license communication failure
```

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the license granted to it and on successful verification, emits a `LicenseVerified` event.

```
Normal    LicenseGranted    successfully obtained a license from the server
Normal    LicenseVerified    ASA operating at full potential, license status verified
```

It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the licenses have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale down the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager emits a `LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be granted a license, or it will be removed by Kubernetes because the controller scaled down the cluster.

```
Warning    LicenseRevoked    ASA operating at reduced throughput because the server revoked its license, retrying to acquire
```

### Unauthorized Requests

License requests may be granted by the License Server to any pod capable of requesting a licensing, however the License Controller sees a grant as authorized only if that pod belonged to a Deployment/HPA specified in one of the Smart License resources otherwise it considers that pod as unauthorized and takes action to delete that pod and set the number of replicas to 0 on its owners to prevent the Kubernetes from creating such pods. The License Controller will emit an event on the pod that
was deleted specifying the reason behind it. It then releases the license back to the License Server after the pod is killed.

```markdown
Warning PodDeleted Deleted Pod as it requested a license but does not belong to any licensed EP deployment. Please, check SmartLicense resources to update licensing configuration.
```

This might happen when you have an Enforcer deployment but did not specify that Deployment in a Smart License resource in the same namespace. To remedy that, simply add a Smart License resource with the desired configuration and specify the Deployment of the Enforcer in it.

### Identifying Licensed Pods

All licensed Deployments specified via the Smart License resources, and their Pods that have been granted a license will include a label `sfcn.cisco.com/license-holder=true`. You should be able to use `kubectl` to list all the pods in a namespace that are having this label to identify the pods currently holding a license.

```go
package controllers_test
    autoscalingV1 "k8s.io/api-autoscaling/v1"
    coreV1 "k8s.io/api/core/v1"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
```
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent

const (
    epPodName = "epPod"
    redirectorEpPodName = "redirectorEpPod"
    defaultServiceRole = "default"
    vpnRedirectorServiceRole = "vpnredirector"
    deploymentName2 = "test-deployment-2"
    secondDefaultEpDeploymentName = "secondDefaultEpDeployment"
    redirectorEpDeploymentName = "vpnRedirectorEpDeployment"
    initialRedirectorDeploymentReplicas int32 = 2
)

var controllerTrue = true

var _ = Describe("Pod License Controller Test", func() {

    podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}
    redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}
    deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
    redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpDeploymentName}

    var reconciler *controllers.PodLicenseReconciler
    var fakeClient client.Client
    var mockCtrl *gomock.Controller
    var recorder *record.FakeRecorder

    var licensingClient *mocks.MockLicensingClient
    var allotmentService *mocks.MockAllotmentService

    var pod *corev1.Pod
    var deployment *appsv1.Deployment
    var redirectorPod *corev1.Pod
    var redirectorDeployment *appsv1.Deployment
    var smartLicense *v1.SmartLicense

    BeforeEach(func() {

        pod = &corev1.Pod{
            ObjectMeta: metav1.ObjectMeta{
                Name: epPodName,
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{
                    metav1.OwnerReference{
                        Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue,
                    },
                },
            },
        }
    })
replicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "epReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{
            {Kind: "Deployment", Name: epDeploymentName, Controller: &controllerTrue},
        },
    },
}

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        epDeploymentName,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}
secondDefaultDeployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        secondDefaultEpDeploymentName,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

redirectorPod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name:            redirectorEpPodName,
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{
            {Kind: "ReplicaSet", Name: "redirectorEpReplicaSet", Controller: &controllerTrue},
        },
    },
}

redirectorReplicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "redirectorEpReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{
            {Kind: "Deployment", Name: redirectorEpDeploymentName, Controller: &controllerTrue},
        },
    },
}
redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: redirectorEpDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{
            controllers.ServiceRoleLabel: vpnRedirectorServiceRole,
        },
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
    },
    Spec: appsv1.DeploymentSpec{
        Replicas: &redirectorReplicas,
    }
}

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{
        Name: smartLicenseName,
        Namespace: defaultNs,
    },
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
        ScalingRef: autoscalingv1.CrossVersionObjectReference{
            Kind: "Deployment",
            Name: epDeploymentName,
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Registered,
        },
    }
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(deployment, replicaSet, pod, secondDefaultDeployment, redirectorDeployment, redirectorReplicaSet, redirectorPod, smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
reconciler = &controllers.PodLicenseReconciler{
    Client: fakeClient,
    LicensingClient: licensingClient,
    Log: logf.NullLogger{},
    Recorder: recorder,
}

AfterEach(func() {
    mockCtrl.Finish()
})
It("should add the licensing label for licensed pod", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
    Expect(pod.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
})

It("should ensure one replica per service role without SmartLicense", func() {
    // initiate reconcile for the pod which is part of deployment with vpnredirector service role and without smart license
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
    Expect(err).To(BeNil())

    // expect the deployment to be scaled to 1 and mark it as trial license holder
    redirDeployment := appsv1.Deployment{}
    Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
    Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))
    Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

    // create another deployment with vpnredirector role
    redirectorEpPodName2 := "redirectorEpPod2"
    redirectorEpDeploymentName2 := "redirectorEpDeployment2"
    replicaSetName2 := "redirectorEpReplicaSet2"
    redirectorPod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name: redirectorEpPodName2,
        }
    }

    // expect another deployment to be scaled to 1 and mark it as trial license holder
    redirectorEpDeployment := appsv1.Deployment{}
    Expect(fakeClient.Get(context.TODO(), redirectorEpDeploymentNsName, &redirectorEpDeployment)).To(Succeed())
    Expect(*redirectorEpDeployment.Spec.Replicas).Should(Equal(int32(1)))
    Expect(redirectorEpDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(redirectorEpDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(redirectorEpDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorEpDeploymentReplicas))))
})
namespace: defaultNs,
ownerReferences: []metav1.OwnerReference{{kind: "ReplicaSet", name: replicaSetName2, controller: &controllerTrue}},
}
Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
redirectorReplicaSet2 := &appsv1.ReplicaSet{
    objectMeta: metav1.ObjectMeta{
        name: replicaSetName2,
        namespace: defaultNs,
        ownerReferences: []metav1.OwnerReference{{kind: "Deployment", name: redirectorEpDeploymentName2, controller: &controllerTrue}},
    },
    spec: appsv1.ReplicaSetSpec{replicas: &initialRedirector2Replicas},
}
Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
initialRedirector2Replicas := int32(3)
redirectorDeployment2 := &appsv1.Deployment{
    objectMeta: metav1.ObjectMeta{
        name: redirectorEpDeploymentName2,
        namespace: defaultNs,
        labels: map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
        annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
    },
    spec: appsv1.DeploymentSpec{replicas: &initialRedirector2Replicas},
}
Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

// initiate reconcile for the pod which is part of another deployment with vpnRedirector service role and without
smart license
redirector2PodNsName := types.NamespacedName{Name: redirectorEpPodName2, namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirector2PodNsName.String()}).Return(nil, nil)
_, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
Expect(err).To(BeNil())

// expect the second vpnRedirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2, namespace: defaultNs}, &redirDeployment2)).To(Succeed())
Expect(*redirDeployment2.Spec.Replicas).Should(Equal(int32(0)))
Expect(redirDeployment2.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(redirDeployment2.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment2.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirector2Replicas))))
}
Context("on pod removal", func() {
It("should release licensing allotments", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
  allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
    ContextId: "fooBar",
    Tenant:    &licensing.Tenant{Name: podNsName.String()},
  }).Return(nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should requeue request if failed to release licensing allotments", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
  allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
    ContextId: "fooBar",
    Tenant:    &licensing.Tenant{Name: podNsName.String()},
  }).Return(errors.New("failed to release allotments"))
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(HaveOccurred())
})

It("should not release licensing allotments if tenant is not registered", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
  Return(nil, fmt.Errorf("unknown tenant: %w", licensing.ErrNotRegistered))
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when NumCores is 0", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
  Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
  Return(nil, nil)
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})
})

Context("for pod without corresponding SmartLicense", func() {

It("should remove pod if not belong to any deployment", func() {
  pod.OwnerReferences = nil
  Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())

  err = fakeClient.Get(context.TODO(), podNsName, pod)
  Expect(err).NotTo(BeNil())
  Expect(apiErrors.IsNotFound(err)).To(BeTrue())
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license but does not belong to any Deployment")))
})

It("should scale down pod's deployment", func() {
  smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})
})

Context("without SmartLicense resources", func() {
 BeforeEach(func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
  })

  Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})
})

Context("without SmartLicense resources", func() {
  BeforeEach(func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
  })

  Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})
})
It("should scale down Deployment to 1 Replica and mark as trial", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
    Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
})

It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func() {
    var replicaCount int32 = 4
    var expectedInitialReplicasNumber int32 = 4

    createDeployment := func(name string, role string) *appsv1.Deployment {
        pod := &corev1.Pod{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("pod-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: fmt.Sprintf("rs-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

        replicaSet := &appsv1.ReplicaSet{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("rs-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

        deployment := &appsv1.Deployment{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("deployment-%s", name),
                Namespace: defaultNs,
                Labels: map[string]string{controllers.ServiceRoleLabel: role},
                Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
            },
        }
        Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())
    }

    createDeployment("pod1", "service")
    createDeployment("pod2", "service")
    createDeployment("pod3", "service")
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```
Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
Expect(err).To(BeNil())

return deployment
}

deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", ")

assertScaledDown := func(d *appsv1.Deployment) {
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: d.Namespace, Name: d.Name}, d)).To(Succeed())
Expect(*d.Spec.Replicas).Should(Equal(int32(0)))
Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(expectedInitialReplicasNumber))))
}
assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix(Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster')))
}

It("should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist", func() {
deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
var replicaCount int32 = 1
pod2 := &corev1.Pod{
ObjectMeta: metav1.ObjectMeta{
```
Name: "deployment-test-2",
Namespace: defaultNs,
OwnerReferences: []metav1.OwnerReference{ {Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue} },
}

Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())

replicaSet2 := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name: "epReplicaSet2",
        Namespace: defaultNs,
        OwnerReferences: []metav1.OwnerReference{ {Kind: "Deployment", Name: deploymentName2, Controller: &controllerTrue} },
    },
}

Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())

deployment2 := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: deploymentName2,
        Namespace: defaultNs,
        Labels: map[string]string{controllers.ServiceRoleLabel: "new-service-role"},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}

Expect(fakeClient.Create(context.TODO(), deployment2)).To(Succeed())

pod2NsName := types.NamespacedName{Namespace: defaultNs, Name: "deployment-test-2"}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: pod2NsName.String(), Attributes: pod.Labels}).Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: pod2NsName})

Expect(err).To(BeNil())

deployment2Ns := types.NamespacedName{Namespace: defaultNs, Name: deploymentName2}

Expect(fakeClient.Get(context.TODO(), deployment2Ns, deployment2)).To(Succeed())

Expect(*deployment2.Spec.Replicas).Should(Equal(int32(1)))

Expect(deployment2.Labels).Should(HaveKey(controllers.TrialLicenseHolderLabel))

Expect(recorder.Events).ShouldNot(HaveLen(1))

package handlers_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"
)
"css.cisco.com/kasa/license-broker/controllers/handlers"
"css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
"github.com/golang/mock/gomock"
  . "github.com/onsi/ginkgo"
autoscalingv1 "k8s.io/api/autoscaling/v1"
m metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"
"sigs.k8s.io/controller-runtime/pkg/reconcile"
)

const (  
defaultNamespace = "default"
smartLicenseName = "smart-license"
deploymentName = "ep-deployment"
deploymentName2 = "ep-deployment2"
hpaName = "ep-hpa"
hpaName2 = "ep-hpa2"
)

var _ = Describe("DeploymentHandler", func() {  
var handler handler.EventHandler
var mockCtrl *gomock.Controller
var mockQueue *mocks.MockRateLimitingInterface

BeforeEach(func() {  
mockCtrl = gomock.NewController(GinkgoT())
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
handler = handlers.DeploymentHandler()
})

AfterEach(func() {  
mockCtrl.Finish()
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {  
mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
})

handler.Create(event.CreateEvent{
Object: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
},

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It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {
handler.Create(event.CreateEvent{
Object: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
}, mockQueue)
})

It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
})
mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
})
handler.Update(event.UpdateEvent{
ObjectOld: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
},
ObjectNew: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
}, mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is deleted", func() {
mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
})
handler.Delete(event.DeleteEvent{
Object: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
}}
var _ = Describe("HPAHandler", func() {
  var handler handler.EventHandler
  var mockCtrl *gomock.Controller
  var mockQueue *mocks.MockRateLimitingInterface

 BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
    handler = handlers.HPAHandler()
  })

  AfterEach(func() {
    mockCtrl.Finish()
  })

  It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
      NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })

    handler.Create(event.CreateEvent{
      Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
      },
    }, mockQueue)
  })

  It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
    handler.Create(event.CreateEvent{
      Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
      },
    }, mockQueue)
  })

  It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
    var _ = Describe("HPAHandler", func() {
      var handler handler.EventHandler
      var mockCtrl *gomock.Controller
      var mockQueue *mocks.MockRateLimitingInterface

      BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
        handler = handlers.HPAHandler()
      })

      AfterEach(func() {
        mockCtrl.Finish()
      })

      It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
        mockQueue.EXPECT().Add(reconcile.Request{
          NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
        })

        handler.Create(event.CreateEvent{
          Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
          },
        }, mockQueue)
      })

      It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
        handler.Create(event.CreateEvent{
          Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
          },
        }, mockQueue)
      })

      It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {

mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
})
mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
})

handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
        ObjectNew: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
            mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with HPA kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
})

handler.Delete(event.DeleteEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
        mockQueue)
})

# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.
global:
    platform: $platform
    imageCredentials:
        # the url to the docker registry, for example dockerhub.cisco.com
        registry: $registry
        artifactoryRepo: $artifactoryRepo
    apiGroup: sfcn.cisco.com
fullnamePrefix: sfcn-license-

# Docker image for the controller that manages licensing CRDs and their reconciliation
controllerImage: $controllerImage

# Docker image for the server-agent license server
licenseServerImage: $licenseServerImage

# licenseServerPort is the port where the server-agent license server is listening for requests
licenseServerPort: 17051

# licenseServerTransportUrl is the http transport to make use of to connect to CSSM
licenseServerTransportUrl: $licenseServerTransportUrl

# Default image policy that is used by all pod containers unless being explicitly overwritten
defaultImagePullPolicy: $defaultImagePullPolicy

# log verbosity
logLevel: $logLevel

# zap log encoder
# options: console, json
logFormat: $logFormat

# managerMemoryRequest specifies the amount of memory to allocate per request for manager container
managerMemoryRequest: "20Mi"

# managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
managerCoreRequest: "100m"

# managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
managerMemoryLimit: "100Mi"

# managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
managerCoreLimit: "100m"

# metricsPort is the port the metric endpoint binds to
metricsPort: 17080

# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"
licenseServerXms specifies the amount of memory to allocate for license-server process. The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory. 

licenseServerXms: "128M"

licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container. 

licenseServerCoreRequest: "100m"

licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container. 

licenseServerMemoryLimit: "768Mi"

licenseServerXmx specifies the maximum amount of memory to allocate for license-server process. The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory. 

licenseServerXmx: "512M"

licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container. 

licenseServerCoreLimit: "300m"

licenseServerStorage specifies the persistent volume size to use for storing licensing data. 

licenseServerStorage: "1Gi"

disktype for dynamic azure disk storage on azure platform. 

options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS 

azureDiskStorageAccountType: "Standard_LRS"

open source used in kasa v1.5

```go
package listeners

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    licensing "css.cisco.com/licensing/client-agent"
    licensingProto "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "sigs.k8s.io/controller-runtime/pkg/client"
)

type EntitlementListener struct {
    Log     logr.Logger
    Client  client.Client
    LicenseNsName types.NamespacedName
}

func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
    log := l.Log.WithValues("smartlicense", lLICENSENsName)
    log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)

    if err := l.processEvent(event); err != nil {
        return
    }
}
```
log.Error(err, "failed to process entitlement event")
return
}
log.V(1).Info("successfully processed entitlement event")
}

func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()

    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense", l.LicenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }

    originalLicense := license.DeepCopy()

    switch event.Type {
    case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
        license.Status.LicenseState = v1.OutOfCompliance
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
        license.Status.LicenseState = v1.Unlicensed
        license.Status.EstimatedMaxReplicas = 0
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
        license.Status.LicenseState = v1.InCompliance
    default:
        return fmt.Errorf("unknown event type: %s", event.Type.String())
    }

    license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
    license.Status.LicenseNumber = uint32(event.EntitlementNumber)

    // using patch to avoid conflict errors caused by version mismatch and optimistic lock
    // as events from the server have the latest data, it is admissible to overwrite status without version check
    if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
        return fmt.Errorf("failed to patch SmartLicense status: %w", err)
    }
    return nil
}

package handlers

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "k8s.io/apimachinery/pkg/types"
)
package v1

import (
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"

    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue
RateLimitingInterface

var log = ctrl.Log.WithName("handlers").WithName("SmartLicense")

// DeploymentHandler handles SmartLicense changes and queues up events for the Deployment that the
SmartLicense manages.
func DeploymentHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.DeploymentKind)
}

// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.HPAKind)
}

func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
    return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
        smartLicense, ok := obj.(*v1.SmartLicense)
        if !ok {
            log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
            return []ctrl.Request{
        }
    }
    return []ctrl.Request{{NamespacedName: types.NamespacedName{
        Namespace: smartLicense.Namespace,
        Name:     smartLicense.Spec.ScalingRef.Name,
    }}}
    }
}
"errors"
"fmt"
"github.com/go-logr/logr"
coreV1 "k8s.io/api/core/v1"
"k8s.io/apimachinery/pkg/api/resource"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/tools/record"
"os"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/builder"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"
"sigs.k8s.io/controller-runtime/pkg/reconcile"
"sigs.k8s.io/controller-runtime/pkg/source"
"strings"
"time"
)

const (  
RetryDuration      = 15 * time.Second  
MaxWaitingDuration = 5 * time.Minute  
MaxRetryAttempts   = int(MaxWaitingDuration / RetryDuration)  
LicenseCmd         = "show license feature"  
UnlicensedResponse = "Licensing Status : Unlicensed"  
LicensedResponse   = "Licensing Status : Licensed"
)

type licenseEvent int

const (  
Revoked licenseEvent = iota + 1  
Awaiting  
Granted  
Verified  
CommunicationFailed
)

func (l licenseEvent) reasonCode() string {  
switch l {  
case Revoked:  
return "LicenseRevoked"  
case Awaiting:  
return "AwaitingLicense"  
case Granted:  
return "LicenseGranted"  
case Verified:  
return "LicenseVerified"
)
func (l licenseEvent) eventType() string {
    switch l {
    case Awaiting, Revoked, CommunicationFailed:
        return coreV1.EventTypeWarning
    default:
        return coreV1.EventTypeNormal
    }
}

func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher) *SmartLicenseReconciler {
    s.notificationChan = make(chan event.GenericEvent)
    lsp.AddListener(s)
    return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
    pod := &coreV1.Pod{
    }
    s.Log.Info("lina (re)started, initiating license reconciliation")
    s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    podName := os.Getenv("POD_NAME")
podNamespace := os.Getenv("POD_NAMESPACE")
return ctrl.NewControllerManagedBy(mgr).
Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{ }).
For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{ 
Name:      podName,
Namespace: podNamespace,
}).Complete(s)
}

// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list

func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result, error) {
s.Log.Info("reconciling license status", "pod", request)
erResult := reconcile.Result{RequeueAfter: RetryDuration}
pod, err := s.CoreClient.Pods().Get(request.NamespacedName)
if err != nil {
    s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NamespacedName)
    return errResult, err
}
if s.lastRecordedEvent == 0 {
    licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
    if err != nil {
        s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
        return errResult, nil
    }
    if strings.Contains(licenseResponse, LicensedResponse) {
        s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
        s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
    } else if strings.Contains(licenseResponse, UnlicensedResponse) {
        s.recordEvent(pod, Awaiting, "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
    }
}
if pod.DeletionTimestamp == nil {
    s.computeRequiredNumCores(pod)
    // (re)register with the license server
    err := s.registerTenantWithLicenseServer(pod)
    if err != nil {
        return errResult, nil
    }
    // registration successful, fetch or request allotment of this tenant
    err = s.syncAllotmentStatus(pod)
    if err != nil {
        return errResult, nil
    }
    err = s.grantASAcLicenseToOperate(pod)
if err != nil {
    return errResult, nil
} else {
    err := s.releaseAllotment()
    if err != nil {
        s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
        return errResult, nil
    }
}

return reconcile.Result{}, nil

func (s *SmartLicenseReconciler) recordEvent(pod *coreV1.Pod, event licenseEvent, description string) {
    if s.lastRecordedEvent != event || event == Verified { // always record verified events
        s.lastRecordedEvent = event
        s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
    }
}

func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *coreV1.Pod) {
    requiredCoresQuantity := resource.MustParse("0")
    var containerCores = make(map[string]string)
    for _, container := range pod.Spec.Containers {
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container", container.Name)
            if err != nil {
                s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
                continue
            }
            // set the required core quantities directly to the capacity of the node
            requiredCoresQuantity = *node.Status.Capacity.Cpu()
            break
        }
        requiredCoresQuantity.Add(containerLimit)
    }
    requiredCoresQuantity = uint32(requiredCoresQuantity.Value())
    if len(pod.Spec.Containers) == len(containerCores) {
        s.Log.Info("computed resources usage", "cpu", containerCores)
    }
    s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *corev1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}.String(),
            Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            s.numRetriedAttempts = s.numRetriedAttempts + 1
            if s.numRetriedAttempts > MaxRetryAttempts {
                s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                    "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
                s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
                    communication failure (%s), "+
                    "retrying communication", err.Error()))
                _ = s.revokeASAcLicenseAndRetry()
                return err
            }
            s.Log.Info(fmt.Sprintf("failed to register with licensing server, will retry (reason: %s)
                    retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
                return err
            }
        }
        s.isRegistered = true
    }
    return nil
}

func (s *SmartLicenseReconciler) revokeASAcLicenseAndRetry() error {
    reason, err := s.Dispatcher.RevokeLicense()
    if err != nil {
        s.Log.Error(err, "failed to revoke license")
        return err
    }
    if reason != "" {
        err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
        return err
    }
    s.Log.Info("successfully revoked ASAc license")
    s.numRetriedAttempts = 0
    return nil
}

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *corev1.Pod) error {
    allottedStatus, err := s.Licenser.Allotment().Status(s.tenant)
    if err != nil {
        if errors.Is(err, lca.ErrLicenseServerUnavailable) {
            s.Log.Info("licensing server is unavailable, unregistering the tenant")
            s.isRegistered = false
        }
    }
    return err
}
s.numRetriedAttempts = s.numRetriedAttempts + 1
if s.numRetriedAttempts > MaxRetryAttempts {
    s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
    s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license communication failure (%s), "+
                "retrying communication", err.Error()))
    _ = s.revokeASAcLicenseAndRetry()
    return err
}

s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)", err.Error()),
            "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
return err
}

if allotmentStatus == nil {
    s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
    // no allotment was made to this tenant, requesting one
    allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
        PoolName: pod.Namespace,
        Tenant:   s.tenant,
        NumCores: s.requiredNumCores,
    })
    if err != nil {
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                        "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to obtain a license (%s), "+
                        "retrying the operation", err.Error()))
            _ = s.revokeASAcLicenseAndRetry()
            return err
        }
        s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
                    "numAttempt", s.numRetriedAttempts)
        return err
    }
    s.Log.Info("successfully leased an allotment from the licensing server")
    s.recordEvent(pod, Granted, "successfully obtained a license from the server")
    s.allotment = allotment
} else {
    s.allotment = allotmentStatus
}

s.Log.Info("allotment status verified", "cores", s.allotment.NumCores, "context", s.allotment.ContextId,
            "domain", s.allotment.SmartAccountName, "account", s.allotment.VirtualAccountName, "exportControlled", s.allotment.ExportControlled, "tenant", s.allotment.Tenant.Name)
func (s *SmartLicenseReconciler) grantASAcLicenseToOperate(pod *coreV1.Pod) error {
    if s.allotment != nil {
        s.Log.Info("license status verified, communicating the status to ASA")
        s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
        reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
        if err != nil {
            s.Log.Error(err, "failed to grant license")
            return err
        }
        if reason != "" {
            err = fmt.Errorf("ASAc failed to set license : %v", reason)
            return err
        }
        s.numRetriedAttempts = 0
        s.Log.Info("successfully granted license to ASA")
    } else {
        s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")
    }
    return nil
}

func (s *SmartLicenseReconciler) releaseAllotment() error {
    _ = s.revokeASAcLicenseAndRetry()
    if s.allotment != nil {
        err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
            ContextId: s.allotment.ContextId,
            Tenant:    s.tenant,
        })
        if err != nil {
            s.Log.Error(err, "failed to release the allotment to server")
            return err
        }
        s.allotment = nil
    }
    return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
    podName := types.NamespacedName{
        Namespace: os.Getenv("POD_NAMESPACE"),
        Name:      os.Getenv("POD_NAME"),
    }
    pod, err := s.CoreClient.Pods().Get(podName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
switch event.Type {
    case proto.AllotmentEvent_RELEASE_ALLOTMENT:
        s.Log.Info("license requested to be released by the server, un-licensing ASA")
        if err == nil {
            s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying to acquire")
        }
        _ = s.releaseAllotment()
    case proto.AllotmentEvent_REPORT_ALLOTMENT:
        s.Log.Info("license requested to be reported to the server")
        _ = s.reportAllotment()
}

func (s *SmartLicenseReconciler) reportAllotment() error {
    allotment := &lca.AllotmentReport{ContextId: "", Tenant: s.tenant, NumCores: 0}
    if s.allotment != nil {
    }
    err := s.Licenser.Allotment().ReportAllotment(allotment)
    if err != nil {
        s.Log.Error(err, "failed to report the allotment to server")
    }
    return err
}

// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import (
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
    time "time"
)

// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl      *gomock.Controller
    recorder  *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}

// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
}

// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}

// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl_RecordCallWithMethodType(mr.mock, "AddRateLimited",
reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
defunc (m *MockRateLimitingInterface) Done(arg0 interface{ }) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
defunc (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{ }) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl_RecordCallWithMethodType(mr.mock, "Done",
reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}

// Forget mocks base method
defunc (m *MockRateLimitingInterface) Forget(arg0 interface{ }) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
defunc (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{ }) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl_RecordCallWithMethodType(mr.mock, "Forget",
reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
defunc (m *MockRateLimitingInterface) Get() (interface{ }, bool) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Get")
    ret0._ := ret[0].(interface{ })
    ret1._ := ret[1].(bool)
    return ret0, ret1
}

// Get indicates an expected call of Get
defunc (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl_RecordCallWithMethodType(mr.mock, "Get",
reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Len")
    ret0, _ := ret[0].(int)
    return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}

// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "NumRequeues", arg0)
    ret0, _ := ret[0].(int)
    return ret0
}

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
}

// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}
// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
reflect.TypeOf((*MockRateLimitingInterface)(nil)).ShuttingDown))
}

apiVersion: v1
kind: Secret
metadata:
    name: cssm-token
    namespace: sfcn-system
stringData:
    # this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
token:
    "NGVmN2EwNjc5MzZkLTkyO0EwMjBmNThiNiJkLTE2NDYyMTIx%0A2NjF8UnBHL3NzTUU5S1JhSmNBYStBMTVyK05qQlBzTHJJSkk0TE9r%0ARUg4WT0%3D%0A"

---
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
    name: sfcn-enforcer
    namespace: sfcn-system
spec:
    action: "REGISTER"
tokenSecret:
    name: cssm-token
    namespace: sfcn-system
minLicenseCount: 1
maxLicenseCount: 12
scalingFactor: 4
scalingRef:
    kind: Deployment
    name: sfcn-enforcer
package listeners_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"

    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
)

const (smartLicenseName = "license-sample"
defaultNs = "default"
licenseType = "L-ASAV10S-STD"
)

func TestListeners(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Listeners Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

FROM gcr.io/distroless/java-debian10:nonroot

WORKDIR /
COPY license-broker/bin/sa-server-*-all.jar sa-server-all.jar

ENTRYPOINT ["java", "-jar", "sa-server-all.jar"]

package listeners_test

import (  
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensingProto "css.cisco.com/licensing/client-agent/proto"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/client/fake"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (  
  epDeploymentName = "epDeployment"
  entitlementNumber = 4
  coresPerLicenseType = 2
)

var _ = Describe("Entitlement Listener Test", func() {

  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var listener *listeners.EntitlementListener

  ...
var fakeClient client.Client

var smartLicense *v1.SmartLicense

BeforeEach(func() {
    var defaultLicenseCount uint32 = 1
    var maxLicenseCount uint32 = 3
    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1.SmartLicenseSpec{
            Action:          v1.Register,
            LicenseType:     licenseType,
            MinLicenseCount: &defaultLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor:   &defaultLicenseCount,
        },
    }
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
    listener = &listeners.EntitlementListener{
        Log:           logf.NullLogger{},
        Client:        fakeClient,
        LicenseNsName: licenseNsName,
    }
})

It("should update license status on OUT_OF_COMPLIANCE event", func() {
    event := licensingProto.EntitlementEvent{
        Type: licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
        Message: "entitlement is out of compliance",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
    event := licensingProto.EntitlementEvent{
        Type: licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
        Message: "entitlement request succeeded",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})
Message:  "granted new entitlement",
EntitlementSku:  licenseType,
EntitlementNumber:  entitlementNumber,
CoresPerLicenseType:  coresPerLicenseType,
}
listener.OnEntitlementEvent(&event)

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:  licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
        Message:  "failed to reserve a new entitlement",
        EntitlementSku:  licenseType,
        EntitlementNumber:  entitlementNumber,
        CoresPerLicenseType:  coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
    name:  smartlicense-redirector
    namespace:  sfcn-system
spec:
    action:  "REGISTER"
    tokenSecret:
        name:  csm-token
        namespace:  sfcn-system
    minLicenseCount:  1
    maxLicenseCount:  4
    scalingRef:
        kind:  Deployment
        name:  sfcn-vpnredirector-enforcer

/****************************************************************************
* Copyright (c) 2021 Cisco Systems, Inc.
* All rights reserved.
* Unauthorized redistribution prohibited. 
**************************************************************************/
package v1

import (
    "context"
    "fmt"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/apimachinery/pkg/util/validation/field"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
    "sigs.k8s.io/controller-runtime/pkg/webhook"
)

// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac89-96bb5a8def84"

var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1

// log is for logging in this package.
var smartlicenselog = logf.LogWithName("smartlicense-resource")
var webhookClient client.Client

func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {
    webhookClient = mgr.GetClient()
    return ctrl.NewWebhookManagedBy(mgr).
        For(r).
        Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io

var _ webhook.Defaulter = &SmartLicense{
}

// Default implements webhook.Defaulter so a webhook will be registered for the type
func (r *SmartLicense) Default() {
    log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)
}
if r.Spec.Action == "" {
    r.Spec.Action = Register
}
if r.Spec.LicenseType == "" {
    r.Spec.LicenseType = SFWLicenceTag
}
if r.Spec.MinLicenseCount == nil {
    r.Spec.MinLicenseCount = &defaultMinLicenseCount
}
if r.Spec.MaxLicenseCount == nil {
    r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
}
if r.Spec.ScalingFactor == nil {
    r.Spec.ScalingFactor = &defaultScalingFactor
}
log.V(1).Info("updated SmartLicense default values")
}

// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io

var _ webhook.Validator = &SmartLicense{

    // ValidateCreate implements webhook.Validator so a webhook will be registered for the type
    func (r *SmartLicense) ValidateCreate() error {
        smartlicenselog.V(1).Info("validate create", "name", r.Name)

        var allErrs field.ErrorList
        r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
        r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)
        r.validateMinimum(1, r.Spec.ScalingFactor, "scalingFactor", &allErrs)
        r.requireRegisterAction(&allErrs)
        r.validateLicenseCount(&allErrs)
        r.validateToken(&allErrs)
        r.validateScalingRef(&allErrs)

        if len(allErrs) == 0 {
            return nil
        }
        return allErrs.ToAggregate()
    }

    // ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
    func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
        smartlicenselog.V(1).Info("validate update", "name", r.Name)
var allErrs field.ErrorList
r.validateLicenseCount(&allErrs)

// avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
if r.GetDeletionTimestamp() == nil {
    r.validateToken(&allErrs)
    r.validateScalingRef(&allErrs)
}
oldObj := old.(*SmartLicense)
r.requireNoLicenseTypeChange(&allErrs, oldObj)

if len(allErrs) == 0 {
    return nil
}
return allErrs.ToAggregate()

// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}

func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
    if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
        *errs = append(*errs,
            field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
    }
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")

    if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount <
        *r.Spec.MinLicenseCount {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum
            license count"))
    }
}
func (r *SmartLicense) validateToken(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("tokenSecret")
    secret := &v1.Secret{}
    if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "token secret is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
            return
        }
    }
    if len(secret.Data[TokenKeyName]) == 0 {
        *errs = append(*errs, field.Required(path.Child("data").Child(TokenKeyName), "cannot be empty"))
    }
}

func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("scalingRef")
    if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == "" {
        *errs = append(*errs, field.Required(path, "kind or name of referenced object cannot be empty"))
        return
    }
    key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
    var obj client.Object
    switch r.Spec.ScalingRef.Kind {
    case DeploymentKind:
        obj = &appsv1.Deployment{}
    case HPAKind:
        obj = &autoscalingv1.HorizontalPodAutoscaler{}
    default:
        return
    }
    if err := webhookClient.Get(context.TODO(), key, obj); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "referenced object is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: %w", err)))
            return
        }
    }
}
func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
    if val == nil || *val < min {
        path := field.NewPath("spec").Child(path)
        *errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to %d", min)))
    }
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/kasa/license-broker/controllers (interfaces: ReplicasCalculator)

// Package mocks is a generated GoMock package.
package mocks

import {
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    gomock "github.com/golang/mock/gomock"
    v10 "k8s.io/api/apps/v1"
    reflect "reflect"
}

// MockReplicasCalculator is a mock of ReplicasCalculator interface
type MockReplicasCalculator struct {
    ctrl     *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}

type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

// NewMockReplicasCalculator creates a new mock instance
func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

// CalculateMaxLicensedReplicas mocks base method
func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1
    *v10.Deployment) (int32, error) {
}
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
ret0, _ := ret[0].(int32)
ret1, _ := ret[1].(error)
return ret0, ret1
}

// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{})
*gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "CalculateMaxLicensedReplicas",
      reflect.TypeOf((*MockReplicasCalculator)(nil).CalculateMaxLicensedReplicas), arg0, arg1)
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import (
  clientagent "css.cisco.com/licensing/client-agent"
  gomock "github.com/golang/mock/gomock"
  reflect "reflect"
)

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
  ctrl     *gomock.Controller
  recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
  mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
  mock := &MockLicensingClient{ctrl: ctrl}
  mock.recorder = &MockLicensingClientMockRecorder{mock}
  return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
  return m.recorder
}
// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Allotment")
    ret0, _ := ret[0].(clientagent.AllotmentService)
    return ret0
}

// Allotment indicates an expected call of Allotment
func (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Allotment",
        reflect.TypeOf((*MockLicensingClient)(nil).Allotment))
}

// Entitlement mocks base method
func (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Entitlement")
    ret0, _ := ret[0].(clientagent.EntitlementService)
    return ret0
}

// Entitlement indicates an expected call of Entitlement
func (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Entitlement",
        reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
func (m *MockLicensingClient) Registration() clientagent.RegistrationService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Registration")
    ret0, _ := ret[0].(clientagent.RegistrationService)
    return ret0
}

// Registration indicates an expected call of Registration
func (mr *MockLicensingClientMockRecorder) Registration() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Registration",
        reflect.TypeOf((*MockLicensingClient)(nil).Registration))
}

// Subscription mocks base method
func (m *MockLicensingClient) Subscription() clientagent.SubscriptionService {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Subscription")
ret0, _ := ret[0].(clientagent.SubscriptionService)
return ret0
}

// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
    reflect.TypeOf((*MockLicensingClient)(nil).Subscription))
}

package services_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/services"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (smartLicenseName = "license-sample"
defaultNs = "default"
licenseType = "L-ASAV10S-STD"
)

var (minLicenseCount uint32 = 1
maxLicenseCount uint32 = 5
scalingFactor uint32 = 2
)

var _ = Describe("ReplicasCalculator Service Test", func() {
var (deployment *appsv1.Deployment
licenses [v1.SmartLicense

...
fakeClient   client.Client
replicasCalculator *services.ReplicasCalculator
smartLicense   v1.SmartLicense
node           *corev1.Node

licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}
BeforeEach(func() {
    licenses = []v1.SmartLicense{}
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    replicasCalculator = services.NewReplicasCalculator(fakeClient, logf.NullLogger{})

    var replicaCount int32 = 1
    deployment = &appsv1.Deployment{
        ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},
        Spec: appsv1.DeploymentSpec{
            Replicas: &replicaCount,
            Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},
            Template: corev1.PodTemplateSpec{
                    Name: "ep-container",
                    Resources: corev1.ResourceRequirements{
                        Limits: map[corev1.ResourceName]resource.Quantity{
                            "cpu": resource.MustParse("2000m"),
                        },
                    },
                }},
            },
        },
        Status: appsv1.DeploymentStatus{ReadyReplicas: replicaCount},
    }

    pod := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name: "ep-pod",
            Namespace: defaultNs,
            Labels: map[string]string{"role": "enforcer"},
        },
        Spec: corev1.PodSpec{NodeName: "ep-node"},
    }
    Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

    node = &corev1.Node{
        ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
smartLicense = v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:          v1.Register,
        LicenseType:     licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor:   &scalingFactor,
    },
}

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Pod{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Node{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
})

It("should return default value because license state is not in compliance", func() {
    smartLicense.Status.LicenseState = v1.OutOfCompliance
    Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(2)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})
It("should calculate max limits based on 2 smart licenses", func() {
    smartLicense2 := v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action:          v1.Register,
            LicenseType:     licenseType,
            MinLicenseCount: &minLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor:   &scalingFactor,
        },
        Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance, CoresPerLicense: 1},
    }

    Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
    licenses = append(licenses, smartLicense2, smartLicense)

    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(4)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense2)).ShouldNot(HaveOccurred())
    Expect(smartLicense2.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should look at node limits if pod containers do not have limits defined", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{
    }
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense2, smartLicense)

    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
})

It("should return default value if pod containers do not have limits defined and deployment ready replicas is 0", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{
    }
    deployment.Status.ReadyReplicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense2, smartLicense)

    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
})
licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(*deployment.Spec.Replicas))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
}

It("should return default value if there is no node defined in pod spec", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{}
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).Should(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
  Expect(maxReplicas).Should(Equal(int32(0)))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

{{ include "aegis.configmap.standard" (list . "config" "kasa.licensebroker.config") }}
---
{{- define "kasa.licensebroker.config" -}}
  {{- $ := first . -}}
  {{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") -}}
  {{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName -}}
  apiVersion: v1
  kind: ConfigMap
  data:
    server-id.json:
      {
        "name": "{{ $licenseServerName }}",
        "hostname": "{{ $hostname }}",
        "productId": "SFW",
        "softwareTag": "regid.2021-01.com.cisco.SFW,1.0_6f4891e2-97a4-443b-ad9a-9675b85b504f",
        "serialNumber": "{{ $hostname | sha256sum | trunc 11 | upper }}",
        "storagePath": "/home/nonroot/licensing/{{ $.Release.Namespace }}",
        "transportHttpUrl": "{{ $.Values.licenseServerTransportUrl }}"
      }"
import (  
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/handlers"
  "css.cisco.com/kasa/pkg/predicates"
  "fmt"
  "github.com/go-logr/logr"
  appsv1 "k8s.io/api/apps/v1"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  "k8s.io/api/autoscaling/v2beta1"
  corev1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/tools/record"
  ctrl "sigs.k8s.io/controller-runtime"
  "sigs.k8s.io/controller-runtime/pkg/builder"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/source"
  "time"
)

type HPALicenseReconciler struct {
  client.Client
  Log                logr.Logger
  Recorder           record.EventRecorder
  ReplicasCalculator ReplicasCalculator
}

func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
  return ctrl.NewControllerManagedBy(mgr).
  For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(
    &predicates.LabelExistsPredicate{Key: LicenseHolderLabel}).
    Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).
    Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
  log.V(1).Info("reconciliation started")
  start := time.Now()
  defer func() {
    log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
  }()
hpa := &autoscalingv1.HorizontalPodAutoscaler{}  
if err != nil {  
  if errors.IsNotFound(err) {  
    log.Info("HPA does not exist, nothing to reconcile")  
  }  
  return ctrl.Result{}, client.IgnoreNotFound(err)  
}

licenseList := v1.SmartLicenseList{}  
  return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)  
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)  
hpal Licenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpal Licenses) != 0)  
if labelsChanged {  
  if err = c.Client.Update(ctx, hpa); err != nil {  
    return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)  
  }  
  log.Info("updated HPA labels")  
}

if len(hpal Licenses) == 0 {  
  log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")  
  return ctrl.Result{}, nil  
}

if pendingLicenseExists(hpal Licenses) {  
  log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")  
  return ctrl.Result{}, nil  
}

  log.Info("scaled resource is not deployment")  
  return ctrl.Result{}, nil  
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)  
if err != nil {  
  return ctrl.Result{}, err  
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpal Licenses, deployment)  
if err != nil {  
  return ctrl.Result{}, err  
}
if hpa.Spec.MaxReplicas > maxLicensedReplicas {
    log.Info("decreasing HPA's MaxReplicas to max amount of licensed replicas", "hpaMaxReplicas",
        hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
    hpa.Spec.MaxReplicas = maxLicensedReplicas
    changedFields := []string{"MaxReplicas"}
        changedFields = append(changedFields, "MinReplicas")
    }
    if err = c.Client.Update(context.Background(), hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA resource: %w", err)
    }
    c.Recorder.Event(hpa, corev1.EventTypeWarning, "HPAScaledDown", fmt.Sprintf("Decreased HPA's %s to %d as
        it is the maximum EP replicas that could be granted a license. Please, check SmartLicense resource to increase the
        limit.", changedFields, maxLicensedReplicas))
    log.Info(fmt.Sprintf("successfully decreased HPA's %s to max license limit", changedFields),
        "updatedHPAMaxReplicas", hpa.Spec.MaxReplicas)
    return ctrl.Result{}, nil
}
log.Info("skipping HPA update, system has enough licenses to have all HPA's MaxReplicas running",
    "hpaMaxReplicas", hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa
    *autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
    deploymentName := hpa.Spec.ScaleTargetRef.Name
    deployment := &appsv1.Deployment{
            deployment)
        if err != nil {
            return nil, err
        }
        return deployment, nil
    }

---

apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
    creationTimestamp: null
    name: mutating-webhook-configuration
webhooks:
    - admissionReviewVersions:
- v1
clientConfig:
  service:
    name: webhook-service
    namespace: system
    path: /mutate-sfcn-cisco-com-v1-smartlicense
failurePolicy: Fail
name: msmartlicense.kb.io
rules:
  - apiGroups:
    - sfcn.cisco.com
      apiVersions:
        - v1
      operations:
        - CREATE
        - UPDATE
      resources:
        - smartlicenses
      sideEffects: None
---
apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
  creationTimestamp: null
name: validating-webhook-configuration
webhooks:
  - admissionReviewVersions:
    - v1
    clientConfig:
      service:
        name: webhook-service
        namespace: system
        path: /validate-sfcn-cisco-com-v1-smartlicense
failurePolicy: Fail
name: vsmartlicense.kb.io
rules:
  - apiGroups:
    - sfcn.cisco.com
      apiVersions:
        - v1
      operations:
        - CREATE
        - UPDATE
      resources:
        - smartlicenses
      sideEffects: None
// Code generated by controller-gen. DO NOT EDIT.

package v1

import {
    "k8s.io/apimachinery/pkg/runtime"
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.Spec.DeepCopyInto(&out.Spec)
    out.Status = in.Status
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicense.
func (in *SmartLicense) DeepCopy() *SmartLicense {
    if in == nil {
        return nil
    }
    out := new(SmartLicense)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicense) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.ListMeta.DeepCopyInto(&out.ListMeta)
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.ListMeta.DeepCopyInto(&out.ListMeta)
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}
if in.Items != nil {
    in, out := &in.Items, &out.Items
    *out = make([]SmartLicense, len(*in))
    for i := range *in {
        (*in)[i]. DeepCopyInto(&(*out)[i])
    }
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}
// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseSpec.  
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {  
    if in == nil {  
        return nil  
    }  
    out := new(SmartLicenseSpec)  
in.DeepCopyInto(out)  
return out  
}  

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.  
func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {  
    *out = *in  
}  

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseStatus.  
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {  
    if in == nil {  
        return nil  
    }  
    out := new(SmartLicenseStatus)  
in.DeepCopyInto(out)  
return out  
}  

// Code generated by MockGen. DO NOT EDIT.  
// Source: css.cisco.com/licensing/client-agent (interfaces: EntitlementService)  

// Package mocks is a generated GoMock package.  
package mocks
  
import (  
    proto "css.cisco.com/licensing/client-agent/proto"  
    service "css.cisco.com/licensing/client-agent/service"  
    gomock "github.com/golang/mock/gomock"  
    reflect "reflect"  
)  

// MockEntitlementService is a mock of EntitlementService interface  
type MockEntitlementService struct {  
    ctrl  *gomock.Controller  
    recorder *MockEntitlementServiceMockRecorder  
}  

// MockEntitlementServiceMockRecorder is the mock recorder for MockEntitlementService  
type MockEntitlementServiceMockRecorder struct {  
    mock *MockEntitlementService  
}
// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
    mock.recorder = &MockEntitlementServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}

// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Notify", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify",
        reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}

// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement",
        reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test
open_source_used_in_kasa_v1_5_v293

"css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
"github.com/golang/mock/gomock"
  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
corev1 "k8s.io/api/core/v1"
metav1 "k8s.io/apiserver/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/kubernetes/scheme"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
"sigs.k8s.io/controller-runtime/pkg/client/event"
"sigs.k8s.io/controller-runtime/pkg/client/handler"
"sigs.k8s.io/controller-runtime/pkg/request"

const (  
  secretName = "secretTest"
)

var _ = Describe("SecretHandler", func() {  
  var handler handler.EventHandler  
  var mockCtrl *gomock.Controller  
  var mockQueue *mocks.MockRateLimitingInterface  
  var coreClient client.Client

  beforeEach(func() {  
    mockCtrl = gomock.NewController(GinkgoT())  
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)  
    coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
    handler = handlers.SecretHandler(coreClient)
  })

  afterEach(func() {  
    mockCtrl.Finish()
  })

  it("should do nothing where there are no smart license objects", func() {  
    handler.Update(event.UpdateEvent{  
      ObjectNew: &corev1.Secret{  
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
      mockQueue
    })
  })

  it("should not add request because secret is not used in SmartLicense object", func() {  
    smartLicenseObject := &v1.SmartLicense{  
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
      Spec: v1.SmartLicenseSpec{  
        }"
TokenSecret: corev1.SecretReference{
    Name:      "some_secret",
    Namespace: defaultNamespace,
},
Status: v1.SmartLicenseStatus{
    RegistrationState: v1.RegistrationFailed,
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
}, mockQueue)
}

It("should not add request because SmartLicense is registered", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      smartLicenseName,
                Namespace: defaultNamespace,
            },
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Registered,
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
    }, mockQueue)
})

It("should not add request because SmartLicense is deregistered", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      smartLicenseName,
                Namespace: defaultNamespace,
            },
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.RegistrationFailed,
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
    }, mockQueue)
})
Open Source Used in kASA v1.5

It("should add request because SmartLicense status is registration failed", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      secretName,
                Namespace: defaultNamespace,
            },
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.RegistrationFailed,
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))
}

mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

It("should add request for SmartLicense even if secret is in different namespace", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      secretName,
                Namespace: "test-namespace",
            },
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Deregistered,
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))
})
License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).

## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:

```
```
s
```
go env -w GOPRIVATE="css.cisco.com/*"
```

```
{{- include "aegis.deployments.configuration" (list . "license-api" (fromYaml `
deployment: kasa.licensebroker.deployment
rbac: config/rbac/**.yaml
crds: config/crd/**.yaml
webhooks: config/webhook/manifests.yaml`
`)) -}}
```

```
{{- define "kasa.licensebroker.deployment" -}}
```

```
{{- $ := first . -}}
```

```
{{- $global := default (dict) $.Values.global -}}
```

apiVersion: apps/v1
kind: Deployment
spec:
  {{- if eq $global.platform "eks" }}
  strategy:
    type: Recreate
  {{- end }}
template:
  metadata:
    annotations:
      {{/* checksum annotation forces Deployment's RollingUpdate when ConfigMap's values are updated */}}
      checksum/license-config: {{ include "aegis.configmap.standard" (list $ "config" "kasa.licensebroker.config") | sha256sum }}
  spec:
    securityContext:
      # 65532 is ID of nonroot user group
      fsGroup: 65532
  {{- if eq $global.platform "eks" }}
  dnsPolicy: ClusterFirstWithHostNet
  hostNetwork: true
  {{- end }}
  {{- if ($.Values.global.platform | eq "azure") }}
  {{- /* https://github.com/kubernetes-sigs/azuredisk-csi-driver/issues/815
         azure disk seems to ignore fsgroup setting right now for v1.2.0 release,
         need an init container to fix permissions */}}
  initContainers:
    - name: change-ownership
      image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
      command: ['sh', '-c', 'chown -R 65532:65532 /home/nonroot']
      volumeMounts:
        - mountPath: /home/nonroot
          name: disk
          securityContext:
            # Files or directories created with HostPath on the host are only writable by root. Which means, you either
            # need to run your container process as root or modify the file permissions on the host to be writable by
            # non-root user.
            runAsUser: 0
            capabilities:
            add:
              - DAC_OVERRIDE
              - FOWNER
    {{- end }}
  containers:
    - name: manager
      image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
      imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
      env:
        {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
args:
- --zap-log-level={{ $.Values.logLevel }}
- --zap-encoder={{ $.Values.logFormat }}
- --webhook-port={{ $.Values.webhookPort }}
- --metrics-port={{ $.Values.metricsPort }}
- --license-server-port={{ $.Values.licenseServerPort }}
ports:
- containerPort: {{ $.Values.webhookPort }}
  name: webhook-server
protocol: TCP
resources:
  requests:
    cpu: {{ $.Values.managerCoreRequest }}
    memory: {{ $.Values.managerMemoryRequest }}
  limits:
    cpu: {{ $.Values.managerCoreLimit }}
    memory: {{ $.Values.managerMemoryLimit }}
securityContext:
  allowPrivilegeEscalation: false
- name: license-server
  image: {{ include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) }}
  imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
  command:
    - "java"
    - "-Xms{{ $.Values.licenseServerXms }}"
    - "-Xmx{{ $.Values.licenseServerXmx }}"
    - "-jar"
    - "sa-server-all.jar"
    - "--configFile"
    - "/etc/licensing/server-id.json"
    - "--port"
    - {{ $.Values.licenseServerPort | quote }}
  ports:
    - containerPort: {{ $.Values.licenseServerPort }}
    protocol: TCP
  securityContext:
    # 65532 is ID of nonroot user
    runAsUser: 65532
    allowPrivilegeEscalation: false
  env:
    {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
  resources:
    requests:
      cpu: {{ $.Values.licenseServerCoreRequest }}
      memory: {{ $.Values.licenseServerMemoryRequest }}
    limits:
      cpu: {{ $.Values.licenseServerCoreLimit }}
      memory: {{ $.Values.licenseServerMemoryLimit }}
volumeMounts:
- mountPath: /home/nonroot
  name: disk
- mountPath: /etc/licensing/server-id.json
  name: license-config
  subPath: server-id.json
volumes:
- name: disk
  persistentVolumeClaim:
    claimName: {{ include "aegis.metadata.fullname" (list $ "server") }}
- name: license-config
  configMap:
    name: {{ include "aegis.metadata.fullname" (list $ "config") }}
{{- if ne $global.platform "kind" }}
imagePullSecrets:
- name: regsfncn
{{- end }}
terminationGracePeriodSeconds: 10
{{- end }}
---

{{ include "aegis.services.deployment" (list $ "configurer" "kasa.licensebroker.server") -}}
{{- define "kasa.licensebroker.server" -}}
{{- $ := first . -}}
apiVersion: v1
kind: Service
metadata:
  name: {{ include "aegis.metadata.fullname" (list $ "server") }}
spec:
  ports:
  - protocol: TCP
    port: 80
    targetPort: {{ $.Values.licenseServerPort }}
type: ClusterIP
{{- end -}}
cloud.google.com/go v0.26.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLick0ClmMTw=
cloud.google.com/go v0.34.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLick0ClmMTw=
cloud.google.com/go v0.38.0/go.mod h1:-990N+gfupTy94rShfnMCWGDr0LpTmmzTp2qbd1dvSRU=
cloud.google.com/go v0.44.1/go.mod h1:iSa0KzasP4Uvy3f1mN/7PiObzGgfIwredwwASm/v6AU=
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package controllers

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  auttestingv1 "k8s.io/api/auttesting/v1"
)

var _ = Describe("Common Test", func() {  
It("serialNumber", func() {    
serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}).String()    
Expect(len(serialNum)).Should(Equal(11))    
Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))    
Expect(serialNum).Should(Equal("F0529A6CDD9"))  
})
It("containsString", func() {
    list := []string{"one", "two", "three"}
    Expect(containsString(list, "three")).Should(BeTrue())
    Expect(containsString(list, "four")).Should(BeFalse())
})

It("removeString", func() {
    list := []string{"one", "two", "three"}
    Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
    Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
})

It("filterLicensesByState", func() {
    licenses := []v1.SmartLicense{
        {
            ObjectMeta: metav1.ObjectMeta{
                Name: "license1",
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Deregistered,
            },
        },
        {
            ObjectMeta: metav1.ObjectMeta{
                Name: "license2",
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Registered,
            },
        },
    }

    filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
    Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
        {
            ObjectMeta: metav1.ObjectMeta{
                Name: "license1",
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Deregistered,
            },
        }
    }))

    filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
    Expect(filteredLicenses).Should(BeEmpty())
})

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It("filterLicensesByKind", func() {
  var licenses v1.SmartLicenseList
  licenses.Items = []v1.SmartLicense{
    {
      Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
        },
    },
    {
      Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
        },
    },
    {
      Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName1"},
        },
    }
  }
  filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")
  Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
    Spec: v1.SmartLicenseSpec{
      ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
      },
  }}))
  filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
  Expect(filteredLicenses).Should(BeNil())

  filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")
  Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
    Spec: v1.SmartLicenseSpec{
      ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
      },
  }}))
})

It("pendingLicenseExists", func() {
  licenses := []v1.SmartLicense{
    {
      Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance},
    },
    {
    }
  }
  Expect(pendingLicenseExists(licenses)).Should(BeFalse())
})
licenses = append(licenses, v1.SmartLicense{
    Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState},
})

Expect(pendingLicenseExists(licenses)).Should(BeTrue())

It("setLicenseLabel", func () {
    meta := metav1.ObjectMeta{
    res := setLicenseLabel(&meta, LicenseHolderLabel, true)
    Expect(res).Should(BeTrue())

    val, ok := meta.Labels[LicenseHolderLabel]
    Expect(ok).Should(BeTrue())
    Expect(val).Should(Equal("true"))

    res = setLicenseLabel(&meta, LicenseHolderLabel, true)
    Expect(res).Should(BeFalse())

    res = setLicenseLabel(&meta, LicenseHolderLabel, false)
    Expect(res).Should(BeTrue())

    _, ok = meta.Labels[LicenseHolderLabel]
    Expect(ok).Should(BeFalse())
})

---
title: "Licensing the Cluster"
weight: 2
description: >
  Learn how to license a scalable cluster, understand the components involved, and the implications of an unlicensed cluster
  
Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing.
There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this
section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.

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***************************************************************************************/
# Smart Licensing

* Licensing a kASA cluster involves licensing every ASA instance running in the cluster. Since the ASA instances
are ephemeral, a license server runs locally in your cluster to manage the license lifecycle of these ASA instances. This server is responsible for registering the set of ASA instances you license with the Cisco Smart Software Manager, obtain or release the licenses based on the number of cores those instances use, and releasing all the licenses back to your Smart account when you deregister the cluster.

* After kASA bundle is successfully installed with licensing enabled, to license the cluster, you need a token from your Smart Account that has Secure Firewall (SFW) licenses. Go to [software.cisco.com](https://www.software.cisco.com) and navigate to Smart Software Licensing. Find `asac-dev` virtual account that has the SFW licenses and generate a token from it. For development purposes, we have created a token that you can use:

```
YTRkNWFlMTMzWEyNi0zNDc1MEI5MDkzMDcyMjY4MjYzOTUwMDQwMjExNDU2MjMzNjgK
```

If this token has expired, please send an email to sfcn-controlplane@cisco.com

* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc) and a service type (e.g. `Deployment` or `HorizontalPodAutoscaler`).

* Examples of the secret and the Smart License object are located [here](../../license-broker/config/samples/sfcn.cisco.com_v1_smartlicense.yaml).

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  creationTimestamp: null
  name: broker-role
rules:
- apiGroups:
  - apps
    resources:
    - deployments
    verbs:
    - get
    - list
    - update
    - watch
- apiGroups:
  - apps
    resources:
    - replicaset
```

---
verbs:
- get
- list
- watch
- apiGroups:
  - autoscaling
resources:
  - horizontalpodautoscalers
verbs:
- get
- list
- update
- watch
- apiGroups:
  - ""
resources:
- pods
verbs:
- delete
- get
- list
- update
- watch
- apiGroups:
  - ""
resources:
- secrets
verbs:
- get
- list
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses
verbs:
- create
- delete
- get
- list
- patch
- update
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses/status
verbs:
Licensing setup comprises two components - the License Server, and the License Controller. References to Server and Controller in this document mean the License Server and License Controller.

1. User creates a Smart License resource and applies it to the Kubernetes API Server
2. Kubernetes API Server sends a notification to License Controller.
3. License Controller inspects the configuration in the Smart License resource
   1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server, which then talks to CSSM to reserve the licenses and responds back to the Controller
   2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server
4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.
5. The License Server checks its pool to see if it has sufficient licenses to grant the request
   1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates this status to ASAc.
   2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.

## Packaging

Licensing components are packaged in to two Kubernetes Deployment resources targeting different namespaces and distributed via Helm as part of the `sfcn-bundle` Helm chart

### License Broker
The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

License Broker is set to be deployed once per Cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode).

The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.

## License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the [Controller](#license-controller), sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.

## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart
License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the [License Server](#license-server). It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests](#monitoring#unauthorized-requests) for more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the form of events on that resource.

### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart License resource in the same namespace.

Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
```
tokenSecret:
  name: cssm-token
  namespace: cisco-systems

# license type can be blank or not set explicitly to let the system use the default value
# At present, there is only one license type for kASA, so this field is reserved for future use.
licenseType: ""
minLicenseCount: 1
maxLicenseCount: 10
scalingRef:
  kind: Deployment
  name: sfcn-enforcer
```

where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by obtaining a token from the [Virtual Account](terminology#smart-and-virtual-accounts) and doing a base64 encoding of that text. This can be done from a shell as follows
```
```shell
  echo "your-token" | base64
```

And, use that content in the Secret as follows
```
yaml
  apiVersion: v1
  kind: Secret
  metadata:
    name: cssm-token
    namespace: cisco-systems
  data:
    # this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
    token: "TXpJMk1UVXhOV1V0Tm1Jld1ppMDBORFUzTFRnd09ETXRNamMyWm1JMVltWTBORGhrTFRFMk16YzBNamcyJTBTVRBmk16QyhVSFE1U25WVGNhbeRMEZU2paSk5FeDRZbHAXYnpkdGFHcGFZbJQVDFGWFOyMURjR3h4JTBBVFUxVk9EMCUzRCUwQQ=="
```

{{% alert title="Note" color="primary" %}}
The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual account as you are expecting the number of vCPUs in your cluster namespace.
{{% /alert %}}

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`.
The resource specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a minimum of 1 license and up to 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA license type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request up to 10 vCPUs. Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing configuration thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

```alert title="Warning" color="warning" %]
Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the License Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the license configuration.
In the example here, the Deployment replica count would be set to 2.
```

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more replicas, the license Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to the account.

Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.

### Using the Scaling Factor

When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient number of licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to retry the operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the `scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or down, it reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may ask the pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the pod is assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its pool.
Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the virtual account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following configuration, the Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this number to the number of vCPUs the enforcer pods will be using.

```
yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  # scaling factor of 4 implies the license reservations change in increments/decrements of 4
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates un-registration and on successfully unregistering from the virtual account, the Controller deletes the resource.

## The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.
### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

{{% alert title="Note" color="primary" %}}
It is recommended that a CPU limit be specified on all the containers where the ASA is running. If you prefer to take advantage of burstable CPU of the Node, be advised that the licensed cores would be that of the Node rather than the Pod.
{{% /alert %}}

### Licensing ASA

When the ASA comes up, it does not hold a license and therefore runs at a low-bandwidth mode, typically 100kbps and has very restricted capabilities and features it supports. The Manager tries to get a license from the License Server and if successful communicates the status to ASA. Once licensed, ASA runs at its full potential.

The Manager periodically verifies the status of the license it obtained, with the License Server, and if the license is not valid anymore either because the License Server has insufficient licenses, or the Manager failed to verify the validity despite several retries, it will revoke the license of ASA and keeps retrying to fetch the license.

```yaml
apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into versioned archives
# to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They're included as
# a dependency of application charts to inject those utilities and functions into the rendering
# pipeline. Library charts do not define any templates and therefore cannot be deployed.
type: application

# This is the chart version. This version number should be incremented each time you make changes
# to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
version: 0.1.0

# This is the version number of the application being deployed. This version number should be
# incremented each time you make changes to the application. Versions are not expected to
# follow Semantic Versioning. They should reflect the version the application is using.
appVersion: 1.16.0

dependencies:
  - name: aegis-common
    version: "0.1.0"
    repository: "file://../aegis-common"
module css.cisco.com/kasa/license-broker

go 1.14

require (  
css.cisco.com/kasa/pkg/predicates v0.0.0  
css.cisco.com/licensing/client-agent v0.1.11  
github.com/go-logr/logr v0.3.0  
github.com/golang/mock v1.3.1  
github.com/onsi/ginkgo v1.14.1  
github.com/onsi/gomega v1.10.2  
k8s.io/api v0.19.2  
k8s.io/apimachinery v0.19.2  
k8s.io/client-go v0.19.2  
k8s.io/utils v0.0.0-20200912215256-4140de9c8800  
sigs.k8s.io/controller-runtime v0.7.2  
)

replace css.cisco.com/kasa/pkg/predicates v0.0.0 => ../pkg/predicates
// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: AllotmentService)

// Package mocks is a generated GoMock package.
package mocks

import (  
proto "css.cisco.com/licensing/client-agent/proto"  
service "css.cisco.com/licensing/client-agent/service"  
gomock "github.com/golang/mock/gomock"  
reflect "reflect"
)

// MockAllotmentService is a mock of AllotmentService interface
type MockAllotmentService struct {
  ctrl *gomock.Controller
  recorder *MockAllotmentServiceMockRecorder
}
// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService
type MockAllotmentServiceMockRecorder struct {
    mock *MockAllotmentService
}

// NewMockAllotmentService creates a new mock instance
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {
    mock := &MockAllotmentService{ctrl: ctrl}
    mock.recorder = &MockAllotmentServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {
    return m.recorder
}

// LeaseAllotment mocks base method
func (m *MockAllotmentService) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "LeaseAllotment", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
        reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReleaseAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReleaseAllotment), arg0)
}

// ReportAllotment mocks base method
func (m *MockAllotmentService) ReportAllotment(arg0 *proto.AllotmentReport) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReportAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReportAllotment indicates an expected call of ReportAllotment
func (mr *MockAllotmentServiceMockRecorder) ReportAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReportAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReportAllotment), arg0)
}

// Status mocks base method
func (m *MockAllotmentService) Status(arg0 *proto.Tenant) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Status", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Status indicates an expected call of Status
func (mr *MockAllotmentServiceMockRecorder) Status(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Status",
        reflect.TypeOf((*MockAllotmentService)(nil).Status), arg0)
}
### Cisco Smart Software Manager (CSSM)

Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any licensing activity outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed [here](https://software-stage.cisco.com).

There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html) often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.

{{% alert title="Warning" color="warning" %}}
kASA Licensing currently supports only direct access to CSSM. The system is NOT tested for accessing CSSM from behind an HTTPs proxy or via Satellite, and the behavior is unknown; though, in theory, it may work.
{{% /alert %}}

### Smart License

Smart License is the license(_noun_) that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license(_verb_) a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that
license
from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).

### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.

Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited to. The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account.
You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased.
This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from
which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation

License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product. The reservation process requires connectivity to internet and only on successful reservation can you use the product in Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR). PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does not mean the product supports it. You should check the product documentation to verify the support for license reservation.

{{% alert title="Warning" color="warning" %}}
kASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.{{% /alert %}}

### References

If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

/***************************************************************
* Copyright (c) 2020 Cisco Systems, Inc.
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* ***************************************************************/
package integ_tests

import (  
    "context"  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
    . "github.com/onsi/ginkgo"  
    . "github.com/onsi/gomega"  
    autoscalingv1 "k8s.io/api/autoscaling/v1"  
    corev1 "k8s.io/api/core/v1"  
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
    "k8s.io/apimachinery/pkg/types"
)

var _ = Describe("SmartLicense Webhook Test", func() {  
    const defaultNamespace = "default"

    var defaultCount uint32 = 1

    var secret *corev1.Secret  
    var hpa *autoscalingv1.HorizontalPodAutoscaler

   BeforeEach(func() {  
        secret = &corev1.Secret{  
            Data:       map[string][]byte{"token": []byte("MTIz")},
        }  
        Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())
    hpa = &autoscalingv1.HorizontalPodAutoscaler{  
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{  
            MaxReplicas:  3,  
        },  
        }  
        Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
    })

    AfterEach(func() {  
        Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
        Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
    })

    Context("Mutating Webhook", func() {  
        It("should fill in values on creation", func() {  
            license := &v1.SmartLicense{  
                Spec: v1.SmartLicenseSpec{  
                }
            }  
            Expect(k8sClient.Create(context.TODO(), license)).To(Succeed())

            Expect(k8sClient.Get(context.TODO(), types.SelfSubjectAccessReview{}, &v1.SmartLicense{})).To(Succeed())
            Expect(k8sClient.Delete(context.TODO(), license)).To(Succeed())
            Expect(k8sClient.Delete(context.TODO(), license)).To(Succeed())
        })
    })
})
err := k8sClient.Create(testCtx, license)
Expect(err).ShouldNot(HaveOccurred())

err = k8sClient.Get(testCtx, types.NamespacedName{
    Namespace: defaultNamespace,
    Name: "foo",
}, license)
Expect(err).ShouldNot(HaveOccurred())
Expect(license.Spec.Action).To(Equal(v1.Register))
Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.ScalingFactor).To(Equal(&defaultCount))
}
})

})

Context("Validating Webhook", func() {

It("should pass for valid object", func() {
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
})

It("has fields validations", func() {
    //given
    var zeroLicenses uint32 = 0
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            MinLicenseCount: &zeroLicenses,
            MaxLicenseCount: &zeroLicenses,
            ScalingFactor: &zeroLicenses,
        },
    }
    Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
})

//when
err := k8sClient.Create(testCtx, license)

//then
Expect(err).To(MatchError("admission webhook \"vsmartlicense.kb.io\" denied the request: [" + 
  "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + 
  "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + 
  "spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1"]))
}

It("should return error if max value is less then min value", func () {
  //given
  var minLicenses uint32 = 5
  var maxLicenses uint32 = 3
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      MinLicenseCount: &minLicenses, 
      MaxLicenseCount: &maxLicenses,
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))
})

It("should return error when creating license with non-REGISTER action", func () {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      Action:      v1.Deregister,
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))
})
It("should return error when secret does not exist", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
})

It("should return error when secret does not token key", func() {
    //given
    secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
    Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))
})

It("should return error when invalid scalingRef kind is specified", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))
})
// when
err := k8sClient.Create(context.TODO(), license)

// then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.scalingRef.kind: Unsupported value: "Pod": supported values: "Deployment", "HorizontalPodAutoscaler")
})

It("should return error when scalingRef does not exist", func() {
// given
license := &v1.SmartLicense{
  Spec: v1.SmartLicenseSpec{
  },
}

// when
err := k8sClient.Create(context.TODO(), license)

// then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found")
})

It("should not allow changing licenseType after registration", func() {
// given
license := &v1.SmartLicense{
  Spec: v1.SmartLicenseSpec{
  },
}

// when
license.Status.RegistrationState = v1.Registered
Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())

license.Spec.LicenseType = "buzz"
err := k8sClient.Update(context.TODO(), license)

})
//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})
})
})

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: broker-role-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: broker-role
subjects:
- kind: ServiceAccount
  name: default
  namespace: system

package controllers_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  ".github.com/onsi/ginkgo"
  ".github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

package handlers_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  ".github.com/onsi/ginkgo"
  ".github.com/onsi/gomega"
func TestHandlers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {
    Expect(v1.AddToScheme(scheme.Scheme)).To(Succeed())
})

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package integ_tests

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "github.com/go-logr/logr"
    "github.com/onsi/ginkgo"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/client-go/rest"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
)

func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))

    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }
}
close(done)
if err := mgr.Start(ctx); err != nil {
    return err
}
return nil
}

package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
    "strconv"
}

const {
    epDeploymentName = "epDeployment"
    initialDeploymentReplicas int32 = 3
}

var _ = Describe("Deployment License Controller Test", func() {

    deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
    var {
        reconciler *controllers.DeploymentLicenseReconciler
        fakeClient client.Client
        mockCtrl *gomock.Controller
        deployment *appsv1.Deployment
        smartLicense *v1.SmartLicense
        recorder *record.FakeRecorder
        replicasCalculatorMock *mocks.MockReplicasCalculator
    }
}
BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    recorder = record.NewFakeRecorder(1024)
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

    reconciler = &controllers.DeploymentLicenseReconciler{
        Client:     fakeClient,
        Log:        logf.NullLogger{},
        Recorder:   recorder,
        ReplicasCalculator: replicasCalculatorMock,
    }

    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1.SmartLicenseSpec{
            Action:          v1.Register,
            LicenseType:     licenseType,
            MinLicenseCount: &minLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor:   &scalingFactor,
        },
        Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
    }
    Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

    replicas := initialDeploymentReplicas
    deployment = &appsv1.Deployment{
        ObjectMeta: metav1.ObjectMeta{
            Name:      epDeploymentName,
            Namespace: defaultNs,
            Annotations: map[string]string{
                controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
            },
        },
        Spec: appsv1.DeploymentSpec{
            Replicas: &replicas,
        },
    }
    Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())
})

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
})
mockCtrl.Finish()
}

It("should skip if Deployment does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})

It("should skip if Deployment SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    expect(err).To(BeNil())
    expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(4), nil)
    expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    expect(err).To(BeNil())
    expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    expect(err).To(BeNil())
    expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3")))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 2"))))

It("should an event if initial replica number annotation is incorrect", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)

deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(HaveOccurred())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial- replicas-count label is not correct. Please, update it to correct number.")))})

It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
    *deployment.Spec.Replicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(25), nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3"))))})

It("should send a warning if deployment controlled by HPA", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(4), nil)

hpa := &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: initialHPAMaxReplicas,
    },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())
Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf("Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", epDeploymentName, epHpaName, epHpaName)))))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3"))))
}
})
})

package handlers

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/util/workqueue"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
    return handler.Funcs{
        UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
            if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
                licenseList := v1.SmartLicenseList{}}


err := c.List(context.TODO(), &licenseList)
if err != nil {
    secretLog.Error(err, 
    "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
panic(err.Error())
}

for smartLicense := range licenseList.Items {
    if smartLicense.Spec.TokenSecret.Name == secret.Name &&
        if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
        smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
            q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                Namespace: smartLicense.Namespace,
                Name: smartLicense.Name,
            }})
        }
    } else {
        secretLog.Error(fmt.Errorf("cannot cast %T to Secret", evt.ObjectNew), "event is ignored")
    }
}

package v1_test

import {
    v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
    "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1/mocks"
    dispatcherMock "cisco.com/kasa/operator/enforcementpoint/dispatcher/mocks"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    clientagent "css.cisco.com/licensing/client-agent"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService

var _ = Describe("SmartLicense Controller Test", func () {

    const (  
podName = "sfcn-enforcer"
podNamespace = "sfcn-system"  
nodeName = "aws-eks-node0"
)

    var tenant, podNamespacedName = &clientagent.Tenant{
        Name: podNamespace + "/" + podName,
        Attributes: map[string]string{
            "role": "license-requestor",
        },
    }, types.NamespacedName{
        Namespace: podNamespace,
        Name:      podName,
    }

    newPod := func(name, namespace, nodeName string) *coreV1.Pod {
        return &coreV1.Pod{
            TypeMeta: metaV1.TypeMeta{
                Kind: "Pod",
                APIVersion: "v1",
            },
            ObjectMeta: metaV1.ObjectMeta{
                Name:      name,
                Namespace: namespace,
                Labels:    tenant.Attributes,
            },
            Spec: coreV1.PodSpec{
                Name:      nodeName,
                Containers: []coreV1.Container{
                    {  
                        Name: "ep-container",
                        Resources: coreV1.ResourceRequirements{
                            Limits: map[coreV1.ResourceName]resource.Quantity{
                                "cpu": resource.MustParse("2000m"),
                            },
                        },
                    }
                },
            }
        }
    }
newNode := func(name string) *coreV1.Node {
    return &coreV1.Node{
        TypeMeta:   metaV1.TypeMeta{Kind: "Node", APIVersion: "v1"},
        ObjectMeta: metaV1.ObjectMeta{Name: name},
            "cpu": resource.MustParse("4"),
        }},
    }
}

var (  
pod      *coreV1.Pod
node     *coreV1.Node
reconciler   *v1.SmartLicenseReconciler  
fakeClient     client.Client
mockCtrl     *gomock.Controller
licensingClient *mocks.MockLicensingClient
allotmentService *mocks.MockAllotmentService
dispatcher    *dispatcherMock.MockGatewayClient
recorder     *record.FakeRecorder
)

resetRecorder := func() {
    recorder = record.NewFakeRecorder(1024)
    reconciler.Recorder = recorder
}

reconcileAndExpectFail := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred())  // failure is determined by requeue after duration
    Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration}))
}

reconcileAndExpectSuccess := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred())
    Expect(result).To(Equal(ctrl.Result{ }))
}

recordedEvents := func() []string {
    close(recorder.Events)
    return recorder.Events
}
var events []string
for event := range recorder.Events {
    events = append(events, event)
}
return events

lastRecordedEvent := func() string {
    events := recordedEvents()
    if len(events) == 0 {
        return ""
    }
    return events[0]
}

BeforeEach(func() {
    pod = newPod(podName, podNamespace, nodeName)
    node = newNode(nodeName)
    data := []client.Object{pod, node}
    mockCtrl = gomock.NewController(GinkgoT())
    scheme := runtime.NewScheme()
    Expect(coreV1.AddToScheme(scheme)).To(Succeed())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
    allotmentService = mocks.NewMockAllotmentService(mockCtrl)
    licensingClient = mocks.NewMockLicensingClient(mockCtrl)
    dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
    recorder = record.NewFakeRecorder(1024)
    reconciler = &v1.SmartLicenseReconciler{
        CoreClient: coreV1Client.New(fakeClient, context.Background),
        Licenser:   licensingClient,
        Log:        logf.NullLogger{},
        Recorder:   recorder,
        Dispatcher: dispatcher,
    }
    licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
    Dispatcher: dispatcherMock.NewMockGatewayClient(mockCtrl)
}

It("should revoke ASAc license after failing multiple attempts of registration", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(fmt.Errorf("test registration failure")).AnyTimes()
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().RevokeLicense().Times(1)
    numAttempts := 0
    for numAttempts < v1.MaxRetryAttempts {
        reconcileAndExpectFail()
        numAttempts += 1
        if numAttempts == 1 {
            // on the first attempt expect an event is recorded
Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
} else {
Expect(lastRecordedEvent()).Should(BeEmpty())

reconcileAndExpectFail()
Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
}

ItReconcileSuccessfullyWithExpectedNumberOfCores := func(numCores uint32) {
  allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
  allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil)
  allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
    PoolName: podNamespace,
    Tenant:   tenant,
    NumCores: numCores, // this is the limit specified for the container
  })).Return(&clientagent.AllotmentRequestStatus{
    ContextId:          "test-context",
    Tenant:             tenant,
    NumCores:           numCores,
    SmartAccountName:   "test-domain",
    VirtualAccountName: "test-account",
    ExportControlled:   true,
  }, nil)
  dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
  dispatcher.EXPECT().GrantLicense(true)

  reconcileAndExpectSuccess()
  Expect(recordedEvents()).Should(ConsistOf(
    HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),
    HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),
    HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified")))
}

It("should verify the license status and request on successful registration", func() {
  ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
    Name: "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
  })
  Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
  ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})
It("should revoke ASAc license after successful registration but fails to get a lease", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().RevokeLicense().Times(1)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil).AnyTimes()
    allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
        PoolName: podNamespace,
        Tenant:   tenant,
        NumCores: 2, // this is the limit specified for the container
    })).Return(nil, fmt.Errorf("test insufficient cores")).AnyTimes()
    numAttempts := 0
    for numAttempts < v1.MaxRetryAttempts {
        reconcileAndExpectFail()
        numAttempts += 1
        if numAttempts == 1 {
            // on the first attempt expect an event is recorded
            Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
        } else {
            Expect(lastRecordedEvent()).Should(BeEmpty())
        }
        reconcileAndExpectFail()
    }
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because it failed to obtain a license"))
})

It("should revoke ASAc license when server requests to the release the allotment", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

    dispatcher.EXPECT().RevokeLicense().Times(1)
    allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
        ContextId: "test-context",
        Tenant:    tenant,
    })).Return(nil)

    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
    resetRecorder()
    reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
        ContextId: "test-context",
        Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
        Message:   "testing release allotment request",
        Tenant:    tenant,
    })
})
It("should report the allotment it holds when the server requests so", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

    allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
        ContextId: "test-context",
        Tenant:    tenant,
        NumCores:  2,
    })).Return(nil)

    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
    resetRecorder()
    reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
        ContextId: "test-context",
        Type:      proto.AllotmentEventREPORT_ALLOTMENT,
        Message:   "testing release allotment request",
        Tenant:    tenant,
    })
    Expect(lastRecordedEvent()).Should(BeEmpty())
})

It("should mark tenant as unregistered if license server is unavailable and retry again", func() {
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil,
        fmt.Errorf("some error occures: %w", lca.ErrLicenseServerUnavailable))
    res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})

    Expect(err).Should(BeNil())
    Expect(res).ShouldNot(BeNil())
    Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
})

AfterEach(func() {
    mockCtrl.Finish()
})

/******************************************************************************
* Copyright (c) 2021 Cisco Systems, Inc.                                       
* Unauthorized redistribution prohibited.                                     
*******************************************************************************/
package controllers

import (
    "context"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/listener"
    "sigs.k8s.io/controller-runtime/pkg/reconciler"
    corePredicate "sigs.k8s.io/controller-runtime/pkg/predicate"
    "sigs.k8s.io/controller-runtime/pkg/source"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    coreV1 "k8s.io/api/core/v1"
    "time"
)

const SFCNProductId = "SFW"

const (  registrationReason   = "Registration"  deregistrationReason = "Deregistration"  FinalizerName        = "sfcn.cisco.com/license-degistration-finalizer" )

// SmartLicenseReconciler reconciles a SmartLicense object
type SmartLicenseReconciler struct {
    Client            client.Client
    LicensingClient   licensing.LicensingClient
    Log               logr.Logger
    Recorder          record.EventRecorder
    Scheme            *runtime.Scheme
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := r.Log.WithValues("smartlicense", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    var license v1.SmartLicense
    if err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("SmartLicense does not exist, nothing to reconcile")
            return ctrl.Result{}, client.IgnoreNotFound(err)
        }
    }

    if license.ObjectMeta.DeletionTimestamp.IsZero() {
        if err := r.addFinalizerIfMissing(&license); err != nil {
            return ctrl.Result{}, err
        }
    } else {
        // the license is being deleted, need to deregister it first
        return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
    }

    switch license.Spec.Action {
    case v1.Register:
        err := r.registerPlatform(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
        }

        err = r.scaleEntitlements(&license)
    // +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses,verbs=get;list;watch;create;update;patch;delete
    // +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses/status,verbs=get;update;patch
    // +kubebuilder:rbac:groups=core,resources=secrets,verbs=get;list;watch
    // +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list;watch;update;delete
    // +kubebuilder:rbac:groups=apps,resources=deployments,verbs=get;list;watch;update
    // +kubebuilder:rbac:groups=apps,resources=replicasets,verbs=get;list;watch
    // +kubebuilder:rbac:groups=autoscaling,resources=horizontalpodautoscalers,verbs=get;list;watch;update
if err != nil {
    r.recordFailureAndUpdateStatus(&license, registrationReason, err)
    return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
}

if err = r.recordSuccessAndUpdateStatus(&license, registrationReason); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
}
return ctrl.Result{}, nil

case v1.Deregister:
    err := r.deregisterPlatform(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, deregistrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to deregister the platform: %w", err)
    }
if err = r.recordSuccessAndUpdateStatus(&license, deregistrationReason); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
}
return ctrl.Result{}, nil

default:
    // should not happen due to CRD validation, but not returning an error as subsequent reconciliations will not fix the
    // issue anyway
    // 'action' value")
    return ctrl.Result{}, nil
}

func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
    if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
        r.licenseLogger(license).Info("added finalizer")
    }
    return nil
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    if containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        license.Status.RegistrationState == v1.Registered {
if err := r.deregisterPlatform(license); err != nil {
//TODO: return error and do not remove finalizer when corner cases are tested


log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
}
} else {
log.Info("removing finalizer without deregistration as platform is not registered")
}

license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
if err := r.Client.Update(context.Background(), license); err != nil {
    return err
}
log.Info("removed finalizer")
return nil
}

func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {
    licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
    log := r.licenseLogger(license)
    token, err := r.getToken(license)
    if err != nil {
        return fmt.Errorf("failed to retrieve licensing token: %w", err)
    }
    log.Info("trying to register platform", "platformName", licenseNsName.String())
    deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client,
ctrl.Log.WithName("listeners").WithName("DeregistrationListener"), r.Recorder, oobChangeNotifier)
    registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
        Uuid: string(license.UID),
        Name: licenseNsName.String(),
        SerialNumber: serialNumber(licenseNsName.String()),
        ProductId: SFCNProductId,
        PoolName: license.Namespace,
    }, token, deregistrationListener)
    if err != nil {
        license.Status.RegistrationState = v1.RegistrationFailed
        license.Status.LicenseState = v1.Unlicensed
        return fmt.Errorf("failed to complete registration call: %w", err)
    }
    log.Info("registered the platform in CSSM", "registrationInfo", registration)
    license.Status.RegistrationState = v1.Registered
    // we don't want to change license state to Pending if a platform is already registered and a user just updates some field.
    if !registration.IsRegistered {
        license.Status.LicenseState = v1.PendingLicenseState
    }
    license.Status.AccountDomain = registration.SmartAccountName
    license.Status.AccountName = registration.VirtualAccountName
    license.Status.ContextId = registration.ContextId
license.Status.ExportControlled = registration.ExportControlled

entitlementListener := &listeners.EntitlementListener{
    Log:           ctrl.Log.WithName("listeners").WithName("EntitlementListener"),
    Client:        r.Client,
    LicenseNsName: licenseNsName,
}
if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
    if errors.Is(err, licensing.ErrDuplicateListener) {
        log.Info("entitlement listener is already added", "contextId", registration.ContextId)
        return nil
    }
    return fmt.Errorf("failed to subscribe to entitlement notifications: %w", err)
}
log.Info("added entitlement listener", "contextId", registration.ContextId)
return nil
}

func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
    if license.Status.RegistrationState != v1.Registered {
        return fmt.Errorf("platform must be registered before license reservation")
    }
    log := r.licenseLogger(license)
    log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
    err := r.LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
        ContextId:       license.Status.ContextId,
        EntitlementId:   license.Spec.LicenseType,
        MinEntitlements: *license.Spec.MinLicenseCount,
        MaxEntitlements: *license.Spec.MaxLicenseCount,
        ScalingFactor:   *license.Spec.ScalingFactor,
    })
    if err != nil {
        return fmt.Errorf("failed to enable licensing scaling: %w", err)
    }
    log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
    return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    state := license.Status.RegistrationState
    if state == v1.Deregistered {
        log.Info("platform is already deregistered, skipping deregistration")
        return nil
    }
    log.Info("trying to deregister platform", "contextId", license.Status.ContextId)
    err := r.LicensingClient.Deregister(&licensing.DeregistrationRequest{
        ContextId:       license.Status.ContextId,
        EntitlementId:   license.Spec.LicenseType,
        LicenseNsName:   license.Spec.LicenseNsName,
    })
    if err != nil {
        return fmt.Errorf("failed to deregister platform: %w", err)
    }
    return nil
}
err := r.LicensingClient.Registration().Deregister(license.Status.ContextId)
if err != nil {
    license.Status.RegistrationState = v1.DeregistrationFailed
    return fmt.Errorf("failed to complete deregistration call: %w", err)
}
log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
license.Status.RegistrationState = v1.Deregistered
license.Status.LicenseState = v1.Unlicensed
license.Status.EstimatedMaxReplicas = 0
license.Status.CoresPerLicense = 0
license.Status.LicenseNumber = 0
return nil
}

func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
    secretNamespacedName := types.NamespacedName{
        Namespace: license.Spec.TokenSecret.Namespace,
        Name:      license.Spec.TokenSecret.Name,
    }
    var tokenSecret coreV1.Secret
    if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
        return "", fmt.Errorf("failed to get token secret: %w", err)
    }
    return string(tokenSecret.Data[v1.TokenKeyName]), nil
}

func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error) {
    r.Recorder.Event(license, coreV1.EventTypeWarning, reason,
        fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
    license.Status.ErrorReason = err.Error()
    if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
        r.Log.Error(statusErr, "failed to update SmartLicense status")
    }
}

func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
    r.Recorder.Event(license, coreV1.EventTypeNormal, reason, "SmartLicense state updated.")
    license.Status.ErrorReason = ""
    if err := r.Client.Status().Update(context.Background(), license); err != nil {
        return err
    }
    return nil
}

func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
    return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/apis/apimachinery.pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/apis/apimachinery.pkg/types"
    "k8s.io/client-go/kubernetes/pkg/client"
    "k8s.io/client-go/kubernetes/pkg/client/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
}

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/registration.go css.cisco.com/licensing/client-agent RegistrationService
//go:generate mockgen -package=mocks -destination=./mocks/entitlement.go css.cisco.com/licensing/client-agent EntitlementService

cost {
smartLicenseName = "license-sample"
secretName = "secret-sample"
defaultNs = "default"
licenseType = "L-ASAV10S-STD"
secretToken = "MTIz"
}

var {
minLicenseCount uint32 = 1
maxLicenseCount uint32 = 5
newMaxLicenseCount uint32 = 10
scalingFactor uint32 = 2
}

var _ = Describe("SmartLicense Controller Test", func {
licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

var reconciler *controllers.SmartLicenseReconciler
var fakeClient client.Client
var mockCtrl *gomock.Controller

var licensingClient *mocks.MockLicensingClient
var registrationService *mocks.MockRegistrationService
var entitlementService *mocks.MockEntitlementService

var (smartLicense *v1.SmartLicense
secret *corev1.Secret)

BeforeEach(func() {
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()

registrationService = mocks.NewMockRegistrationService(mockCtrl)
extitlementService = mocks.NewMockEntitlementService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
reconciler = &controllers.SmartLicenseReconciler{
Client: fakeClient,
LicensingClient: licensingClient,
Log: logf.NullLogger{},
Recorder: record.NewFakeRecorder(1024),
}

licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()

secret = &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},
Data: map[string][]byte{"token": []byte(secretToken)},
}
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())

smartLicense = &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
Action: v1.Register,
TokenSecret: corev1.SecretReference{
Name: secretName,
Namespace: defaultNs,
},
LicenseType: licenseType,
MinLicenseCount: &minLicenseCount,
}
MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,

},
}

Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

})

AfterEach(func() {
mockCtrl.Finish()
})

Context("platform registration", func() {
It("should register platform in licensing system", func() {
registrationService.EXPECT().Register(&licensing.Platform{
Uuid:  string(smartLicense.UID),
Name:  licenseNsName.String(),
SerialNumber:  "8B201B63BB8" ,
ProductId: controllers.SFCNProductId,
PoolName:  defaultNs,
}, secretToken, gomock.Any()).Return(&licensing.Registration{
ContextId:  "testContextId",
SmartAccountName:  "TestAccountName",
VirtualAccountName:  "TestVirtualName",
ExportControlled:  true,
IsRegistered:  false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
ContextId:  "testContextId",
EntitlementId:  licenseType,
MinEntitlements:  minLicenseCount,
MaxEntitlements:  maxLicenseCount,
ScalingFactor:  scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())

})

Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))

Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))

Expect(smartLicense.Status.ExportControlled).Should(BeTrue())

Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))

})
It("should ignore ErrDuplicateListener error", func() {
  registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
  gomock.Any()).Return(&licensing.Registration{
    ContextId:    "testContextId",
    IsRegistered: false,
  }, nil)
  entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(
    fmt.Errorf("entitlement listener already exists: %w", licensing.ErrDuplicateListener))
  entitlementService.EXPECT().ScaleEntitlement(gomock.Any(), gomock.Any()).Return(nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())
}

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
})
})
})

Context("platform deregistration", func() {
  It("should deregister platform in licensing system", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.ContextId = "testContextId"
    smartLicense.Status.RegistrationState = v1.Registered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0))))
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0))))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0))))
  })
})

It("should skip deregistration if platform is already deregistered", func() {
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  smartLicense.Status.RegistrationState = v1.Deregistered
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())
})
It("should deregister platform on resource deletion", func() {
    smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
    now := metav1.Now()
    smartLicense.DeletionTimestamp = &now
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.RegistrationState = v1.Registered
    smartLicense.Status.ContextId = "testContextId"
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
}

context("smart license updating", func() {
    It("license state should not be updated", func() {
        Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
        licenseStateBeforeUpdate := smartLicense.Status.LicenseState
        smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
        Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
        registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
            gomock.Any()).Return(&licensing.Registration{
            ContextId:    "testContextId",
            IsRegistered: true,
            }, nil)
        entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
        entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
            ContextId:       "testContextId",
            EntitlementId:   licenseType,
            MinEntitlements: minLicenseCount,
            MaxEntitlements: newMaxLicenseCount,
            ScalingFactor:   scalingFactor,
            }).Return(nil)
        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
        Expect(err).To(BeNil())
    }
})
Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))
})
})
})
}

package subscribers

import (
    licensing "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "strings"
)

func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
    return &subscriptionListener{
        channel: channel,
        log:     log,
    }
}

type subscriptionListener struct {
    channel chan event.GenericEvent
    log     logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)
    switch e.Type {
    case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED, proto.AllotmentEvent_ALLOTMENT_DENIED:
        l.log.V(1).Info("scheduling event for PodLicenseReconciler")
        l.sendEventToChannel(e.Tenant.Name)
    }
}
func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
    pod := &coreV1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:      namespacedName[1],
            Namespace: namespacedName[0],
        }
    }
    l.channel <- event.GenericEvent{Object: pod}
}

package listeners

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "time"
)

func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger,
    recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
    return &deregistrationListener{
        log:          log,
        client:       client,
        licenseNsName: licenseNsName,
        recorder:     recorder,
        notifierChannel: notifierChannel,
        retries:      int
    }
}

const MaxRetries = 10

type deregistrationListener struct {
    log          logr.Logger
    client       client.Client
    licenseNsName types.NamespacedName
    recorder     record.EventRecorder
    notifierChannel chan event.GenericEvent
    retries      int
}

// OnAutoDeregistration updates SmartLicense status to be in deregistered state.
// The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
    log := d.log.WithValues("smartlicense", d.licenseNsName)
    log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)

    if err := d.warnSmartLicenseDeregistered(msg); err != nil {
        if d.retries < MaxRetries {
            d.retries++
            time.Sleep(1 * time.Second)
            d.OnAutoDeregistration(platform, msg)
            return
        }
        log.Error(err, "failed to process auto-deregistration event")
        return
    }
    d.retries = 0
    log.V(1).Info("successfully processed auto-deregistration event")
}

func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
    var license v1.SmartLicense
    if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }

    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status_LICENSE_NUMBER = 0
    license.Status.CoresPerLicense = 0
    license.Status.EstimatedMaxReplicas = 0

    if err := d.client.Status().Update(context.Background(), &license); err != nil {
        return fmt.Errorf("failed to update SmartLicense status: %w", err)
    }
    d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
    d.notifierChannel <- event.GenericEvent{Object: &license}
    return nil
}
package controllers

import (  
    "context"  
    v1 "css.cisco.com/kasa/license-broker/api/v1"  
    "css.cisco.com/kasa/license-broker/controllers/handlers"  
    "css.cisco.com/kasa/pkg/predicates"  
    "fmt"  
    "github.com/go-logr/logr"  
    appsV1 "k8s.io/api/apps/v1"  
    autoscalingV1 "k8s.io/api/autoscaling/v1"  
    corev1 "k8s.io/api/core/v1"  
    "k8s.io/apimachinery/pkg/api/errors"  
    "k8s.io/apimachinery/pkg/types"  
    "k8s.io/client-go/tools/record"  
    ctrl "sigs.k8s.io/controller-runtime"  
    "sigs.k8s.io/controller-runtime/pkg/builder"  
    "sigs.k8s.io/controller-runtime/pkg/client"  
    "sigs.k8s.io/controller-runtime/pkg/source"  
    "strconv"  
    "time"  
)

//go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator  
type ReplicasCalculator interface {  
    CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error)  
}

type DeploymentLicenseReconciler struct {  
    client.Client  
    Log            logr.Logger  
    Recorder       record.EventRecorder  
    ReplicasCalculator ReplicasCalculator  
}

func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {  
    return ctrl.NewControllerManagedBy(mgr).  
        For(&appsv1.Deployment{ }, builder.WithPredicates(  
            &predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey: InitialReplicasNumberAnnotation}).  
        Watches(&source.Kind{Type: &v1.SmartLicense{ }, }.handler.DeploymentHandler()).  
        Complete(c)  
    }

    // Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value  
    // when it exceeds the replicas allowed by licensing config.  
    func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {  
        return c.Reconcile(ctx, req)  
    }
log.V(1).Info("reconciliation started")
start := time.Now()
defer func() {
    log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
}()

deployment := &appsv1.Deployment{}
if err != nil {
    if errors.IsNotFound(err) {
        log.Info("Deployment does not exist, nothing to reconcile")
    }
    return ctrl.Result{}, client.IgnoreNotFound(err)
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("updated Deployment labels")
}

if len(deploymentLicenses) == 0 {
    log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentControlledByHPA",
        fmt.Sprintf("%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s
        HPA", deployment.Name, hpa.Name, hpa.Name))
}

if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
    initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
    if err != nil {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "WrongInitialReplicasNumber",
            fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
        return ctrl.Result{}, err
    }
    log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
    *deployment.Spec.Replicas = int32(initialReplicasCountInt)
    // delete initial replica number from Deployment annotations to don't back to initial number on each reconciliation
    delete(deployment.Annotations, InitialReplicasNumberAnnotation)
    if err = c.Client.Update(context.Background(), deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    c.Recorder.Event(deployment, corev1.EventTypeNormal, "ScaledDeploymentToInitialReplicasNumber",
        fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))
}

if *deployment.Spec.Replicas > maxLicensedReplicas {
    log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas",
        *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
    *deployment.Spec.Replicas = maxLicensedReplicas
    if err = c.Client.Update(context.Background(), deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check
    SmartLicense resource to increase the limit.", maxLicensedReplicas))
    log.Info("successfully scaled down deployment to max license limit", "updatedReplicas",
        *deployment.Spec.Replicas)
    return ctrl.Result{}, nil
}
log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas", *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment *appsv1.Deployment) (*autoscalingv1.HorizontalPodAutoscaler, error) {

hpaList := &autoscalingv1.HorizontalPodAutoscalerList{
if err != nil {
return nil, err
}

for _, hpa := range hpaList.Items {
return &hpa, err
}
}

return nil, err
}

package controllers

import (  "context"  "errors"  "fmt"  "strconv"  "time"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "css.cisco.com/kasa/pkg/predicates"  licensing "css.cisco.com/licensing/client-agent"  "github.com/go-logr/logr"  appsv1 "k8s.io/api/apps/v1"  autoscalingv1 "k8s.io/api/autoscaling/v1"  coreV1 "k8s.io/api/core/v1"  corev1 "k8s.io/api/core/v1"  apiErrors "k8s.io/apimachinery/pkg/api/errors"  "k8s.io/apimachinery/pkg/apimachinerygetPath"  "k8s.io/apimachinery/pkg/labels"  "k8s.io/apimachinery/pkg/selection"  "k8s.io/apimachinery/pkg/types"  "k8s.io/client-go/tools/record"  "k8s.io/utils/pointer"
ctl "sigs.k8s.io/controller-runtime"  "sigs.k8s.io/controller-runtime/pkg/builder"
type PodLicenseReconciler struct {
    client.Client
    LicensingClient licensing.LicensingClient
    Log      logr.Logger
    Recorder record.EventRecorder
}

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&corev1.Pod{}, builder.WithPredicates(&predicates.LabelExistsPredicate{Key: LicenseHolderLabel})�)
        Watches(&source.Channel{Source: eventChannel}, &handler.EnqueueRequestForObject{}).
        Complete(c)
}

// Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
// a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
// On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    pod := &corev1.Pod{}
    podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
    err := c.Client.Get(ctx, podNsName, &pod)
    if err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("Pod does not exist, releasing allotments it might still hold")
            return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
        }
        return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
    }

    status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

shouldHaveLicensingLabel := status != nil && status.NumCores != 0
changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
if changed {
    if err = c.Client.Update(ctx, &pod); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
    }
    log.Info("updated Pod labels")
}

deployment, err := c.findPodDeployment(&pod)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
}

if deployment == nil {
    log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
    if err := c.Client.Delete(context.Background(), &pod); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
    }
    c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration.")
    log.Info("deleted orphan Pod")
    return ctrl.Result{}, nil
}

licenseList := v1.SmartLicenseList{
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

serviceRole := getDeploymentServiceRole(deployment)

serviceRoleIsRegistered, err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
}
if !serviceRoleIsRegistered {
    if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
} else {
    if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
}
if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
    return ctrl.Result{}, err
}

return ctrl.Result{}, nil

// releaseAllotmentsIfAny releases licensing allotments that Pod held in the licence-server
func (c *PodLicenseReconciler) releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
    log := c.Log.WithValues("pod", nsName.String())

    tenant := &licensing.Tenant{Name: nsName.String()}
    status, err := c.LicensingClient.Allotment().Status(tenant)
    if err != nil {
        if errors.Is(err, licensing.ErrNotRegistered) {
            log.Info("Pod tenant is not registered in license server, nothing to release")
            return nil
        }
    }

    return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
}

if status != nil && status.NumCores != 0 {
    log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
        ContextId: status.ContextId,
        Tenant:    tenant,
    }); err != nil {
        return fmt.Errorf("failed to release Pod allotments: %w", err)
    }

    log.Info("successfully released Pod allotments")
    return nil
}

log.Info("Pod does not hold any allotments, nothing to release")
    return nil

func (c *PodLicenseReconciler) podLogger(pod *coreV1.Pod) logr.Logger {
}

func toLicenseTenant(pod coreV1.Pod) *licensing.Tenant {
    podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
    return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each
service role

// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is
// scaled down.
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment,
reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the
namespace")

    trialDeploymentList := appsv1.DeploymentList{}
    labelSelector := labels.NewSelector()
    trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals,
[]string{"true"})
    if err == nil {
        labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
    }
    serviceRole := getDeploymentServiceRole(deployment)
    serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals,
[]string{serviceRole})
    if err == nil {
        labelSelector = labelSelector.Add(*serviceLabelRequirement)
    }
    if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
        Namespace:     deployment.Namespace,
        LabelSelector: labelSelector,
    }); err != nil {
        return fmt.Errorf("failed to fetch Deployments with trial license label")
    }
    log.Info("Length of trial deployment list", "length", len(trialDeploymentList.Items))
    var allowedReplicas int32 = 0
    trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
    isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name ==
deployment.Name
    if trialDeploymentIsAbsent || isDeploymentInTrial {
        log.Info("Deployment has to be marked as trial license holder")
        allowedReplicas = 1
    }

    trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
    scaleDownRequired := *deployment.Spec.Replicas > allowedReplicas
    if scaleDownRequired || trialLabelUpdated {
        initialReplicasNumber := strconv.Itoa(int(pointer.Int32PtrDerefOr(deployment.Spec.Replicas, 1)))
        log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
        deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
        deployment.Spec.Replicas = &allowedReplicas
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment resource: %w", err)
        }
    }

    return nil
}
if scaleDownRequired {
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
    fmt.Sprintf("Decreased Deployment's Replicas to %d "+
    "as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. "+
    "Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas))
    log.Info("scaled Deployment", "replica count", allowedReplicas)
}

return nil

// throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
// If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList []v1.SmartLicense, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
    if err != nil {
        return fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }
    if !containsString(licensedDeploymentNames, deployment.Name) {
        log.Info("scaling down Pod's Deployment to 0 as it requested license but does not belong to any licensed EP deployment")
        *deployment.Spec.Replicas = 0
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment resource: %w", err)
        }
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
        fmt.Sprintf("Decreased Deployment's Replicas to 0 "+
        "as it requested license but does not belong to any licensed EP deployment. "+
        "Please, check SmartLicense resources to update licensing configuration."))
        log.Info("scaled down Pod's Deployment to 0")
        return nil
    }
    log.Info("verified that Pod belongs to the licensed Deployment")
    return nil
}

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
func (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment: %w", err)
        }
    }
}


```
log.Info("removed Deployment trial license label")
}
return nil
}

// getLicensedDeploymentNames collects names of all Deployments that have a corresponding SmartLicense resource.
func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
    var deploymentNames []string
    for _, license := range licenseList {
        switch license.Spec.ScalingRef.Kind {
        case v1.DeploymentKind:
            deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
        case v1.HPAKind:
            hpa := &autoscalingv1.HorizontalPodAutoscaler{}
            hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
            if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
                return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
            }
            deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
        default:
        }
    }
    return deploymentNames, nil
}

// findPodDeployment tries to find Pod's Deployment if Pod is managed by Deployment. If Pod is not managed by Deployment controller, `nil` is returned.
func (c *PodLicenseReconciler) findPodDeployment(pod *corev1.Pod) (*appsv1.Deployment, error) {
    log := c.podLogger(pod)
    if len(pod.OwnerReferences) != 1 || !*pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind != "ReplicaSet" {
        log.Info("pod is not owned by ReplicaSet")
        return nil, nil
    }
    replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
    replicaSet := &appsv1.ReplicaSet{}
    if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
        return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
    }
    if len(replicaSet.OwnerReferences) != 1 || !*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
        log.Info("pod's ReplicaSet is not owned by Deployment")
        return nil, nil
    }
    replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
    replicaSet := &appsv1.ReplicaSet{}
    if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
        return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
    }
    if len(replicaSet.OwnerReferences) != 1 || !*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
        log.Info("pod's ReplicaSet is not owned by Deployment")
        return nil, nil
    }
```
deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
deployment := &apps_v1.Deployment{ }
if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
    return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
}
return deployment, nil

// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in registeredLicenses.
// It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified service role label.
func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense, namespace string, serviceRole string) (bool, error) {
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
    if err != nil {
        return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }
    for _, deploymentName := range licensedDeploymentNames {
        deployment := &apps_v1.Deployment{ }
deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
        err := c.Client.Get(context.Background(), deploymentNsName, deployment)
        if err != nil {
            return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
        }
        if getDeploymentServiceRole(deployment) == serviceRole {
            return true, nil
        }
    }
    return false, nil
}

func getDeploymentServiceRole(deployment *apps_v1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistrylessTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val getPublicTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String, String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra
val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(":")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

ext {
    set("publishImages", listOf(
        project.findProperty("imageName") as String,
        project.findProperty("licenseServerImageName") as String
    ))
}

tasks {

    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }

    named("dockerBuild") {
        doLast {
            exec {
                environment("DOCKER_BUILDKIT", 1)
                commandLine("docker build -f ./Dockerfile -t $imageNameForPush .":split(" ")")
            }
            val artifactoryUser = project.findProperty("artifactoryUser")!! as String
            val artifactoryApiKey = project.findProperty("artifactoryApikey")!! as String
            val saArtifactoryUrl = project.findProperty("saArtifactoryUrl")!! as String
            val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
            val downloadUrl = "$saArtifactoryUrl/com/cisco/css/sl/sa-server/$saServerArtifactVersion/sa-server" + 
"-.saServerArtifactVersion-all.jar"
            if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
                // Download artifact
            }

            // More tasks...
        }
    }
}
exec {
  setWorkingDir("bin")
  commandLine = listOf(
    "bash", "-c",
    "curl -f -u $artifactoryUser:$artifactoryApiKey -O $downloadUrl"
  )
}
}

eval {
  environment("DOCKER_BUILDKIT", 1)
  commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}
}

named("promoteImage") {
  val licenseServerImageName: String? by project
  onlyIf {
    licenseServerImageName != null
  }
  doLast {
    val sourceTag: String? by project
    val sourceRepo: String? by project
    val imageTag: String? by project
    if (sourceTag == null || sourceRepo == null || imageTag == null) {
      val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please, specify them with: -PsourceTag=<srcImageTag> -PsourceRepo=<sourceRepoName> -PimageTag=<targetImageTag>"
      logger.error(msg)
      throw GradleException(msg)
    }
    val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
    val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split(':')[0]
    promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
  }
}

named("check") {
  doLast {
    execCommands(listOf(
      "go fmt ./...",
      "go vet ./..."
    ))
  }
}

named("test") {
doLast {
    execCommands(listOf(
        "go test -coverpkg=./... -coverprofile cover.out ./...",
        "go tool cover -func=cover.out -o ${project.name}-cover.txt"
    ))
}
}

named("publish") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        println(execCommand("docker push $serverImageNameForPush"))
    }
}

named("manifests") {
    dependsOn("controller-gen")
    description = "Generates manifests for k8s deployment using Helm"
    doLast {
        execHelmCommand("helm dependency update")
        val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")} . --namespace $systemNamespace --set nameOverride=licenseapi")

        buildDir.deleteRecursively()
        buildDir.mkdir()
        File("$buildDir/license-broker.yaml").writeText(stdOut)
    }
}

named<Copy>("generateValuesFile") {
    expand(
        "platform" to project.findProperty("platform")!!,
        "registry" to project.findProperty("dockerRegistry")!!,
        "artifactaryRepo" to project.findProperty("imageDirectory")!!,
        "controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
        "licenseServerImage" to getRegistrylessTaggedImage(project.findProperty("licenseServerImageName")!! as String),
        "defaultImagePullPolicy" to project.findProperty("imagePullPolicy")!!,
        "logLevel" to project.findProperty("logLevel")!!,
        "logFormat" to project.findProperty("logFormat")!!,
        "licenseServerTransportUrl" to project.findProperty("licenseServerTransportUrl")!!
    )
}
named("generateControllerGenFiles") {  
dependsOn("controller-gen")  
doLast {  
  execCommand("controllerGen ScrdOpts rbac:roleName=broker-role webhook paths=./...
  output:crd:artifacts:config=config/crd")
}
}

register("generate") {  
dependsOn("controller-gen")  
description = "Executes code generators"  
doLast {  
  execCommand("controllerGen object:headerFile=./hack/boilerplate.go.txt paths=./...")
}
}

register("uninstall") {  
description = "Removes k8s objects from the active cluster"  
dependsOn("manifests")  
doLast {  
  exec {  
    isIgnoreExitValue = true  
    commandLine("kubectl delete -f $buildDir".split(" "))
  }
}
}

named("deploy") {  
dependsOn(":installCertManager")  
dependsOn("manifests")  
doLast {  
  exec {  
    commandLine("kubectl apply -f $buildDir".split(" "))
  }
  createRegistrySecret(systemNamespace)
}
}

named("loadImagesToKind") {  
doLast {  
  val clusterName: String by project  
  execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")  
  execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
  execCommand("docker tag $imageNameForPush $imageNameForPull")  
  execCommand("kind load docker-image $imageNameForPull --name $clusterName")
}
}
package mocks

import {
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
}

// MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {
    ctrl       *gomock.Controller
    recorder   *MockRegistrationServiceMockRecorder
}

// MockRegistrationServiceMockRecorder is the mock recorder for MockRegistrationService
type MockRegistrationServiceMockRecorder struct {
    mock *MockRegistrationService
}

// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.T.Helper().Call(mr.mock, "Deregister", arg0)
}
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister", reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener) (*service.Registration, error) {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
  ret0, _ := ret[0].(*service.Registration)
  ret1, _ := ret[1].(error)
  return ret0, ret1
}

// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}

Please review the EULA agreement and set the flag '--set global.acceptEULA=[yes, or agree]' for acknowledgement.

Cisco End User License Agreement
package integ_tests
import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  . "github.com/onsi/ginkgo"  . "github.com/onsi/gomega"  "k8s.io/apimachinery/pkg/api/errors"  "k8s.io/client-go/kubernetes/scheme"  "k8s.io/client-go/rest"  "path/filepath"  "sigs.k8s.io/controller-runtime/pkg/client"  "sigs.k8s.io/controller-runtime/pkg/envtest"  "sigs.k8s.io/controller-runtime/pkg/envtest/printer"  "sigs.k8s.io/controller-runtime/pkg/log/zap"  "strings"  "testing"  "time"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {
RegisterFailHandler(Fail)

SetDefaultEventuallyTimeout(time.Minute)
RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite",
[[Reporter{printer.NewlineReporter{}}]])
}

var _ = BeforeSuite(func(done Done) {
logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))

By("bootstrapping test environment")
apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
testEnv = &envtest.Environment{
WebhookInstallOptions: envtest.WebhookInstallOptions{
Paths: []string{filepath.Join("..", "config", "webhook")},
},
CRDDirectoryPaths: []string{filepath.Join("..", "config", "crd")},
KubeAPIServerFlags: apiServerFlags,
ControlPlaneStartTimeout: 100 * time.Second,
ControlPlaneStopTimeout: 100 * time.Second,
}

var err error
cfg, err = testEnv.Start()
Expect(err).ToNot(HaveOccurred())
Expect(cfg).ToNot(BeNil())

er = v1.AddToScheme(scheme.Scheme)
Expect(err).NotTo(HaveOccurred())

k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
Expect(err).NotTo(HaveOccurred())
Expect(k8sClient).ToNot(BeNil())

By("running webhook server")
go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done)
}, envtest.StartTimeout)

var _ = AfterSuite(func(done Done) {
By("tearing down the test environment")
cancelCtx()
Expect(testEnv.Stop()).ToNot(HaveOccurred())


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func errCauses(err error) []string {
    var causes []string
    if statusError, ok := err.(*errors.StatusError); ok {
        for _, cause := range statusError.Status().Details.Causes {
            causes = append(causes, strings.Split(cause.Message, ": ")[2])
        }
    }
    return causes
}

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***************************************************************/

package v1

import (
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
)

const TokenKeyName = "token"

type RegistrationAction string

const (  
    Register  RegistrationAction = "REGISTER"
    Deregister RegistrationAction = "DEREGISTER"
)

// SmartLicenseSpec defines the desired state of SmartLicense

type SmartLicenseSpec struct {

    // Action is the desired state of the Smart Agent license registration.
    // +kubebuilder:validation:Enum=REGISTER;DEREGISTER
    // +optional
    Action RegistrationAction `json:"action"

    // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
    TokenSecret v1.SecretReference `json:"tokenSecret"

    // LicenseType defines the type of license to request/release, usually the SKU of the license.
// The default value is a SFW license tag being able to handle 1vCPU.
// +optional
LicenseType string `json:"licenseType"

// MinLicenseCount is a minimum number of licenses SFCN reserves for the product.
// The default value is 1.
// +optional
MinLicenseCount *uint32 `json:"minLicenseCount,omitempty"

// MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.
// The default value is equal to MinLicenseCount.
// +optional
MaxLicenseCount *uint32 `json:"maxLicenseCount,omitempty"

// ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down.
// The default value is 1.
// +optional
ScalingFactor *uint32 `json:"scalingFactor,omitempty"

// ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
ScalingRef autoscalingv1.CrossVersionObjectReference `json:"scalingRef,omitempty"

}

type LicenseState string

const ( PendingLicenseState LicenseState = "PENDING"
Unlicensed LicenseState = "UNLICENSED"
InCompliance LicenseState = "IN_COMPLIANCE"
OutOfCompliance LicenseState = "OUT_OF_COMPLIANCE"
Overage LicenseState = "OVERAGE"
)

const ( DeploymentKind = "Deployment"
HPAKind = "HorizontalPodAutoscaler"
)

type RegistrationState string

const ( PendingRegistrationState RegistrationState = "PENDING"
Registered RegistrationState = "REGISTERED"
RegistrationFailed RegistrationState = "REGISTRATION_FAILED"
Deregistered RegistrationState = "DEREGISTERED"
DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
// SmartLicenseStatus defines the observed state of SmartLicense
// type SmartLicenseStatus struct {

// AccountDomain is the account domain in Cisco Software Central.
AccountDomain string `json:"accountDomain,omitempty"

// AccountName is the name of the virtual account in Cisco Software Central.
AccountName string `json:"accountName,omitempty"

// RegistrationState is the registration status of the SFCN product in Cisco Software Central.
//+kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DEREGISTRATION_FAILED
RegistrationState RegistrationState `json:"registrationState,omitempty"

// LicenseState is the state of the reserved licenses.
//+kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVERAGE
LicenseState LicenseState `json:"licenseState,omitempty"

// ErrorReason specifies the error due to which the the SFCN product was not registered in Cisco Software Central.
ErrorReason string `json:"errorReason,omitempty"

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
LicenseNumber uint32 `json:"licenseNumber,omitempty"

// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicense,omitempty"

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicas,omitempty"

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while
// generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlled,omitempty"

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextId,omitempty"

// +kubebuilder:object:root=true
// +kubebuilder:subresource:status
// +kubebuilder:printcolumn:name="Age",type="date",JSONPath=".metadata.creationTimestamp"
// +kubebuilder:printcolumn:name="Registration State",type="string",JSONPath=".status.registrationState"
// +kubebuilder:printcolumn:name="License State",type="string",JSONPath=".status.licenseState"
// +kubebuilder:printcolumn:name="License Number",type="integer",JSONPath=".status.licenseNumber"
// +kubebuilder:printcolumn:name="Domain",type="string",priority=1,JSONPath=".status.accountDomain"
// +kubebuilder:printcolumn:name="Account",type="string",priority=1,JSONPath=".status.accountName"
// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
metav1.TypeMeta `json:",inline"`
metav1.ObjectMeta `json:"metadata,omitempty"`
Spec SmartLicenseSpec `json:"spec,omitempty"`
Status SmartLicenseStatus `json:"status,omitempty"`
}
// +kubebuilder:object:root=true
// SmartLicenseList contains a list of SmartLicense
type SmartLicenseList struct {
metav1.TypeMeta `json:",inline"`
metav1.ListMeta `json:"metadata,omitempty"`
Items
[]SmartLicense `json:"items"`
}
func init() {
SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}
/***************************************************************
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**************************************************************/
// Package v1 contains API Schema definitions for the sfcn.cisco.com v1 API group
// +kubebuilder:object:generate=true
// +groupName=sfcn.cisco.com
package v1
import (
"k8s.io/apimachinery/pkg/runtime/schema"
"sigs.k8s.io/controller-runtime/pkg/scheme"
)
var (
// GroupVersion is group version used to register these objects
// SchemeBuilder is used to add go types to the GroupVersionKind scheme
SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}
// AddToScheme adds the types in this group-version to the given scheme.

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AddToScheme = SchemeBuilder.AddToScheme
)
domain: sfcn.cisco.com
repo: css.cisco.com/kasa/license-broker
resources:
- group: sfcn.cisco.com
  kind: SmartLicense
  version: v1
  version: "2"
package controllers

import (
  "crypto/md5"
  "fmt"
)

v1 "css.cisco.com/kasa/license-broker/api/v1"
metav1 "k8s.io/apimachinerypkg/apis/meta/v1"
)

const ( LicenseHolderLabel = "sfcn.cisco.com/license-holder"
TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder"
ServiceRoleLabel = "sfcn.cisco.com/service-role"
// DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set DefaultServiceRole = "default"
InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"
)

// serialNumber generates platform's Serial Number for SmartLicense resource.
// According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {
  return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName)))[0:11]
}

func containsString(slice []string, s string) bool {
  for _, item := range slice {
    if item == s {
      return true
    }
  }
  return false
}

func removeString(slice []string, s string) (result []string) {
  for _, item := range slice {
    if item == s {
      continue
    }
    result = append(result, item)
  }
  return result
}
result = append(result, item)
}
return

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Status.RegistrationState == state {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// filterLicensesByKind filters SmartLicenses by given kind and name properties of ScalingRef field and returns the result.
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// pendingLicenseExists returns true if any license in the list is in Pending state.
func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status-LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

// setLicenseLabel makes sure that the licensing label is present when `shouldBePresent` is `true`
// and that the label is absent when `shouldBePresent` is `false`.
func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
    }
    return true
}
if _, ok := meta.Labels[label]; ok && !shouldBePresent {
    delete(meta.Labels, label)
    return true
}

return false
}
package services

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "math"
    "sigs.k8s.io/controller-runtime/pkg/client"
}

    return &ReplicasCalculator{client, logger}
}

type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and
// calculates maximum amount of replicas based on licensing.
// If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    var maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 && deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods", "deployment", deployment.Name)
        // it can be a scenario when we have spec.Replicas = 5, but Status.ReadyReplicas = 0. So, we just return desired
        replicas by a user.
        return *deployment.Spec.Replicas, nil
    }
var err error
if coresQuantity == 0 && deployment.Status.ReadyReplicas != 0 {
    coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
    if err != nil {
        return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
    }
}

r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores", coresQuantity)

for _, license := range licenses {
    if license.Status.LicenseState == v1.InCompliance {
        maxLicensedCores := int(*license.Spec.MaxLicenseCount) * int(license.Status.CoresPerLicense)
        maxLicensedReplicas := int32(maxLicensedCores / int(coresQuantity))
        r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)
    }
    maxLimit += maxLicensedReplicas
    license.Status.EstimatedMaxReplicas = maxLicensedReplicas
    if err := r.Client.Status().Update(ctx, &license); err != nil {
        return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
    }
}

// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil
}

func (r *ReplicasCalculator) getCoresQuantity(deployment *appsv1.Deployment) uint32 {
    coresQuantity := resource.MustParse("0")
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
            return 0
        }
        coresQuantity.Add(containerLimit)
    }
    return uint32(coresQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
    podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
}
if err != nil {
    return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
}

pods := corev1.PodList{}
if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
    return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
}

// TODO: do not rely on the fact that all nodes have the same CPU limit
pod := pods.Items[0]

node := corev1.Node{}
nodeNsName := types.NamespacedName{Name: pod.Spec.NodeName}
if err := r.Client.Get(ctx, nodeNsName, &node); err != nil {
    return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
}

r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPULimit, nil

1.43 evanphx-json-patch v4.5.0+incompatible
1.43.1 Available under license:

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1.44 gophercloud v0.1.0

1.44.1 Available under license:

```go
package RESOURCE

import (
    "github.com/gophercloud/gophercloud"
    "github.com/gophercloud/gophercloud/pagination"
)

// RESOURCE represents...
type Resource struct {
}

type commonResult struct {
    gophercloud.Result
}

// GetResult is the response from a Get operation. Call its Extract method
// to interpret it as a RESOURCE.
type GetResult struct {
    commonResult
}

// CreateResult is the response from a Create operation. Call its Extract method
// to interpret it as a RESOURCE.
type CreateResult struct {
    commonResult
}

// DeleteResult is the response from a Delete operation. Call its ExtractErr to
// determine if the request succeeded or failed.
type DeleteResult struct {
    gophercloud.ErrResult
}

// UpdateResult is the result of an Update request. Call its Extract method to
// interpret it as a RESOURCE.
type UpdateResult struct {
    commonResult
}
```
// ResourcePage is a single page of RESOURCE results.
type ResourcePage struct {
pagination.LinkedPageBase
}

// IsEmpty determines whether or not a page of RESOURCES contains any results.
func (r ResourcePage) IsEmpty() (bool, error) {
resources, err := ExtractResources(r)
return len(resources) == 0, err
}

// NextPageURL extracts the "next" link from the links section of the result.
func (r ResourcePage) NextPageURL() (string, error) {
var s struct {
Links struct {
Next string `json:"next"
Previous string `json:"previous"
} `json:"links"
}
err := r.ExtractInto(&s)
if err != nil {
return "", err
}
return s.Links.Next, err
}

// ExtractResources returns a slice of Resources contained in a single page of
// results.
func ExtractResources(r pagination.Page) ([]Resource, error) {
var s struct {
Resources []Resource `json:"resources"
}
err := (r.(ResourcePage)).ExtractInto(&s)
return s.Resources, err
}

// Extract interprets any commonResult as a Resource.
func (r commonResult) Extract() (*Resource, error) {
var s struct {
Resource *Resource `json:"resource"
}
err := r.ExtractInto(&s)
return s.Resource, err
}

Contributor Tutorial

This tutorial is to help new contributors become familiar with the processes
used by the Gophercloud team when adding a new feature or fixing a bug.

While we have a defined process for working on Gophercloud, we're very mindful that everyone is new to this in the beginning. Please reach out for help or ask for clarification if needed. No question is ever "dumb" or not worth our time answering.

To begin, go to [Step 1](step-01-introduction.md).

Step 5: Writing the Code

At this point, you should have:

- [x] Identified a feature or bug fix
- [x] Opened an Issue about it
- [x] Located the project's service code which validates the feature or fix
- [x] Have an OpenStack environment available to test with

Now it's time to write the actual code! We recommend reading over the [CONTRIBUTING](/.github/CONTRIBUTING.md) guide again as a refresh. Notably the [Getting Started](/.github/CONTRIBUTING.md#getting-started) section will help you set up a `git` repository correctly.

We encourage you to browse the existing Gophercloud code to find examples of similar implementations. It would be a very rare occurrence for you to be implementing something that hasn't already been done.

Use the existing packages as templates and mirror the style, naming, and logic.

Types of Pull Requests

The amount of changes you plan to make will determine how much code you should submit as Pull Requests.

### A Single Bug Fix

If you're implementing a single bug fix, then creating one `git` branch and submitting one Pull Request is fine.

### Adding a Single Field

If you're adding a single field, then a single Pull Request is also fine. See [#662](https://github.com/gophercloud/gophercloud/pull/662) as an example of this.

If you plan to add more than one missing field, you will need to open a Pull
### Adding a Single API Call

Single API calls can also be submitted as a single Pull Request. See [#722](https://github.com/gophercloud/gophercloud/pull/722) as an example of this.

### Adding a Suite of API Calls

If you're adding support for a "suite" of API calls (meaning: Create, Update, Delete, Get), then you will need to create one Pull Request for _each_ call.

The following Pull Requests are good examples of how to do this:

* https://github.com/gophercloud/gophercloud/pull/584
* https://github.com/gophercloud/gophercloud/pull/586
* https://github.com/gophercloud/gophercloud/pull/587
* https://github.com/gophercloud/gophercloud/pull/594

You can also use the provided [template](/docs/contributor-tutorial/template) as it contains a lot of the repeated boiler plate code seen in each resource. However, please make sure to thoroughly review and edit it as needed. Leaving templated portions in-place might be interpreted as rushing through the work and will require further rounds of review to fix.

### Adding an Entire OpenStack Project

To add an entire OpenStack project, you must break each set of API calls into individual Pull Requests. Implementing an entire project can be thought of as implementing multiple API suites.

An example of this can be seen from the Pull Requests referenced in [#723](https://github.com/gophercloud/gophercloud/issues/723).

### What to Include in a Pull Request

Each Pull Request should contain the following:

1. The actual Go code to implement the feature or bug fix
2. Unit tests
3. Acceptance tests
4. Documentation

Whether you want to bundle all of the above into a single commit or multiple commits is up to you. Use your preferred style.
### Unit Tests

Unit tests should provide basic validation that your code works as intended.

Please do not use JSON fixtures from the API reference documentation. Please generate your own fixtures using the OpenStack environment you're testing with.

### Acceptance Tests

Since unit tests are not run against an actual OpenStack environment, acceptance tests can arguably be more important. The acceptance tests that you include in your Pull Request should confirm that your implemented code works as intended with an actual OpenStack environment.

### Documentation

All documentation in Gophercloud is done through in-line `godoc`. Please make sure to document all fields, functions, and methods appropriately. In addition, each package has a `doc.go` file which should be created or amended with details of your Pull Request, where appropriate.

Dealing with Related Pull Requests
----------------------------------

If you plan to open more than one Pull Request, it's only natural that code from one Pull Request will be dependent on code from the prior Pull Request.

There are two methods of handling this:

### Create Independent Pull Requests

With this method, each Pull Request has all of the code to fully implement the code in question. Each Pull Request can be merged in any order because it's self contained.

Use the following `git` workflow to implement this method:

```
```
$ (write your code)
$ git add .
$ git commit -m "Implementing Regions Update"

Advantages of this Method:

* Pull Requests can be merged in any order
* Additional commits to one Pull Request are independent of other Pull Requests

Disadvantages of this Method:

* There will be _a lot_ of duplicate code in each Pull Request
* You will have to rebase all other Pull Requests and resolve a good amount of merge conflicts.

### Create a Chain of Pull Requests

With this method, each Pull Request is based off of a previous Pull Request. Pull Requests will have to be merged in a specific order since there is a defined relationship.

Use the following `git` workflow to implement this method:

```
```
$ git checkout master
$ git pull
$ git checkout -b identityv3-regions-create
$ (write your code)
$ git add .
$ git commit -m "Implementing Regions Create"

$ git checkout -b identityv3-regions-update
$ (write your code)
$ git add .
$ git commit -m "Implementing Regions Update"
```

Advantages of this Method:

* Each Pull Request becomes smaller since you are building off of the last

Disadvantages of this Method:

* If a Pull Request requires changes, you will have to rebase _all_ child Pull Requests based off of the parent.

The choice of method is up to you.
Once you have your code written, submit a Pull Request to Gophercloud and proceed to [Step 6](step-06-code-review.md).

Step 6: Code Review

Once you've submitted a Pull Request, three things will happen automatically:

1. Travis-CI will run a set of simple tests:
   a. Unit Tests
   b. Code Formatting checks
   c. `go vet` checks

2. Coveralls will run a coverage test.
3. [OpenLab](https://openlabtesting.org/) will run acceptance tests.

Depending on the results of the above, you might need to make additional changes to your code.

While you're working on the finishing touches to your code, it is helpful to add a `[wip]` tag to the title of your Pull Request.

You are most welcomed to take as much time as you need to work on your Pull Request. As well, take advantage of the automatic testing that is done to each commit.

### Travis-CI

If Travis reports code formatting issues, please make sure to run `gofmt` on all of your code. Travis will also report errors with unit tests, so you should ensure those are fixed, too.

### Coveralls

If Coveralls reports a decrease in test coverage, check and make sure you have provided unit tests. A decrease in test coverage is _sometimes_ unavoidable and ignorable.

### OpenLab

OpenLab does not yet run a full suite of acceptance tests, so it's possible that the acceptance tests you've included were not run. When this happens, a core member for Gophercloud will run the tests manually.
There are times when a core reviewer does not have access to the resources required to run the acceptance tests. When this happens, it is essential that you've run them yourself (See [Step 4](step-04.md)).

**Request a Code Review**

When you feel your Pull Request is ready for review, please leave a comment requesting a code review. If you don't explicitly ask for a code review, a core member might not know the Pull Request is ready for review.

Additionally, if there are parts of your implementation that you are unsure about, please ask for help. We're more than happy to provide advice.

During the code review process, a core member will review the code you've submitted and either request changes or request additional information. Generally these requests fall under the following categories:

1. Code which needs to be reformatted (See our [Style Guide](/docs/STYLEGUIDE.md) for conventions used).

2. Requests for additional information about the validity of something. This might happen because the included supporting service code URLs don't have enough information.

3. Missing unit tests or acceptance tests.

**Submitting Changes**

If a code review requires changes to be submitted, please do not squash your commits. Please only add new commits to the Pull Request. This is to help the code reviewer see only the changes that were made.

**It's Never Personal**

Code review is a healthy exercise where a new set of eyes can sometimes spot items forgotten by the author.

Please don't take change requests personally. Our intention is to ensure the code is correct before merging.

---

Once the code has been reviewed and approved, a core member will merge your Pull Request.
Please proceed to [Step 7](step-07-congratulations.md).

```go
package testing

import (
    "fmt"
    "net/http"
    "testing"
    "github.com/gophercloud/gophercloud/openstack/service/vN/resources"
    th "github.com/gophercloud/gophercloud/testhelper"
    "github.com/gophercloud/gophercloud/testhelper/client"
)

// ListResult provides a single page of RESOURCE results.
const ListResult = `
{
}
`

// GetResult provides a Get result.
const GetResult = `
{
}
`

// CreateRequest provides the input to a Create request.
const CreateRequest = `
{
}
`

// UpdateRequest provides the input to a Update request.
const UpdateRequest = `
{
}
`

// UpdateResult provides an update result.
const UpdateResult = `
{
}
`

// FirstResource is the first resource in the List request.
var FirstResource = resources.Resource{
}

// SecondResource is the second resource in the List request.
```
var SecondResource = resources.Resource{
}

// SecondResourceUpdated is how SecondResource should look after an Update.
var SecondResourceUpdated = resources.Resource{
}

// ExpectedResourcesSlice is the slice of resources expected to be returned from ListResult.
var ExpectedResourcesSlice = []resources.Resource{FirstResource, SecondResource}

// HandleListResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that responds with a list of two resources.
func HandleListResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc(`/resources`, func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "GET")
        th.TestHeader(t, r, "Accept", "application/json")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)
        w.Header().Set("Content-Type", "application/json")
        w.WriteHeader(http.StatusOK)
        fmt.Fprintf(w, ListResult)
    })
}

// HandleGetResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that responds with a single resource.
func HandleGetResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc(`/resources/9fe1d3`, func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "GET")
        th.TestHeader(t, r, "Accept", "application/json")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)
        w.Header().Set("Content-Type", "application/json")
        w.WriteHeader(http.StatusOK)
        fmt.Fprintf(w, GetResult)
    })
}

// HandleCreateResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that tests resource creation.
func HandleCreateResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc(`/resources`, func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "POST")
        th.TestJSONRequest(t, r, CreateRequest)
        w.WriteHeader(http.StatusCreated)
        fmt.Fprintf(w, GetResult)
    })
}
// HandleDeleteResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that tests resource deletion.
func HandleDeleteResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc(`/resources/9fe1d3`, func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "DELETE")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)
        w.WriteHeader(http.StatusNoContent)
    })
}

// HandleUpdateResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that tests resource update.
func HandleUpdateResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc(`/resources/9fe1d3`, func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "PATCH")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)
        th.TestJSONRequest(t, r, UpdateRequest)
        w.WriteHeader(http.StatusOK)
        fmt.Fprintf(w, UpdateResult)
    })
}

package RESOURCE

import (
    "github.com/gophercloud/gophercloud"
    "github.com/gophercloud/gophercloud/pagination"
)

// ListOptsBuilder allows extensions to add additional parameters to
// the List request
type ListOptsBuilder interface {
    ToResourceListQuery() (string, error)
}

// ListOpts provides options to filter the List results.
type ListOpts struct {
}

// ToResourceListQuery formats a ListOpts into a query string.
func (opts ListOpts) ToResourceListQuery() (string, error) {
    q, err := gophercloud.BuildQueryString(opts)
    return q.String(), err
}

// List retrieves a list of RESOURCES.
func List(client *gophercloud.ServiceClient, opts ListOptsBuilder) pagination.Pager {
    url := listURL(client)
    if opts != nil {
        query, err := opts.ToResourceListQuery()
        if err != nil {
            return pagination.Pager{Err: err}
        }
        url += query
    }
        return ResourcePage{pagination.LinkedPageBase{PageResult: r}}
    })
}

// Get retrieves details of a RESOURCE.
func Get(client *gophercloud.ServiceClient, id string) (r GetResult) {
    _, r.Err = client.Get(getURL(client, id), &r.Body, nil)
    return
}

// CreateOptsBuilder allows extensions to add additional parameters to
// the Create request.
type CreateOptsBuilder interface {
    ToResourceCreateMap() (map[string]interface{}, error)
}

// CreateOpts provides options used to create a RESOURCE.
type CreateOpts struct {
}

// ToResourceCreateMap formats a CreateOpts into a create request.
func (opts CreateOpts) ToResourceCreateMap() (map[string]interface{}, error) {
    return gophercloud.BuildRequestBody(opts, "resource")
}

// Create creates a new RESOURCE.
func Create(client *gophercloud.ServiceClient, opts CreateOptsBuilder) (r CreateResult) {
    b, err := opts.ToResourceCreateMap()
    if err != nil {
        r.Err = err
        return
    }
    _, r.Err = client.Post(createURL(client), &b, &r.Body, &gophercloud.RequestOpts{
        OkCodes: []int{201},
    })
    return
}
// Delete deletes a RESOURCE.
func Delete(client *gophercloud.ServiceClient, id string) (r DeleteResult) {
  r.Err = client.Delete(deleteURL(client, id), nil)
  return
}

// UpdateOptsBuilder allows extensions to add additional parameters to
// the Update request.
type UpdateOptsBuilder interface {
  ToResourceUpdateMap() (map[string]interface{}, error)
}

// UpdateOpts represents parameters to update a RESOURCE.
type UpdateOpts struct {
}

// ToUpdateCreateMap formats a UpdateOpts into an update request.
func (opts UpdateOpts) ToResourceUpdateMap() (map[string]interface{}, error) {
  return gophercloud.BuildRequestBody(opts, "resource")
}

// Update modifies the attributes of a RESOURCE.
func Update(client *gophercloud.ServiceClient, id string, opts UpdateOptsBuilder) (r UpdateResult) {
  b, err := opts.ToResourceUpdateMap()
  if err != nil {
    r.Err = err
    return
  }
  r.Err = client.Patch(updateURL(client, id), b, &r.Body, &gophercloud.RequestOpts{
    OkCodes: []int{200},
  })
  return
}

package testing

import {
  "testing"
  "github.com/gophercloud/gophercloud/openstack/service/vN/resources"
  "github.com/gophercloud/gophercloud/pagination"
  th "github.com/gophercloud/gophercloud/testhelper"
  "github.com/gophercloud/gophercloud/testhelper/client"
  }

func TestListResources(t *testing.T) {
  th.SetupHTTP()
  defer th.TeardownHTTP()
  HandleListResourcesSuccessfully(t)
count := 0
    count++
    actual, err := resources.ExtractResources(page)
th.AssertNoErr(t, err)
th.AssertDeepEquals(t, ExpectedResourcesSlice, actual)
    return true, nil
})
th.AssertNoErr(t, err)
th.AssertEquals(t, count, 1)
}

func TestListResourcesAllPages(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
   (HandleListResourcesSuccessfully(t)
    allPages, err := resources.List(client.ServiceClient(), nil).AllPages()
    th.AssertNoErr(t, err)
    actual, err := resources.ExtractResources(allPages)
    th.AssertNoErr(t, err)
    th.AssertDeepEquals(t, ExpectedResourcesSlice, actual)
}

func TestGetResource(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
    HandleGetResourceSuccessfully(t)
    actual, err := resources.Get(client.ServiceClient(), "9f1d3").Extract()
    th.AssertNoErr(t, err)
}

func TestCreateResource(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
    HandleCreateResourceSuccessfully(t)
    createOpts := resources.CreateOpts{
        Name: "resource two",
    }
    actual, err := resources.Create(client.ServiceClient(), createOpts).Extract()
func TestDeleteResource(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
    HandleDeleteResourceSuccessfully(t)

    res := resources.Delete(client.ServiceClient(), "9fe1d3")
    th.AssertNoErr(t, res.Err)
}

func TestUpdateResource(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
    HandleUpdateResourceSuccessfully(t)

    updateOpts := resources.UpdateOpts{
        Description: "Staging Resource",
    }

    actual, err := resources.Update(client.ServiceClient(), "9fe1d3", updateOpts).Extract()
    th.AssertNoErr(t, err)
    th.AssertDeepEquals(t, SecondResourceUpdated, *actual)
}

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package RESOURCE

import "github.com/gophercloud/gophercloud"

func listURL(client *gophercloud.ServiceClient) string {
    return client.ServiceURL("resource")
}

func getURL(client *gophercloud.ServiceClient, id string) string {
    return client.ServiceURL("resource", id)
}

func createURL(client *gophercloud.ServiceClient) string {
    return client.ServiceURL("resource")
}

func deleteURL(client *gophercloud.ServiceClient, id string) string {
    return client.ServiceURL("resource", id)
}

func updateURL(client *gophercloud.ServiceClient, id string) string {
    return client.ServiceURL("resource", id)
}
Step 7: Congratulations!
----------------------------------

At this point your code is merged and you've either fixed a bug or added a new feature to Gophercloud!

We completely understand that this has been a long process. We appreciate your patience as well as the time you have taken for working on this. You've made Gophercloud a better project with your work.

Step 4: Acceptance Testing
----------------------------------

If we haven't started working on the feature or bug fix, why are we talking about Acceptance Testing now?

Before you implement a feature or bug fix, you _must_ be able to test your code in a working OpenStack environment. Please do not submit code which you have only tested with offline unit tests.

Blindly submitting code is dangerous to the Gophercloud project. Developers from all over the world use Gophercloud in many different projects. If you submit code which is untested, it can cause these projects to break or become unstable.

And, to be frank, submitting untested code will inevitably cause someone else to have to spend time fixing it.

If you don't have an OpenStack environment to test with, we have lots of documentation [here](/acceptance) to help you build your own small OpenStack environment for testing.

---

Once you've confirmed you are able to test your code, proceed to [Step 5](step-05-pull-requests.md) to (finally!) start working on a Pull Request.

/*
Package NAME manages and retrieves RESOURCE in the OpenStack SERVICE Service.

Example to List RESOURCE

Example to Create a RESOURCE

Example to Update a RESOURCE

Example to Delete a RESOURCE

*/
Step 2: Create an Issue

Every patch / Pull Request requires a corresponding issue. If you're fixing a bug for an existing issue, then there's no need to create a new issue.

However, if no prior issue exists, you must create an issue.

Reporting a Bug

When reporting a bug, please try to provide as much information as you can.

The following issues are good examples for reporting a bug:

* https://github.com/gophercloud/gophercloud/issues/108
* https://github.com/gophercloud/gophercloud/issues/212
* https://github.com/gophercloud/gophercloud/issues/424
* https://github.com/gophercloud/gophercloud/issues/588
* https://github.com/gophercloud/gophercloud/issues/629
* https://github.com/gophercloud/gophercloud/issues/647

Feature Request

If you've noticed that a feature is missing from Gophercloud, you'll also need to create an issue before doing any work. This is start a discussion about whether or not the feature should be included in Gophercloud. We don't want to want to see you put in hours of work only to learn that the feature is out of scope of the project.

Feature requests can come in different forms:

### Adding a Feature to Gophercloud Core

The "core" of Gophercloud is the code which supports API requests and responses: pagination, error handling, building request bodies, and parsing response bodies are all examples of core code.

Modifications to core will usually have the most amount of discussion than other requests since a change to core will affect _all_ of Gophercloud.

The following issues are examples of core change discussions:

* https://github.com/gophercloud/gophercloud/issues/310
* https://github.com/gophercloud/gophercloud/issues/613
### Adding a Missing Field

If you’ve found a missing field in an existing struct, submit an issue to request having it added. These kinds of issues are pretty easy to report and resolve.

You should also provide a link to the actual service's Python code which defines the missing field.

The following issues are examples of missing fields:

* https://github.com/gophercloud/gophercloud/issues/620
* https://github.com/gophercloud/gophercloud/issues/621
* https://github.com/gophercloud/gophercloud/issues/658

There's one situation which can make adding fields more difficult: if the field is part of an API extension rather than the base API itself. An example of this can be seen in [this](https://github.com/gophercloud/gophercloud/issues/749) issue.

Here, a user reported fields missing in the `Get` function of `networking/v2/networks`. The fields reported missing weren't missing at all, they're just part of various Networking extensions located in `networking/v2/extensions`.

### Adding a Missing API Call

If you've found a missing API action, create an issue with details of the action. For example:

* https://github.com/gophercloud/gophercloud/issues/715
* https://github.com/gophercloud/gophercloud/issues/719

You'll want to make sure the API call is part of the upstream OpenStack project and not an extension created by a third-party or vendor. Gophercloud only supports the OpenStack projects proper.

### Adding a Missing API Suite

Adding support to a missing suite of API calls will require more than one Pull Request. However, you can use a single issue for all PRs.

Examples of issues which track the addition of a missing API suite are:

* https://github.com/gophercloud/gophercloud/issues/539
Note how the issue breaks down the implementation by request types (Create, Update, Delete, Get, List).

Also note how these issues provide links to the service's Python code. These links are not required for _issues_, but it's usually a good idea to provide them, anyway. These links _are required_ for PRs and that will be covered in detail in a later step of this tutorial.

### Adding a Missing OpenStack Project

These kinds of feature additions are large undertakings. Adding support for an entire OpenStack project is something the Gophercloud team very much appreciates, but you should be prepared for several weeks of work and interaction with the Gophercloud team.

An example of how to create an issue for an entire project can be seen here:

* https://github.com/gophercloud/gophercloud/issues/723

---

With all of the above in mind, proceed to [Step 3](step-03-code-hunting.md) to learn about Code Hunting.

Step 3: Code Hunting

`---`

If you plan to submit a feature or bug fix to Gophercloud, you must be able to prove your code correctly works with the OpenStack service in question.

Let's use the following issue as an example: [https://github.com/gophercloud/gophercloud/issues/621](https://github.com/gophercloud/gophercloud/issues/621). In this issue, there's a request being made to add support for `availability_zone_hints` to the `networking/v2/networks` package. Meaning, we want to change:

```go
type Network struct {
  ID string `json:"id"
  Name string `json:"name"
  AdminStateUp bool `json:"admin_state_up"
  Status string `json:"status"
```
Subnets  []string `json:"subnets"`
TenantID  string  `json:"tenant_id"`
Shared    bool    `json:"shared"
}
```

to look like
```
go
type Network struct {
  ID          string `json:"id"
  Name        string `json:"name"
  AdminStateUp bool  `json:"admin_state_up"
  Status      string `json:"status"
  Subnets     []string `json:"subnets"`
  TenantID    string `json:"tenant_id"
  Shared      bool  `json:"shared"
  AvailabilityZoneHints []string `json:"availability_zoneHints"
}
```

We need to be sure that `availability_zone_hints` is a field which really does exist in the OpenStack Neutron project and it's not a field which was added as a customization to a single OpenStack cloud.

In addition, we need to ensure that `availability_zone_hints` is really a `[]string` and not a different kind of type.

One way of verifying this is through the [OpenStack API reference documentation](https://developer.openstack.org/api-ref/network/v2/).

However, the API docs might either be incorrect or they might not provide all of the details we need to know in order to ensure this field is added correctly.

> Note: when we say the API docs might be incorrect, we are _not_ implying that the API docs aren't useful or that the contributors who work on the API docs are wrong. OpenStack moves fast. Typos happen. Forgetting to update documentation happens.

Since the OpenStack service itself correctly accepts and processes the fields, the best source of information on how the field works is in the service code itself.

Continuing on with using #621 as an example, we can find the definition of `availability_zone_hints` in the following piece of code:

https://github.com/openstack/neutron/blob/8e9959725eda4063a318b4ba6af1e3494cad9e35/neutron/objects/network.py#L191
The above code confirms that `availability_zone_hints` is indeed part of the `Network` object and that its type is a list of strings (`[string]`).

This example is a best-case situation: the code is relatively easy to find and it's simple to understand. However, there will be times when proving the implementation in the service code is difficult. Make no mistake, this is _not_ fun work. This can sometimes be more difficult than writing the actual patch for Gophercloud. However, this is an essential step to ensuring the feature or bug fix is correctly added to Gophercloud.

Examples of good code hunting can be seen here:

* https://github.com/gophercloud/gophercloud/issues/539
* https://github.com/gophercloud/gophercloud/issues/555
* https://github.com/gophercloud/gophercloud/issues/571
* https://github.com/gophercloud/gophercloud/issues/583
* https://github.com/gophercloud/gophercloud/issues/605

Code Hunting Tips
-----------------

OpenStack projects differ from one to another. Code is organized in different ways. However, the following tips should be useful across all projects.

* The logic which implements Create and Delete actions is usually either located in the "model" or "controller" portion of the code.

* Use Github's search box to search for the exact field you're working on. Review all results to gain a good understanding of everywhere the field is used.

* When adding a field, look for an object model or a schema of some sort.

---

Proceed to [Step 4](step-04-acceptance-testing.md) to learn about Acceptance Testing.

Step 1: Read Our Guides

```
CONTRIBUTING
```

There are two introductory guides you should read before proceeding:

* [CONTRIBUTING](/contributing.md): The Contributing guide is a detailed document which describes the different ways you can contribute to Gophercloud and how to get started. This tutorial you're reading is very similar to that guide, but presented in a different way. We still recommend you read it over.
When you've finished reading those guides, proceed to [Step 2](step-02-issues.md).

**1.45 golang-lru v0.5.1**

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1.48 kubernetes-component-base v0.18.6

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1.49 netty-resolver 4.1.61.Final

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1.50 pyasn1 0.4.8

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Metadata-Version: 1.2
Name: pyasn1
Version: 0.4.8
Summary: ASN.1 types and codecs
Home-page: https://github.com/etingof/pyasn1
Author: Ilya Etingof
Author-email: etingof@gmail.com
Maintainer: Ilya Etingof <etingof@gmail.com>
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Description: Pure-Python implementation of ASN.1 types and DER/BER/CER codecs (X.208)
Platform: any
Classifier: Development Status :: 5 - Production/Stable
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ASN.1 library for Python
------------------------
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Open Source Used In kASA v1.5 444
This is a free and open source implementation of ASN.1 types and codecs as a Python package. It has been first written to support particular protocol (SNMP) but then generalized to be suitable for a wide range of protocols based on [ASN.1 specification](https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-X.208-198811-W!!PDF-E&type=items).

Features
--------

* Generic implementation of ASN.1 types (X.208)
* Standards compliant BER/CER/DER codecs
* Dumps/loads ASN.1 structures from Python types
* 100% Python, works with Python 2.4 up to Python 3.7
* MT-safe
* Contributed ASN.1 compiler [Asn1ate](https://github.com/kimgr/asn1ate)

Why using pyasn1
----------------

ASN.1 solves the data serialisation problem. This solution was designed long ago by the wise Ancients. Back then, they did not have the luxury of wasting bits. That is why ASN.1 is designed to serialise data structures of unbounded complexity into something compact and efficient when it comes to processing the data.

That probably explains why many network protocols and file formats still rely on the 30+ years old technology. Including a number of high-profile Internet protocols and file formats.

Quite a number of books cover the topic of ASN.1. [Communication between heterogeneous systems](http://www.oss.com/asn1/dubuisson.html) by Olivier Dubuisson is one of those high quality books freely available on the Internet.

The pyasn1 package is designed to help Python programmers tackling network protocols and file formats at the comfort of their Python prompt. The tool struggles to capture all aspects of a rather complicated ASN.1 system and to represent it on the Python terms.

How to use pyasn1
-----------------

With pyasn1 you can build Python objects from ASN.1 data structures.

For example, the following ASN.1 data structure:
```bash
Record ::= SEQUENCE {
    id        INTEGER,
    room  [0] INTEGER OPTIONAL,
    house [1] INTEGER DEFAULT 0
}
```  

Could be expressed in pyasn1 like this:

```python
class Record(Sequence):
    componentType = NamedTypes(
        NamedType('id', Integer()),
        OptionalNamedType('room', Integer().subtype(
            implicitTag=Tag(tagClassContext, tagFormatSimple, 0)
        )
    ),
    DefaultedNamedType('house', Integer(0).subtype(
        implicitTag=Tag(tagClassContext, tagFormatSimple, 1)
    )
)
```

It is in the spirit of ASN.1 to take abstract data description and turn it into a programming language specific form. Once you have your ASN.1 data structure expressed in Python, you can use it along the lines of similar Python type (e.g. ASN.1 `SET` is similar to Python `dict`, `SET OF` to `list`):

```python
>>> record = Record()
>>> record['id'] = 123
>>> record['room'] = 321
>>> str(record)
'Record:
id=123
room=321'
```  

Part of the power of ASN.1 comes from its serialisation features. You can serialise your data structure and send it over the network.
Conversely, you can turn serialised ASN.1 content, as received from network or read from a file, into a Python object which you can introspect, modify, encode and send back.

The pyasn1 classes struggle to emulate their Python prototypes (e.g. int, list, dict etc.). But ASN.1 types exhibit more complicated behaviour. To make life easier for a Pythonista, they can turn their pyasn1 classes into Python built-ins:

Or vice-versa -- you can initialize an ASN.1 structure from a tree of Python objects:
With ASN.1 design, serialisation codecs are decoupled from data objects, so you could turn every single ASN.1 object into many different serialised forms. As of this moment, pyasn1 supports BER, DER, CER and Python built-ins codecs. The extremely compact PER encoding is expected to be introduced in the upcoming pyasn1 release.

More information on pyasn1 APIs can be found in the [documentation](http://snmplabs.com/pyasn1/), compiled ASN.1 modules for different protocols and file formats could be found in the pyasn1-modules [repo](https://github.com/etingof/pyasn1-modules).

How to get pyasn1

-------------

The pyasn1 package is distributed under terms and conditions of 2-clause BSD [license](http://snmplabs.com/pyasn1/license.html). Source code is freely available as a GitHub [repo](https://github.com/etingof/pyasn1).

You could `pip install pyasn1` or download it from [PyPI](https://pypi.org/project/pyasn1).

If something does not work as expected, [open an issue](https://github.com/etingof/pyasn1/issues) at GitHub or post your question [on Stack Overflow](https://stackoverflow.com/questions/ask) or try browsing pyasn1 [mailing list archives](https://sourceforge.net/p/pyasn1/mailman/pyasn1-users/).

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Found in path(s):
* /opt/cola/permits/1110812511_1607462013.57/0/pyasn1-0-4-8-tar-gz/pyasn1-0.4.8/README.md
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* /opt/cola/permits/1110812511_1607462013.57/0/pyasn1-0-4-8-tar-gz/pyasn1-0.4.8/tests/codec/ber/test_encoder.py
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ASN.1 library for Python

==============

Abstract Syntax Notation One (ASN.1) is a technology for exchanging structured data in a universally understood, hardware agnostic way. Many industrial, security and telephony applications heavily rely on ASN.1.

The `pyasn1 <https://pypi.org/project/pyasn1/>`_ library implements ASN.1 support in pure-Python.

What is ASN.1

--------

ASN.1 is a large, arguably over-engineered and extremely old data modelling and serialisation tool. It is probably among the first serialisation protocols in the history of computer science and technology.

ASN.1 started its life over 30 years ago as a serialisation mechanism for the first electronic mail (known as X.400). Later on if was split off the e-mail application and become a stand-alone tech still being actively supported by its designers and widely used in industry and technology.

Since then ASN.1 is sort of haunted by its relations with the OSI model -- the first, unsuccessful, version of the Internet. You can read many interesting discussions on that topic.

In the following years, generations of software engineers tackled the serialisation
problem many times. We can see that in Google's `ProtoBuffers <https://developers.google.com/protocol-buffers/>`_ or `FlatBuffers <https://google.github.io/flatbuffers/>`_, for example. Interestingly, many new takes on binary protocol design do not depart far from ASN.1 from technical perspective. It's more of a matter of striking a balance between processing overhead, wire format overhead and human readability.

Looking at what ASN.1 has to offer, it has three loosely coupled parts:

* Data types: the standard introduces a collection of basic data types (integers, bits, strings, arrays and records) that can be used for describing arbitrarily complex, nested data structures.

* Serialisation protocols: the above data structures could be converted into a series of octets for storage or transmission over the wire as well as recovered back into their structured form. The system is fully agnostic to hardware architectures differences.

* Schema language: ASN.1 data structures could be described in terms of a schema language for ASN.1 compiler to turn it into platform-specific implementation.

ASN.1 applications
-------------------

Being an old and generally successful standard, ASN.1 is widely adopted for many uses. To give you an example, these technologies use ASN.1 for their data exchange needs:

* Signaling standards for the public switched telephone network (SS7 family)
* Network management standards (SNMP, CMIP)
* Directory standards (X.500 family, LDAP)
* Public Key Infrastructure standards (X.509, etc.)
* PBX control (CSTA)
* IP-based Videoconferencing (H.323 family)
* Biometrics (BIP, CBEFF, ACBio)
* Intelligent transportation (SAE J2735)
* Cellular telephony (GSM, GPRS/EDGE, UMTS, LTE)

ASN.1 gotchas
--------------

Apparently, ASN.1 is hard to implement properly. Quality open-source ASN.1 tools are rare, but ad-hoc implementations are numerous. Judging from the `statistics <http://cve.mitre.org/cgi-bin/cvekey.cgi?keyword=ASN.1>`_ on discovered security vulnerabilities, many people have implemented ASN.1 parsers and oftentimes fell victim to its edge cases.
On the bright side, ASN.1 has been around for a long time, it is well understood and security reviewed.

Documentation
--------------

.. toctree::
   :maxdepth: 2

/pyasn1/contents

Use case
--------

.. toctree::
   :maxdepth: 2

/example-use-case

Download & Install
-----------------

.. toctree::
   :maxdepth: 2

/download

Changes
-------

All changes and release history is maintained in changelog. There you could also download the latest unreleased pyasn1 tarball containing the latest fixes and improvements.

.. toctree::
   :maxdepth: 1

/changelog

License
-------

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.. toctree::
   :maxdepth: 2
Getting help


Books on ASN.1

The pyasn1 implementation is largely based on reading up the following awesome books:

* `ASN.1 - Communication between heterogeneous systems <http://www.oss.com/asn1/dubuisson.html>`_ by Olivier Dubuisson

Here you can get the official standards which is hard to read:


On the other end of the readability spectrum, here is a quick and sweet write up:


If you are working with ASN.1, we'd highly recommend reading a proper book on the subject.

Found in path(s):

* `/opt/cola/permits/1110812511_1607462013.57/0/pyasn1-0.4.8-tar-gz/pyasn1-0.4.8/docs/source/contents.rst`

1.51 popt 1.18-r0
1.51.1 Available under license:

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1.52 oklog-run v1.1.0
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1.53 x-sync v0.0.0-20210220032951-036812b2e83c

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1.54 kasa-operator-controlplane-api v0.0.0

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```yaml
{{- $global := default (dict ) $.Values.global -}}
{{- $dataPlaneNamespace := include "aegis.namespace.dataPlaneNamespace" (list $) -}}
{{- if ($global.platform | eq "azure") -}}
{{ include "kasa.licensebroker.storageAzureDisk" (list $ "azure-disk-sc") }}
{{- else if ($global.platform | ne "aws") | and ($global.platform | ne "eks") -}}
{{ include "kasa.licensebroker.storageLocal" (list $ "broker") }}
{{- end -}}
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: {{ template "aegis.metadata.fullname" (list $ "server") }}
labels: {{ include "aegis.metadata.standardLabels" (list $) | nindent 4 }}
spec:
  accessModes:
  - ReadWriteOnce
  volumeMode: Filesystem
{{- if ($global.platform | eq "aws") | or ($global.platform | eq "eks") -}}
  storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */}}
{{- else if ($global.platform | eq "azure") -}}
  storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc") }} {{/* example yaml has
'managed-csi' as the name which is vague af */}}
{{- else if ($global.platform | eq "kind") -}}
```
storageClassName: "standard" { /* Kind has a default 'standard' StorageClass so reusing it here */ }
{ - else }
storageClassName: {{ include "aegis.metadata.fullname" (list $ "broker") }}
{ - end }
resources:
  requests:
    storage: {{ $.Values.licenseServerStorage }}
---
{ - define "kasa.licensebroker.storageLocal" - }
  { - $ := first . - }
  { - $storageName := last . - }
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  { { template "aegis.metadata.standard" (list $ $storageName) } }
  provisioner: kubernetes.io/no-provisioner
  reclaimPolicy: Delete
  volumeBindingMode: WaitForFirstConsumer
{ - end - }
---
{ - define "kasa.licensebroker.storageAzureDisk" - }
  { - $ := first . - }
  { - $storageName := last . - }
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  { { template "aegis.metadata.standard" (list $ $storageName) } }
  provisioner: disk.csi.azure.com
  parameters:
    { { - /* TODO: parameterize the sku and other params https://github.com/kubernetes-sigs/azuredisk-csi-driver/blob/v1.2.0/docs/driver-parameters.md */ }
  reclaimPolicy: Delete
  volumeBindingMode: WaitForFirstConsumer
  allowVolumeExpansion: true
{ - end - }
{ - define "kasa.validate.eula" - }
  { - $ := first . - }
  { { $acceptValues := list "yes" "agree" } }
  { { if $.Release.IsInstall and (not ($acceptValues | has $.Values.global.acceptEULA)) - }
    { - $.Files.Get "eula/EULA.txt" } }
{ - end - }
{ - end - }
package services_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
"k8s.io/client-go/kubernetes/scheme"
func TestControllers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})

package listeners_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    "sigs.k8s.io/controller-runtime/pkg/event"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
} 

var _ = Describe("Deregistration Listener Test", func() {

    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

    var listener licensing.DeregistrationListener
    var fakeClient client.Client
    var mockCtrl *gomock.Controller
    var recorder *record.FakeRecorder
    var smartLicense *v1.SmartLicense
    var notifier chan event.GenericEvent

   BeforeEach(func() {


smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:      v1.Register,
        LicenseType: licenseType,
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Registered,
        LicenseState:      v1.InCompliance,
        ErrorReason:       "",
    },
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
notifier = make(chan event.GenericEvent, 10)

listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger{}, recorder, notifier)

AfterEach(func() {
    mockCtrl.Finish()
})

It("should update SmartLicense status on deregistration event", func() {
    listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response to out-of-band event from License Server")))
    Expect(notifier).Should(Receive(&event.GenericEvent{
        Object: smartLicense,
    }))
})
const (  
  epHpaName                   = "epHPA"
  initialHPAMaxReplicas int32 = 3
)

var _ = Describe("HPA License Controller Test", func() {

hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}
var (
  reconciler   *controllers.HPALicenseReconciler
  fakeClient   client.Client
  mockCtrl     *gomock.Controller
  hpa          *autoscalingv1.HorizontalPodAutoscaler
  smartLicense *v1.SmartLicense
  recorder     *record.FakeRecorder
  replicasCalculatorMock *mocks.MockReplicasCalculator
)

BeforeEach(func() {
  mockCtrl = gomock.NewController(GinkgoT())
  fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
  recorder = record.NewFakeRecorder(1024)
  replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

  reconciler = &controllers.HPALicenseReconciler{
    Client:   fakeClient,
    Log:      logf.NullLogger{},
    Recorder: recorder,
  }

  hpa = &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{
      Namespace: defaultNs,
      Name:     epHpaName,
    },
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
      MaxReplicas: initialHPAMaxReplicas,
    },
  }

  recorder.Event(hpaNsName, "Info", "hpa created")

  reconciler.SetController(hpa)
  reconciler.SetLogger(logf.NullLogger{})
  reconciler.SetRecorder(recorder)
  reconciler.SetReplicasCalculator(replicasCalculatorMock)
  reconciler.SetSmartLicense(smartLicense)
  reconciler.SetFakeClient(fakeClient)
  reconciler.SetFakeContext("context")

  err := reconciler.Reconcile(context.Background(), hpaNsName)
  expect.Nil(err)

})
ReplicasCalculator: replicasCalculatorMock,
}

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:          v1.Register,
        LicenseType:     licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor:   &scalingFactor,
    },
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

deployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:      "ep",
        Namespace: defaultNs,
    },
    Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

hpa = &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{
        Name:      epHpaName,
        Namespace: defaultNs,
    },
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: initialHPAMaxReplicas,
    },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{ })).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{ })).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{ })).To(Succeed())
})

It("should skip if HPA does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())
})
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
}

It("should skip if HPA SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(initialHPAMaxReplicas, nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
})
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Spec.MinReplicas).Should(BeNil())
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPA\s+Scaled\+Down Decreased HPA\'s \[MaxReplicas\] to 2 ")))
)

It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    hpa.Spec.MaxReplicas = 10
    hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
    Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
    Expect(*hpa.Spec.MinReplicas).Should(Equal(int32(2)))
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPA\s+Scaled\+Down Decreased HPA\'s \[MaxReplicas\], \[MinReplicas\] to 2 ")))
})

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense2 := &v1.SmartLicense{
    Spec: smartLicense.Spec,
}
    Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())
    smartLicense3 := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
    Spec: smartLicense.Spec,
    Status: v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
}
    Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
    Expect(hpa.Spec.MinReplicas).Should(Equal(int32(2)))
})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))
}
}

---

apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  annotations:
  controller-gen.kubebuilder.io/version: v0.4.1
creationTimestamp: null
name: smartlicenses.sfcn.cisco.com
spec:
group: sfcn.cisco.com
names:
  kind: SmartLicense
  listKind: SmartLicenseList
  plural: smartlicenses
  singular: smartlicense
scope: Namespaced
versions:
- additionalPrinterColumns:
  - jsonPath: .metadata.creationTimestamp
    name: Age
    type: date
  - jsonPath: .status.registrationState
    name: Registration State
    type: string
  - jsonPath: .status.licenseState
    name: License State
    type: string
  - jsonPath: .status.licenseNumber
    name: License Number
    type: integer
  - jsonPath: .status.accountDomain
    name: Domain
    priority: 1
    type: string
  - jsonPath: .status.accountName
    name: Account
    priority: 1
type: string
name: v1
schema:
  openAPIV3Schema:
    description: SmartLicense is the Schema for the smartlicenses API
    properties:
      apiVersion:
        description: 'APIVersion defines the versioned schema of this representation
                    of an object. Servers should convert recognized schemas to the latest
                    internal value, and may reject unrecognized values. More info:
                    https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#resources'
        type: string
      kind:
        description: 'Kind is a string value representing the REST resource this
                    object represents. Servers may infer this from the endpoint the client
                    submits requests to. Cannot be updated. In CamelCase. More info:
                    https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'
        type: string
      metadata:
        type: object
      spec:
        description: SmartLicenseSpec defines the desired state of SmartLicense
        properties:
          action:
            description: Action is the desired state of the Smart Agent license
            registration.
            enum:
              - REGISTER
              - DEREGISTER
            type: string
          licenseType:
            description: LicenseType defines the type of license to request/release,
                        usually the SKU of the license. The default value is a SFW license
                        tag being able to handle 1vCPU.
            type: string
          maxLicenseCount:
            description: MaxLicenseCount is an optional value, the maximum number
                        of licenses SFCN can reserve for the product. The default value
                        is equal to MinLicenseCount.
            format: int32
            type: integer
          minLicenseCount:
            description: MinLicenseCount is a minimum number of licenses SFCN
                        reserves for the product. The default value is 1.
            format: int32
            type: integer
          scalingFactor:
            description: ScalingFactor is a factor to increment or decrement the
number of licenses SFCN reserves for the product when scaling up or down. The default value is 1.

format: int32
type: integer

scalingRef:

description: ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.

properties:
  apiVersion:
    description: API version of the referent
type: string
  kind:
    description: 'Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds''
type: string
  name:
    description: 'Name of the referent; More info: http://kubernetes.io/docs/user-guide/identifiers#names'
type: string
  required:
  - kind
  - name
type: object
tokenSecret:

description: TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.

properties:
  name:
    description: Name is unique within a namespace to reference a secret resource.
type: string
  namespace:
    description: Namespace defines the space within which the secret name must be unique.
type: string
type: object
required:
  - tokenSecret
type: object

status:

description: SmartLicenseStatus defines the observed state of SmartLicense

properties:
  accountDomain:
    description: AccountDomain is the account domain in Cisco Software Central.
type: string
  accountName:
    description: AccountName is the name of the virtual account in Cisco Software Central.
contextId:
  description: ContextId is an internal identifier uniquely defining platform registration.
  type: string
coresPerLicense:
  description: CoresPerLicense is number of cores per one requested LicenseType.
  format: int32
  type: integer
errorReason:
  description: ErrorReason specifies the error due to which the SFCN product was not registered in Cisco Software Central.
  type: string
estimatedMaxReplicas:
  description: EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
  format: int32
  type: integer
exportControlled:
  description: ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
  type: boolean
licenseNumber:
  description: LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
  format: int32
  type: integer
licenseState:
  description: LicenseState is the state of the reserved licenses.
  enum:
  - PENDING
  - UNLICENSED
  - IN_COMPLIANCE
  - OUT_OF_COMPLIANCE
  - OVERAGE
  type: string
registrationState:
  description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.
  enum:
  - PENDING
  - REGISTERED
  - REGISTRATION_FAILED
  - Deregistered
  - Deregistration_FAILED
FROM dockerhub.cisco.com/asac-dev-docker/css-golang:v1.16 as builder

WORKDIR /workspace
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"]
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates/"]

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ./pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api/ api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
# disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13

WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot
USER nonroot
ENTRYPOINT ["manager"]
### Smart License Status

When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

```yaml
---
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: "" # omitted to use default value
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
status:
  accountDomain: InternalTestDemoAccount8.cisco.com
  accountName: asac-dev
  contextId: '6947693726752581822'
  coresPerLicense: 1
  estimatedMaxReplicas: 2
  exportControlled: true
  licenseState: IN_COMPLIANCE
  registrationState: REGISTERED
---
```
### ASA Licensing State

The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are:

* AwaitingLicense (Warning)
* LicenseCommunicationFailed (Warning)
* LicenseGranted (Normal)
* LicenseVerified (Normal)
* LicenseRevoked (Warning)

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.

When the ASA comes up successfully, the Manager tries to obtain a license for the [number of cores](https://example.com/deployment/#core-calculation) the Pod uses. During this period, the Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For instance, when the ASA came up for the first time and operating at reduced throughput, this event would read something like:

```markdown
Warning     AwaitingLicense     ASA operating at reduced throughput because it was not licensed, requesting for a new license
```

And, if the ASA came up and operating at full potential, then:

```markdown
Warning     AwaitingLicense     ASA operating at full potential but not licensed, requesting for a new license
```

The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could not communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a `LicenseCommunicationFailed` warning event with the reasoning behind the failure.

```markdown
Warning     LicenseCommunicationFailed     ASA operating at reduced throughput because of license communication failure
```

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the
license granted to it and on successful verification, emits a `LicenseVerified` event.

```markdown
Normal LicenseGranted successfully obtained a license from the server
Normal LicenseVerified ASA operating at full potential, license status verified
```

It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the licenses have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale down the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager emits a `LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be granted a license, or it will be removed by Kubernetes because the controller scaled down the cluster.

```markdown
Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license, retrying to acquire
```

### Unauthorized Requests

License requests may be granted by the License Server to any pod capable of requesting a licensing, however the License Controller sees a grant as authorized only if that pod belonged to a Deployment/HPA specified in one of the Smart License resources otherwise it considers that pod as unauthorized and takes action to delete that pod and set the number of replicas to 0 on its owners to prevent the Kubernetes from creating such pods. The License Controller will emit an event on the pod that was deleted specifying the reason behind it. It then releases the license back to the License Server after the pod is killed.

```markdown
Warning PodDeleted Deleted Pod as it requested a license but does not belong to any licensed EP deployment. Please, check SmartLicense resources to update licensing configuration.
```

This might happen when you have an Enforcer deployment but did not specify that Deployment in a Smart License resource in the same namespace. To remedy that, simply add a Smart License resource with the desired configuration and specify the Deployment of the Enforcer in it.

### Identifying Licensed Pods
All licensed Deployments specified via the Smart License resources, and their Pods that have been granted a license will include a label `sfcn.cisco.com/license-holder=true`. You should be able to use `kubectl` to list all the pods in a namespace that are having this label to identify the pods currently holding a license.

```go
package controllers_test

import (
    "context"
    "errors"
    "fmt"
    "strconv"

    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent
AllotmentService

const ( epPodName = "epPod"
    redirectorEpPodName = "redirectorEpPod"
    defaultServiceRole = "default"
    vpnRedirectorServiceRole = "vpnredirector"
    deploymentName2 = "test-deployment-2"
    secondDefaultEpDeploymentName = "secondDefaultEpDeployment"
    redirectorEpDeploymentName = "vpnRedirectorEpDeployment"
    initialRedirectorDeploymentReplicas int32 = 2
)
var controllerTrue = true

var _ = Describe("Pod License Controller Test", func() {

podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}
redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}
deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpDeploymentName}

var reconciler *controllers.PodLicenseReconciler
var fakeClient client.Client
var mockCtrl *gomock.Controller
var recorder *record.FakeRecorder

var licensingClient *mocks.MockLicensingClient
var allotmentService *mocks.MockAllotmentService

var pod *corev1.Pod
var deployment *appsv1.Deployment
var redirectorPod *corev1.Pod
var redirectorDeployment *appsv1.Deployment
var smartLicense *v1.SmartLicense

BeforeEach(func() {

pod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name:            epPodName,
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue}},
    },
}

replicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "epReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: epDeploymentName, Controller: &controllerTrue}},
    },
}

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{

```
Name: epDeploymentName,
Namespace: defaultNs,
Labels: map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}
secondDefaultDeployment := &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{
Name: secondDefaultEpDeploymentName,
Namespace: defaultNs,
Labels: map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
},
Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

redirectorPod = &corev1.Pod{
ObjectMeta: metav1.ObjectMeta{
Name: redirectorEpPodName,
Namespace: defaultNs,
OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "redirectorEpReplicaSet", Controller: &controllerTrue}},
},
}

redirectorReplicaSet := &appsv1.ReplicaSet{
ObjectMeta: metav1.ObjectMeta{
Name: "redirectorEpReplicaSet",
Namespace: defaultNs,
OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName, Controller: &controllerTrue}},
},
}

redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{
Name: redirectorEpDeploymentName,
Namespace: defaultNs,
Labels: map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
},
Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}

smartLicense = &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
}
Spec: v1.SmartLicenseSpec{
  Action:      v1.Register,
  LicenseType: licenseType,
  Status: v1.SmartLicenseStatus{
    RegistrationState: v1.Registered,
  },
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(
  deployment, replicaSet, pod, secondDefaultDeployment,
  redirectorDeployment, redirectorReplicaSet, redirectorPod,
  smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
reconciler = &controllers.PodLicenseReconciler{
  Client:          fakeClient,
  LicensingClient: licensingClient,
  Log:             logf.NullLogger{},
  Recorder:        recorder,
}

AfterEach(func() {
  mockCtrl.Finish()
})

It("should add the licensing label for licensed pod", func() {
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
  Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
  Expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
  Expect(pod.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
  Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)
})
smartLicense.Status.RegistrationState = v1.Deregistered
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
}

It("should ensure one replica per service role without SmartLicense", func() {
  // initiate reconcile for the pod which is part of deployment with vpnredirector service role and without smart license
  // allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
  Expect(err).To(BeNil())

  // expect the deployment to be scaled to 1 and mark it as trial license holder
  redirDeployment := appsv1.Deployment{
                 ObjectMeta: metav1.ObjectMeta{
                               Name: redirectorPodName2,
                               Namespace: defaultNs,
                               OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}}},
             }
  Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
  redirReplicaSet2 := &appsv1.ReplicaSet{
                ObjectMeta: metav1.ObjectMeta{
                              Name: replicaSetName2,
                              Namespace: defaultNs,
                              OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorDeploymentName2, Controller: &controllerTrue}}},
             }
  Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())

  // create another deployment with vpnredirector role
  redirectorEpPodName2 := "redirectorEpPod2"
  redirectorEpDeploymentName2 := "redirectorEpDeployment2"
  replicaSetName2 := "redirectorEpReplicaSet2"
  redirectorPod2 := &corev1.Pod{
         ObjectMeta: metav1.ObjectMeta{
                      Name: redirectorEpPodName2,
                      Namespace: defaultNs,
                      OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}}},
      }
  Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
  redirectorReplicaSet2 := &appsv1.ReplicaSet{
                ObjectMeta: metav1.ObjectMeta{
                              Name: replicaSetName2,
                              Namespace: defaultNs,
                              OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName2, Controller: &controllerTrue}}},
             }
  Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
initialRedirector2Replicas := int32(3)
redirectorDeployment2 := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: redirectorEpDeploymentName2,
        Namespace: defaultNs,
        Labels: map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &initialRedirector2Replicas},
}
Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

// initiate reconcile for the pod which is part of another deployment with vpnredirector service role and without
smart license
redirector2PodNsName := types.NamespacedName{Namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Namespace: redirector2PodNsName.String()}).Return(nil, nil)
_, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
Expect(err).To(BeNil())

// expect the second vpnredirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2, Namespace: defaultNs}, &redirDeployment2)).To(Succeed())
Expect(*redirDeployment2.Spec.Replicas).Should(Equal(int32(0)))
Expect(redirDeployment2.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(redirDeployment2.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment2.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(initialRedirector2Replicas)))

Context("on pod removal", func() {
    It("should release licensing allotments", func() {
        Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
        allotmentService.EXPECT().Status(&licensing.Tenant{Namespace: podNsName.String()}).
        allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
            ContextId: "fooBar",
            Tenant: &licensing.Tenant{Namespace: podNsName.String()},
        }).Return(nil)
        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())
    })

    It("should requeue request if failed to release licensing allotments", func() {
        Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    })
})
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
ContextId: "fooBar",
Tenant: &licensing.Tenant{Name: podNsName.String()},
}).Return(errors.New("failed to release allotments"))

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(HaveOccurred())
}

It("should not release licensing allotments if tenant is not registered", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, fmt.Errorf("unknown tenant: %w", licensing.ErrNotRegistered))

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

It("should not release licensing allotments when NumCores is 0", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

Context("for pod without corresponding SmartLicense", func() {

It("should remove pod if not belong to any deployment", func() {
pod.OwnerReferences = nil
Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})
})

Context("for pod without corresponding SmartLicense", func() {

It("should remove pod if not belong to any deployment", func() {
pod.OwnerReferences = nil
Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})
})
Expect(err).To(BeNil())

err = fakeClient.Get(context.TODO(), podNsName, pod)
Expect(err).NotTo(BeNil())
Expect(apiErrors.IsNotFound(err)).To(BeTrue())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license but does not belong to any Deployment")))

It("should scale down pod's deployment", func() {
  smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})

Context("without SmartLicense resources", func() {
 BeforeEach(func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
  })

  It("should scale down Deployment to 1 Replica and mark as trial", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{ Name: podNsName.String(), Attributes: pod.Labels }).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
  })
})
It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func()
{
    var replicaCount int32 = 4
    var expectedInitialReplicasNumber int32 = 4

    createDeployment := func(name string, role string) *appsv1.Deployment {

        pod := &corev1.Pod{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("pod-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{
                    metav1.OwnerReference{
                        Kind: "ReplicaSet",
                        Name: fmt.Sprintf("rs-%s", name),
                        Controller: &controllerTrue,
                    },
                },
            },
        }
        Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

        replicaSet := &appsv1.ReplicaSet{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("rs-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{
                    metav1.OwnerReference{
                        Kind: "Deployment",
                        Name: fmt.Sprintf("deployment-%s", name),
                        Controller: &controllerTrue,
                    },
                },
            },
        }
        Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

        deployment := &appsv1.Deployment{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("deployment-%s", name),
                Namespace: defaultNs,
                Labels: map[string]string{
                    controllers.ServiceRoleLabel: role,
                },
                Annotations: map[string]string{
                    controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount)),
                },
            }
        }
        Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

        podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).Return(nil, nil)
        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
        Expect(err).To(BeNil())

        return deployment
    }

    podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
    Expect(err).To(BeNil())
}

return deployment
}
deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", "")

assertScaledDown := func(d *appsv1.Deployment) {
    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: d.Namespace, Name: d.Name}, d)).To(Succeed())
    Expect(*d.Spec.Replicas).Should(Equal(int32(0)))
    Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
    Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(expectedInitialReplicasNumber))))
}
assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
}

It("should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist", func() {
    deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    var replicaCount int32 = 1
    pod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:            "deployment-test-2",
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())
    replicaSet2 := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
            Name:            "epReplicaSet2",
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: deploymentName2, Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())
package listeners

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    licensing "css.cisco.com/licensing/client-agent"
    licensingProto "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "sigs.k8s.io/controller-runtime/pkg/client"
}

type EntitlementListener struct {
    Log    logr.Logger
    Client client.Client
    LicenseNsName types.NamespacedName
}
func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
    log := l.Log.WithValues("smartlicense", l.LicenseNsName)
    log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)

    if err := l.processEvent(event); err != nil {
        log.Error(err, "failed to process entitlement event")
        return
    }
    log.V(1).Info("successfully processed entitlement event")
}

func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()

    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense", l.LicenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }

    originalLicense := license.DeepCopy()

    switch event.Type {
    case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
        license.Status.LicenseState = v1.OutOfCompliance
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
        license.Status.LicenseState = v1.Unlicensed
        license.Status.EstimatedMaxReplicas = 0
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
        license.Status.LicenseState = v1.InCompliance
    default:
        return fmt.Errorf("unknown event type: %s", event.Type.String())
    }

    license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
    license.Status.LicenseNumber = uint32(event.EntitlementNumber)

    // using patch to avoid conflict errors caused by version mismatch and optimistic lock
    // as events from the server have the latest data, it is admissible to overwrite status without version check
    if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
        return fmt.Errorf("failed to patch SmartLicense status: %w", err)
    }
    return nil
}
# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.

global:
  platform: $platform
  imageCredentials:
    # the url to the docker registry, for example dockerhub.cisco.com
    registry: $registry
    artifactoryRepo: $artifactoryRepo
  apiGroup: sfcn.cisco.com
  fullnamePrefix: sfcn-license-

  # Docker image for the controller that manages licensing CRDs and their reconciliation
  controllerImage: $controllerImage

  # Docker image for the server-agent license server
  licenseServerImage: $licenseServerImage

  # licenseServerPort is the port where the server-agent license server is listening for requests
  licenseServerPort: 17051

  # licenseServerTransportUrl is the http transport to make use of to connect to CSSM
  licenseServerTransportUrl: $licenseServerTransportUrl

  # Default image policy that is used by all pod containers unless being explicitly overwritten
  defaultImagePullPolicy: $defaultImagePullPolicy

  # log verbosity
  logLevel: $logLevel

  # zap log encoder
  # options: console, json
  logFormat: $logFormat

  # managerMemoryRequest specifies the amount of memory to allocate per request for manager container
  managerMemoryRequest: "20Mi"

  # managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
  managerCoreRequest: "100m"

  # managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
  managerMemoryLimit: "100Mi"

  # managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
  managerCoreLimit: "100m"

  # metricsPort is the port the metric endpoint binds to
  metricsPort: 17080
# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"

# licenseServerXms specifies the amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory
licenseServerXms: "128M"

# licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container
licenseServerCoreRequest: "100m"

# licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container
licenseServerMemoryLimit: "768Mi"

# licenseServerXmx specifies the maximum amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory
licenseServerXmx: "512M"

# licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container
licenseServerCoreLimit: "300m"

# licenseServerStorage specifies the persistent volume size to use for storing licensing data
licenseServerStorage: "1Gi"

# disktype for dynamic azure disk storage on azure platform
# options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
azureDiskStorageAccountType: "Standard_LRS"

package handlers_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
"css.cisco.com/kasa/license-broker/controllers/handlers"  
"css.cisco.com/kasa/license-broker/controllers/handlers/mocks"  
"github.com/golang/mock/gomock"  
. "github.com/onsi/ginkgo"  
autoscalingv1 "k8s.io/api/autoscaling/v1"  
metav1 "k8s.io/api/autoscaling/v1"  
"k8s.io/apimachinery/pkg/apis/meta/v1"  
"k8s.io/apimachinery/pkg/types"  
"sigs.k8s.io/controller-runtime/pkg/apis/meta/v1"  
"sigs.k8s.io/controller-runtime/pkg/event"  
"sigs.k8s.io/controller-runtime/pkg/handler"  
"sigs.k8s.io/controller-runtime/pkg/reconcile" )
const (  
defaultNamespace = "default"  
smartLicenseName = "smart-license"  
deploymentName = "ep-deployment"  
deploymentName2 = "ep-deployment2"  
hpaName = "ep-hpa"  
hpaName2 = "ep-hpa2"  
)

var _ = Describe("DeploymentHandler", func() {  
var handler EventHandler  
var mockCtrl *gomock.Controller  
var mockQueue *mocks.MockRateLimitingInterface

BeforeEach(func() {  
mockCtrl = gomock.NewController(GinkgoT())  
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)  
handler = handlers.DeploymentHandler()
})

AfterEach(func() {  
mockCtrl.Finish()
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {  
mockQueue.EXPECT().Add(reconcile.Request{  
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
})

handler.Create(event.CreateEvent{
Object: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
}, mockQueue)
})

It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {  
handler.Create(event.CreateEvent{
Object: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
})
It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
    })
}

handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
        ObjectNew: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
}

handler.Delete(event.DeleteEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
})

var _ = Describe("HPAHandler", func() {
    var handler EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface
BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
    handler = handlers.HPAHandler()
})

AfterEach(func() {
    mockCtrl.Finish()
})

It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    }).
    .
    ., mockQueue)
})

It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    }).
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
    })
    handler.Update(event.UpdateEvent{
        ObjectOld: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
        },
    },
})
Open Source Used In kASA v1.5
// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.HPAKind)
}

func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
    return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
        smartLicense, ok := obj.(*v1.SmartLicense)
        if !ok {
            log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
            return []ctrl.Request{}
        }
        if smartLicense.Spec.ScalingRef.Kind != scalingRefKind {
            return []ctrl.Request{}
        }
        return []ctrl.Request{{NamespacedName: types.NamespacedName{
            Namespace: smartLicense.Namespace,
            Name:      smartLicense.Spec.ScalingRef.Name,
        }}}
    })
}

package v1

import (
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/reconcile"
    "sigs.k8s.io/controller-runtime/pkg/source"
const (  
  RetryDuration = 15 * time.Second  
  MaxWaitingDuration = 5 * time.Minute  
  MaxRetryAttempts = int(MaxWaitingDuration / RetryDuration)  
  LicenseCmd = "show license feature"  
  UnlicensedResponse = "Licensing Status : Unlicensed"  
  LicensedResponse = "Licensing Status : Licensed"
)

type licenseEvent int

const (  
  Revoked licenseEvent = iota + 1  
  Awaiting  
  Granted  
  Verified  
  CommunicationFailed
)

func (l licenseEvent) reasonCode() string {  
  switch l {  
    case Revoked:    
      return "LicenseRevoked"  
    case Awaiting:    
      return "AwaitingLicense"  
    case Granted:    
      return "LicenseGranted"  
    case Verified:    
      return "LicenseVerified"  
    case CommunicationFailed:    
      return "LicenseCommunicationFailed"
  }  
  return "LicenseActivity"
}

func (l licenseEvent) eventType() string {  
  switch l {  
    case Awaiting, Revoked, CommunicationFailed:    
      return coreV1.EventTypeWarning  
    default:    
      return coreV1.EventTypeNormal
  }
}
type SmartLicenseReconciler struct {
  Log      logr.Logger
  CoreClient  *coreV1Client.CoreV1Client
  Licenser  lca.LicensingClient
  Dispatcher dispatcher.GatewayClient
  Recorder  record.EventRecorder
  tenant    *lca.Tenant
  numRetriedAttempts int
  allotment   *lca.AllotmentRequestStatus // needed to report the allotment held to server on request
  requiredNumCores uint32
  isRegistered  bool
  lastRecordedEvent licenseEvent // needed to avoid reporting the same event repeatedly
  notificationChan chan event.GenericEvent
}

func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher) *SmartLicenseReconciler {
  s.notificationChan = make(chan event.GenericEvent)
  lsp.AddListener(s)
  return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
  pod := &coreV1.Pod{
  }
  s.Log.Info("lina (re)started, initiating license reconciliation")
  s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
  podName := os.Getenv("POD_NAME")
  podNamespace := os.Getenv("POD_NAMESPACE")
  return ctrl.NewControllerManagedBy(mgr).
    Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{}).
    For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{
      Name:      podName,
      Namespace: podNamespace,
    })).Complete(s)
}

// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list

func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result, error) {
  s.Log.Info("reconciling license status", "pod", request)
  errResult := reconcile.Result{RequeueAfter: RetryDuration}
  // Handle the reconciliation logic here
  return errResult
}
pod, err := s.CoreClient.Pods().Get(request.NamespacedName)
if err != nil {
    s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NamespacedName)
    return errResult, err
}
if s.lastRecordedEvent == 0 {
    licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
    if err != nil {
        s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
        return errResult, nil
    }
    if strings.Contains(licenseResponse, LicensedResponse) {
        s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
        s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
    } else if strings.Contains(licenseResponse, UnlicensedResponse) {
        s.recordEvent(pod, Awaiting, "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
    }
}

if pod.DeletionTimestamp == nil {
    s.computeRequiredNumCores(pod)
    // (re)register with the license server
    err := s.registerTenantWithLicenseServer(pod)
    if err != nil {
        return errResult, nil
    }
    // registration successful, fetch or request allotment of this tenant
    err = s.syncAllotmentStatus(pod)
    if err != nil {
        return errResult, nil
    }
    err = s.grantASAcLicenseToOperate(pod)
    if err != nil {
        return errResult, nil
    }
    else {
        err := s.releaseAllotment()
        if err != nil {
            s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
            return errResult, nil
        }
    }
    return reconcile.Result{}, nil
}

func (s *SmartLicenseReconciler) recordEvent(pod *coreV1.Pod, event licenseEvent, description string) {

if s.lastRecordedEvent != event || event == Verified { // always record verified events
    s.lastRecordedEvent = event
    s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
}

func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *corev1.Pod) {
    requiredCoresQuantity := resource.MustParse("0")
    var containerCores = make(map[string]string)
    for _, container := range pod.Spec.Containers {
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container", container.Name)
            if err != nil {
                s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
                continue
            }
            // set the required core quantities directly to the capacity of the node
            requiredCoresQuantity = *node.Status.Capacity.Cpu()
            break
        }
        requiredCoresQuantity.Add(containerLimit)
    }
    s.requiredNumCores = uint32(requiredCoresQuantity.Value())
    if len(pod.Spec.Containers) == len(containerCores) {
        s.Log.Info("computed resources usage", "cpu", containerCores)
    }
    s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
}

func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *corev1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}.String(),
            Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            s.numRetriedAttempts = s.numRetriedAttempts + 1
            if s.numRetriedAttempts > MaxRetryAttempts {
                s.Log.Info("failed to communicate with licensing server with in allowed retry attempts", "+
"un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
                s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
communication failure (%s), "+
"retrying communication", err.Error()))
                _ = s.revokeASAcLicenseAndRetry()
            }
        }
    }
}
func (s *SmartLicenseReconciler) revokeASACLicenseAndRetry() error {
    reason, err := s.Dispatcher.RevokeLicense()
    if err != nil {
        s.Log.Error(err, "failed to revoke license")
        return err
    }
    if reason != "" {
        err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
        return err
    }
    s.Log.Info("successfully revoked ASAc license")
    s.numRetriedAttempts = 0
    return nil
}

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *coreV1.Pod) error {
    allotmentStatus, err := s.Licenser.Allotment().Status(s.tenant)
    if err != nil {
        if errors.Is(err, lca.ErrLicenseServerUnavailable) {
            s.Log.Info("licensing server is unavailable, unregistering the tenant")
            s.isRegistered = false
        }
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
                communication failure (%s), "+
                "reretrying communication", err.Error()))
            _ = s.revokeASACLicenseAndRetry()
        }
    }
    s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)", err.Error()),
        "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
    return err
}
if allotmentStatus == nil {
    s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
    // no allotment was made to this tenant, requesting one
    allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
        PoolName: pod.Namespace,
        Tenant:   s.tenant,
        NumCores: s.requiredNumCores,
    })
    if err != nil {
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info(4sfailed to communicate with licensing server with in allowed retry attempts, "+
"un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to obtain a license (%s), "+
"retrying the operation", err.Error()))
            _ = s.revokeASAClLicenseAndRetry()
            return err
        }
        s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
"numAttempt", s.numRetriedAttempts)
        return err
    }
    s.Log.Info("successfully leased an allotment from the licensing server")
    s.recordEvent(pod, Granted, "successfully obtained a license from the server")
    s.allotment = allotment
} else {
    s.allotment = allotmentStatus
}

s.Log.Info("allotment status verified", "cores", s.allotment.NumCores, "context", s.allotment.ContextId,
"domain", s.allotment.SmartAccountName, "account", s.allotment.VirtualAccountName, "exportControlled",
"tenant", s.allotment.Tenant.Name)
return nil

func (s *SmartLicenseReconciler) grantASAClLicenseToOperate(pod *coreV1.Pod) error {
if s.allotment != nil {
    s.Log.Info("license status verified, communicating the status to ASA")
    s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
    reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
    if err != nil {
        s.Log.Error(err, "failed to grant license")
        return err
    }
    if reason != "" {
        err = fmt.Errorf("ASAC failed to set license : %v", reason)
        return err
    }
} else {
    // no allotment was made to this tenant, requesting one
    allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
        PoolName: pod.Namespace,
        Tenant:   s.tenant,
        NumCores: s.requiredNumCores,
    })
    if err != nil {
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info(4sfailed to communicate with licensing server with in allowed retry attempts, "+
"un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to obtain a license (%s), "+
"retrying the operation", err.Error()))
            _ = s.revokeASAClLicenseAndRetry()
            return err
        }
        s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
"numAttempt", s.numRetriedAttempts)
        return err
    }
    s.Log.Info("successfully leased an allotment from the licensing server")
    s.recordEvent(pod, Granted, "successfully obtained a license from the server")
    s.allotment = allotment
} else {
    s.allotment = allotmentStatus
}

s.Log.Info("allotment status verified", "cores", s.allotment.NumCores, "context", s.allotment.ContextId,
"domain", s.allotment.SmartAccountName, "account", s.allotment.VirtualAccountName, "exportControlled",
"tenant", s.allotment.Tenant.Name)
return nil

func (s *SmartLicenseReconciler) grantASAClLicenseToOperate(pod *coreV1.Pod) error {
if s.allotment != nil {
    s.Log.Info("license status verified, communicating the status to ASA")
    s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
    reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
    if err != nil {
        s.Log.Error(err, "failed to grant license")
        return err
    }
    if reason != "" {
        err = fmt.Errorf("ASAC failed to set license : %v", reason)
        return err
    }
}

s.numRetriedAttempts = 0
s.Log.Info("successfully granted license to ASA")
} else {
    s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")
}
return nil

func (s *SmartLicenseReconciler) releaseAllotment() error {
    _ = s.revokeASAcLicenseAndRetry()
    if s.allotment != nil {
        err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
            ContextId: s.allotment.ContextId,
            Tenant:    s.tenant,
        })
        if err != nil {
            s.Log.Error(err, "failed to release the allotment to server")
            return err
        }
        s.allotment = nil
    }
    return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
    podName := types.NamespacedName{
        Namespace: os.Getenv("POD_NAMESPACE"),
        Name:      os.Getenv("POD_NAME"),
    }
    pod, err := s.CoreClient.Pods().Get(podName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
        return
    }
    switch event.Type {
    case proto.AllotmentEvent_RELEASE_ALLOTMENT:
        s.Log.Info("license requested to be released by the server, un-licensing ASA")
        if err == nil {
            s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying
to acquire")
        }
        _ = s.releaseAllotment()
    case proto.AllotmentEvent_REPORT_ALLOTMENT:
        s.Log.Info("license requested to be reported to the server")
        _ = s.reportAllotment()
    }
func (s *SmartLicenseReconciler) reportAllotment() error {
    allotment := &lca.AllotmentReport{ContextId: "", Tenant: s.tenant, NumCores: 0}
    if s.allotment != nil {
    }
    err := s.Licenser.Allotment().ReportAllotment(allotment)
    if err != nil {
        s.Log.Error(err, "failed to report the allotment to server")
    }
    return err
}

// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import (  
gomock "github.com/golang/mock/gomock"
reflect "reflect"
time "time"
)

// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl     *gomock.Controller
    recorder *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
}

// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}

// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
}

// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}

// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddRateLimited",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
func (m *MockRateLimitingInterface) Done(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
func (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Done",}
reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}

// Forget mocks base method
func (m *MockRateLimitingInterface) Forget(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
func (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Forget", 
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
func (m *MockRateLimitingInterface) Get() (interface{}, bool) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Get")
    ret0, _ := ret[0].(interface{})
    ret1, _ := ret[1].(bool)
    return ret0, ret1
}

// Get indicates an expected call of Get
func (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Get", reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Len")
    ret0, _ := ret[0].(int)
    return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len", reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}

// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "NumRequeues", arg0)
    ret0, _ := ret[0].(int)
    return ret0
}

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
}

// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}

// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShuttingDown))
}

apiVersion: v1
kind: Secret
metadata:
    name: cssm-token
    namespace: sfcn-system
stringData:
    # this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
---

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: sfcn-system
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: sfcn-system
  minLicenseCount: 1
  maxLicenseCount: 12
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer

package listeners_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
        "k8s.io/client-go/kubernetes/scheme"
        "testing"
        . "github.com/onsi/ginkgo"
        . "github.com/onsi/gomega"
)

const (smartLicenseName = "license-sample"
defaultNs = "default"
licenseType = "L-ASAV10S-STD"
)

func TestListeners(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Listeners Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})
FROM gcr.io/distroless/java-debian10:nonroot

WORKDIR /
COPY license-broker/bin/sa-server-*-all.jar sa-server-all.jar

ENTRYPOINT ["java", "-jar", "sa-server-all.jar"]
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: smartlicense-redirector
  namespace: sfcn-system
spec:
  action: "REGISTER"
  tokenSecret:
    name: ccssm-token
    namespace: sfcn-system
  minLicenseCount: 1
  maxLicenseCount: 4
  scalingRef:
    kind: Deployment
    name: sfcn-vpnredirector-enforcer
package listeners_test

import (
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensingProto "css.cisco.com/licensing/client-agent/proto"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/client/fake"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (
  epDeploymentName    = "epDeployment"
  entitlementNumber   = 4
  coresPerLicenseType = 2
)

var _ = Describe("Entitlement Listener Test", func() {

  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var listener *listeners.EntitlementListener
var fakeClient client.Client

var smartLicense *v1.SmartLicense

BeforeEach(func() {
    var defaultLicenseCount uint32 = 1
    var maxLicenseCount uint32 = 3
    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1.SmartLicenseSpec{
            Action:          v1.Register,
            LicenseType:     licenseType,
            MinLicenseCount: &defaultLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor:   &defaultLicenseCount,
        },
    }
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
    listener = &listeners.EntitlementListener{
        Log:           logf.NullLogger{},
        Client:        fakeClient,
        LicenseNsName: licenseNsName,
    }
})

It("should update license status on OUT_OF_COMPLIANCE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:                licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
        Message:             "entitlement is out of compliance",
        EntitlementSku:      licenseType,
        EntitlementNumber:   entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
    event := licensingProto.EntitlementEvent{
        Type:                licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
        Message:             "entitlement request is successful",
        EntitlementSku:      licenseType,
        EntitlementNumber:   entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InUse))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(licenseNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})
Message: "granted new entitlement",
EntitlementSku: licenseType,
EntitlementNumber: entitlementNumber,
CoresPerLicenseType: coresPerLicenseType,
}

listener.OnEntitlementEvent(&event)

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:                licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
        Message:             "failed to reserve a new entitlement",
        EntitlementSku:      licenseType,
        EntitlementNumber:   entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

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***************************************************************/

package v1

import (
    "context"
    "fmt"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/apimachinery/pkg/util/validation/field"
    ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
logf "sigs.k8s.io/controller-runtime/pkg/log"
"sigs.k8s.io/controller-runtime/pkg/webhook"

// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac89-96bb5a8def84"

var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1

// log is for logging in this package.
var smartlicenselog = logf.Log.WithName("smartlicense-resource")
var webhookClient client.Client

func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {
    webhookClient = mgr.GetClient()
    return ctrl.NewWebhookManagedBy(mgr).
           For(r).
           Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io
var _ webhook.Defaulter = &SmartLicense{

    // Default implements webhook.Defaulter so a webhook will be registered for the type
    func (r *SmartLicense) Default() {
        log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)

        if r.Spec.Action == "" {
            r.Spec.Action = Register
        }
        if r.Spec.LicenseType == "" {
            r.Spec.LicenseType = SFWLicenceTag
        }
        if r.Spec.MinLicenseCount == nil {
            r.Spec.MinLicenseCount = &defaultMinLicenseCount
        }
        if r.Spec.MaxLicenseCount == nil {
            r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
        }
        if r.Spec.ScalingFactor == nil {
            r.Spec.ScalingFactor = &defaultScalingFactor
        }
    }
}
log.V(1).Info("updated SmartLicense default values")
}

// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io

var _ webhook.Validator = &SmartLicense{

// ValidateCreate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateCreate() error {
    smartlicenselog.V(1).Info("validate create", "name", r.Name)

    var allErrs field.ErrorList
    r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.ScalingFactor, "scalingFactor", &allErrs)
    r.requireRegisterAction(&allErrs)
    r.validateLicenseCount(&allErrs)
    r.validateToken(&allErrs)
    r.validateScalingRef(&allErrs)

    if len(allErrs) == 0 {
        return nil
    }
    return allErrs.ToAggregate()
}

// ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
    smartlicenselog.V(1).Info("validate update", "name", r.Name)

    var allErrs field.ErrorList
    r.validateLicenseCount(&allErrs)
    // avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
    if r.GetDeletionTimestamp() == nil {
        r.validateToken(&allErrs)
        r.validateScalingRef(&allErrs)
    }
    oldObj := old.(*SmartLicense)
    r.requireNoLicenseTypeChange(&allErrs, oldObj)

    if len(allErrs) == 0 {
        return nil
    }
    return allErrs.ToAggregate()
// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}

func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
    if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
        *errs = append(*errs,
            field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
    }
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")
    if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount < *r.Spec.MinLicenseCount {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum license count"))
    }
}

func (r *SmartLicense) validateToken(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("tokenSecret")
    secret := &v1.Secret{}
    if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "token secret is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
            return
        }
    }
    if len(secret.Data[TokenKeyName]) == 0 {
*errs = append(*errs, field.Required(path.Child("data").Child(TokenKeyName), "cannot be empty"))
}
}

func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("scalingRef")
    if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == "" {
        *errs = append(*errs, field.Required(path, "kind or name of referenced object cannot be empty"))
        return
    }
    key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
    var obj client.Object
    switch r.Spec.ScalingRef.Kind {
    case DeploymentKind:
        obj = &appsv1.Deployment{
    case HPAKind:
        obj = &autoscalingv1.HorizontalPodAutoscaler{
    default:
        return
    }
    if err := webhookClient.Get(context.TODO(), key, obj); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "referenced object is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: %w", err)))
            return
        }
    }
}

func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
    if val == nil || *val < min {
        path := field.NewPath("spec").Child(path)
        *errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to %d", min)))
    }
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/kasa/license-broker/controllers (interfaces: ReplicasCalculator)

// Package mocks is a generated GoMock package.
package mocks
import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    gomock "github.com/golang/mock/gomock"
    v10 "k8s.io/api/apps/v1"
    reflect "reflect"
)

// MockReplicasCalculator is a mock of ReplicasCalculator interface
type MockReplicasCalculator struct {
    ctrl  *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}

// MockReplicasCalculatorMockRecorder is the mock recorder for MockReplicasCalculator
type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

// NewMockReplicasCalculator creates a new mock instance
func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

// CalculateMaxLicensedReplicas mocks base method
func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1 *v10.Deployment) (int32, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
    ret0, _ := ret[0].(int32)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{}) {
    *gomock.Call{
    mr.mock.ctrl.T.Helper()}
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "CalculateMaxLicensedReplicas", reflect.TypeOf((*MockReplicasCalculator)(nil)).MethodType, arg0, arg1)
}
// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import (
    clientagent "css.cisco.com/licensing/client-agent"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
   .ctrl *gomock.Controller
   .recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
    mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
    mock := &MockLicensingClient{
       .ctrl: ctrl
    }
    mock.recorder = &MockLicensingClientMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
    return m.recorder
}

// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Allotment")
    ret0, _ := ret[0].(clientagent.AllotmentService)
    return ret0
}

// Allotment indicates an expected call of Allotment
func (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Allotment", reflect.TypeOf((*MockLicensingClient)(nil).Allotment))}
// Entitlement mocks base method
func (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Entitlement")
    ret0, _ := ret[0].(clientagent.EntitlementService)
    return ret0
}

// Entitlement indicates an expected call of Entitlement
func (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Entitlement",
        reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
func (m *MockLicensingClient) Registration() clientagent.RegistrationService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Registration")
    ret0, _ := ret[0].(clientagent.RegistrationService)
    return ret0
}

// Registration indicates an expected call of Registration
func (mr *MockLicensingClientMockRecorder) Registration() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Registration",
        reflect.TypeOf((*MockLicensingClient)(nil).Registration))
}

// Subscription mocks base method
func (m *MockLicensingClient) Subscription() clientagent.SubscriptionService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Subscription")
    ret0, _ := ret[0].(clientagent.SubscriptionService)
    return ret0
}

// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
        reflect.TypeOf((*MockLicensingClient)(nil).Subscription))
}
import (  
"context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/services"
  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
  appsv1 "k8s.io/api/apps/v1"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  corev1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/resource"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/client/fake"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (  
smartLicenseName = "license-sample"
defaultNs = "default"
licenseType = "L-ASAV10S-STD"
)

var (  
minLicenseCount uint32 = 1
maxLicenseCount uint32 = 5
scalingFactor uint32 = 2
)

var _ = Describe("ReplicasCalculator Service Test", func() {  
var (  
deployment *appsv1.Deployment
licenses []v1.SmartLicense
fakeClient client.Client
replicasCalculator *services.ReplicasCalculator
smartLicense v1.SmartLicense
node *corev1.Node
)

licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}
BeforeEach(func() {  
licenses = []v1.SmartLicense{}
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
replicasCalculator = services.NewReplicasCalculator(fakeClient, logf.NullLogger{}))

var replicaCount int32 = 1
deployment = &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},
Spec: appsv1.DeploymentSpec{
  Replicas: &replicaCount,
  Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},
  Template: corev1.PodTemplateSpec{
      Name: "ep-container",
      Resources: corev1.ResourceRequirements{
        Limits: map[corev1.ResourceName]resource.Quantity{
          "cpu": resource.MustParse("2000m")},
      },
    },
    Status: appsv1.DeploymentStatus{ReadyReplicas: replicaCount},
  }
}

pod := &corev1.Pod{
  ObjectMeta: metav1.ObjectMeta{
    Name: "ep-pod",
    Namespace: defaultNs,
    Labels: map[string]string{"role": "enforcer"},
  },
  Spec: corev1.PodSpec{NodeName: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

node = &corev1.Node{
  ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), node)).To(Succeed())

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

smartLicense = v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
  Spec: v1.SmartLicenseSpec{
    Action: v1.Register,
    LicenseType: licenseType,
    MinLicenseCount: &minLicenseCount,
    MaxLicenseCount: &maxLicenseCount,
    ScalingFactor: &scalingFactor,
}
It("should return default value because license state is not in compliance", func() {
    smartLicense.Status.LicenseState = v1.OutOfCompliance
    Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())

    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(2)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should calculate max limits based on 2 smart licenses", func() {
    smartLicense2 := v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action: v1.Register,
            LicenseType: licenseType,
            MinLicenseCount: &minLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor: &scalingFactor,
        },
        Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance, CoresPerLicense: 1},
    }

    Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
    
    AfterEach(func() {
        Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
        Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Pod{})).To(Succeed())
        Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Node{})).To(Succeed())
        Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    })
})
Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
licenses = append(licenses, smartLicense2, smartLicense)

maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HasOccurred())
Expect(maxReplicas).Should(Equal(int32(4)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HasOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense2)).ShouldNot(HasOccurred())
Expect(smartLicense2.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should look at node limits if pod containers do not have limits defined", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{
}
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HasOccurred())
  Expect(maxReplicas).Should(Equal(int32(1)))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HasOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
})

It("should return default value if pod containers do not have limits defined and deployment ready replicas is 0", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{
    template: &corev1.PodTemplateSpec{
      spec: corev1.PodSpec{
        containers: []corev1.Container{
          &corev1.Container{
            name: "smart",
            image: "image",
            resources: corev1.ResourceRequirements{
              limits: map[corev1.Resource]string{
                "memory": "128Mi",
              },
              requests: map[corev1.Resource]string{
                "cpu": "500m",
              },
            },
          }
        }
      }
    }
    replicas: 0
  }
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HasOccurred())
  Expect(maxReplicas).Should(Equal(*deployment.Spec.Replicas))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HasOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

It("should return default value if there is no node defined in pod spec", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{
    template: &corev1.PodTemplateSpec{
      spec: corev1.PodSpec{
        containers: []corev1.Container{
          &corev1.Container{
            name: "smart",
            image: "image",
            resources: corev1.ResourceRequirements{
              limits: map[corev1.Resource]string{
                "memory": "128Mi",
              },
              requests: map[corev1.Resource]string{
                "cpu": "500m",
              },
            },
          }
        }
      }
    }
  }
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  Expect(fakeClient.Delete(context.TODO(), node)).To(Succeed())
licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).Should(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
Expect(maxReplicas).Should(Equal(int32(0)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))

{{ include "aegis.configmap.standard" (list . "config" "kasa.licensebroker.config") }}
---

{{- define "kasa.licensebroker.config" -}}

{{- $ := first . -}}
{{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") -}}
{{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName -}}
apiVersion: v1
do

---

import {
  "context"
} v1 "css.cisco.com/kasa/license-broker/api/v1"
"css.cisco.com/kasa/license-broker/controllers/handlers"
"css.cisco.com/kasa/pkg/predicates"
"fmt"
"github.com/go-logr/logr"
appsv1 "k8s.io/api/apps/v1"
autoscalingv1 "k8s.io/api/autoscaling/v1"
"k8s.io/api/autoscaling/v2beta1"
corev1 "k8s.io/api/core/v1"
type HPALicenseReconciler struct {
    client.Client
    Log        logr.Logger
    Recorder   record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(
            &predicates.LabelExistsPredicate{Key: LicenseHolderLabel})).
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).
        Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    hpa := &autoscalingv1.HorizontalPodAutoscaler{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("HPA does not exist, nothing to reconcile")
        } else {
            return ctrl.Result{}, client.IgnoreNotFound(err)
        }
    }

    licenseList := v1.SmartLicenseList{}
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
    }

    // Perform reconciliation logic here...
}
registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

hpaLicenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpaLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)
    }
    log.Info("updated HPA labels")
}

if len(hpaLicenses) == 0 {
    log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(hpaLicenses) {
    log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")
    return ctrl.Result{}, nil
}

    log.Info("scaled resource is not deployment")
    return ctrl.Result{}, nil
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)
if err != nil {
    return ctrl.Result{}, err
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpaLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

if hpa.Spec.MaxReplicas > maxLicensedReplicas {
    hpa.Spec.MaxReplicas = maxLicensedReplicas
    changedFields := []string{"MaxReplicas"}
        changedFields = append(changedFields, "MinReplicas")
    }
    if err = c.Client.Update(context.Background(), hpa); err != nil {

return ctrl.Result{}, fmt.Errorf("failed to update HPA resource: %w", err)
}
c.Recorder.Event(hpa, corev1.EventTypeError, "HPAScaledDown", fmt.Sprintf("Decreased HPA's %s to %d as it is the maximum EP replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", changedFields, maxLicensedReplicas))
log.Info(fmt.Sprintf("successfully decreased HPA's %s to max license limit", changedFields), "updatedHPAMaxReplicas", hpa.Spec.MaxReplicas)
return ctrl.Result{}, nil
}
log.Info("skipping HPA update, system has enough licenses to have all HPA's MaxReplicas running", "hpaMaxReplicas", hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa *autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
    deploymentName := hpa.Spec.ScaleTargetRef.Name
deployment := &appsv1.Deployment{
    if err != nil {
        return nil, err
    }
    return deployment, err
}

---

apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
    creationTimestamp: null
name: mutating-webhook-configuration
webhooks:
  - admissionReviewVersions:
    - v1
clientConfig:
    service:
    name: webhook-service
    namespace: system
    path: /mutate-sfcn-cisco-com-v1-smartlicense
failurePolicy: Fail
name: msmartlicense.kb.io
rules:
  - apiGroups:
    - sfcn.cisco.com
apiVersions:
  - v1
operations:
- CREATE
- UPDATE
resources:
- smartlicenses
sideEffects: None

---

apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
creationTimestamp: null
name: validating-webhook-configuration
webhooks:
- admissionReviewVersions:
  - v1
clientConfig:
  service:
    name: webhook-service
    namespace: system
    path: /validate-sfcn-cisco-com-v1-smartlicense
failurePolicy: Fail
name: vsmartlicense.kb.io
rules:
- apiGroups:
  - sfcn.cisco.com
apiVersions:
  - v1
operations:
- CREATE
- UPDATE
resources:
- smartlicenses
sideEffects: None
// +build !ignore_autogenerated

*******************************************************************************
* Copyright (c) 2021 Cisco Systems, Inc.                                       *
* Unauthorized redistribution prohibited.                                       *
*******************************************************************************

// Code generated by controller-gen. DO NOT EDIT.

package v1

import (
    "k8s.io/apimachinery/pkg/runtime"
)
// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.Spec.DeepCopyInto(&out.Spec)
    out.Status = in.Status
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicense.
func (in *SmartLicense) DeepCopy() *SmartLicense {
    if in == nil {
        return nil
    }
    out := new(SmartLicense)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicense) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.ListMeta.DeepCopyInto(&out.ListMeta)
    if in.Items != nil {
        in, out := &in.Items, &out.Items
        *out = make([]SmartLicense, len(*in))
        for i := range *in {
            (*in)[i].DeepCopyInto(&(*out)[i])
        }
    }
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
if c := in.DeepCopy(); c != nil {
    return c
}
return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseSpec.
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseSpec)
in.DeepCopyInto(out)
    return out
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {
    *out = *in
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseStatus.
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
in.DeepCopyInto(out)
    return out
}
// DeepCopy is an autogenerated deep copy function, copying the receiver, creating a new SmartLicenseStatus.
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
in.DeepCopyInto(out)
    return out
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: EntitlementService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockEntitlementService is a mock of EntitlementService interface
type MockEntitlementService struct {
    ctrl     *gomock.Controller
    recorder *MockEntitlementServiceMockRecorder
}

// MockEntitlementServiceMockRecorder is the mock recorder for MockEntitlementService
type MockEntitlementServiceMockRecorder struct {
    mock *MockEntitlementService
}

// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
    mock.recorder = &MockEntitlementServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}

// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Notify", arg0, arg1)
ret0, _ := ret[0].(error)
return ret0
}

// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify",
    reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}

// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement",
    reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test

import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "css.cisco.com/kasa/license-broker/controllers/handlers"  "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"  "github.com/golang/mock/gomock"  . "github.com/onsi/ginkgo"  . "github.com/onsi/gomega"  corev1 "k8s.io/api/core/v1"  metav1 "k8s.io/api/апimachinery/pkg/apis/meta/v1"  "k8s.io/api/апimachinery/pkg/types"  "k8s.io/client-go/kubernetes/scheme"  "sigs.k8s.io/controller-runtime/pkg/client"  "sigs.k8s.io/controller-runtime/pkg/client/fake"  "sigs.k8s.io/controller-runtime/pkg/event"  "sigs.k8s.io/controller-runtime/pkg/reconcile"
)
const (
    secretName = "secretTest"
)

var _ = Describe("SecretHandler", func() {
    var handler handler.EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface
    var coreClient client.Client

   BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
        coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
        handler = handlers.SecretHandler(coreClient)
    })

    AfterEach(func() {
        mockCtrl.Finish()
    })

    It("should do nothing where there are no smart license objects", func() {
        handler.Update(event.UpdateEvent{
            ObjectNew: &corev1.Secret{
                ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
            },
            mockQueue
        })
    })

    It("should not add request because secret is not used in SmartLicense object", func() {
        smartLicenseObject := &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
                TokenSecret: corev1.SecretReference{
                    Name: "some_secret",
                    Namespace: defaultNamespace,
                },
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.RegistrationFailed,
            }
        }
        Expect(coreClient.Create(context.TODO(), smartLicenseObject))

        handler.Update(event.UpdateEvent{
            ObjectNew: &corev1.Secret{
                ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
            },
        })
    })
})
It("should not add request because SmartLicense is registered", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name: smartLicenseName,
                Namespace: defaultNamespace,
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Registered,
            },
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))
    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
        }, mockQueue)
})

It("should not add request because SmartLicense is deregistered", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name: smartLicenseName,
                Namespace: defaultNamespace,
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Deregistered,
            },
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))
    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
        }, mockQueue)
})

It("should add request because SmartLicense status is registration failed", func() {

smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
        TokenSecret: corev1.SecretReference{
            Name:      secretName,
            Namespace: defaultNamespace,
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.RegistrationFailed,
        },
    }
}

Expect(coreClient.Create(context.TODO(), smartLicenseObject))

mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
}, mockQueue)
}

It("should add request for SmartLicense even if secret is in different namespace", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      secretName,
                Namespace: "test-namespace",
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.RegistrationFailed,
            },
        }
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
    })

    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: "test-namespace"},
        },
    }, mockQueue)
})
License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).

## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:

```shell
go env -w GOPRIVATE="css.cisco.com/*"```

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{{- include "aegis.deployments.configuration" (list . "license-api" (fromYaml `deployment: kasa.licensebroker.deployment
rbac: config/rbac/**.yaml
crds: config/crd/**.yaml
webhooks: config/webhook/manifests.yaml
`) ) -}}

{{- define "kasa.licensebroker.deployment" -}}

{{- $ := first . -}}

{{- $global := default (dict ) $.Values.global -}}

apiVersion: apps/v1
kind: Deployment
spec:

strategy:
  type: Recreate

template:
  metadata:
    annotations:
      # checksum annotation forces Deployment's RollingUpdate when ConfigMap's values are updated */}
      checksum/license-config: [ {{ include "aegis.configmap.standard" (list $ "config" "kasa.licensebroker.config") | sha256sum }]

spec:
  securityContext:
    # 65532 is ID of nonroot user group
    fsGroup: 65532

    dnsPolicy: ClusterFirstWithHostNet
    hostNetwork: true

    {{- if ($Values.global.platform | eq "azure") }}
azure disk seems to ignore fsgroup setting right now for v1.2.0 release,
need an init container to fix permissions */}

initContainers:
  - name: change-ownership
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    command: ['sh', '-c', 'chown -R 65532:65532 /home/nonroot']

volumeMounts:
  - mountPath: /home/nonroot
    name: disk

securityContext:
  # Files or directories created with HostPath on the host are only writable by root. Which means, you either
  # need to run your container process as root or modify the file permissions on the host to be writable by
  # non-root user.
  runAsUser: 0
  capabilities:
    add:
      - DAC_OVERRIDE
      - FOWNER

containers:
  - name: manager
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
    env:
      {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
    args:
      - --zap-log-level={{ $.Values.logLevel }}
      - --zap-encoder={{ $.Values.logFormat }}
      - --webhook-port={{ $.Values.webhookPort }}
      - --metrics-port={{ $.Values.metricsPort }}
      - --license-server-port={{ $.Values.licenseServerPort }}
    ports:
      - containerPort: {{ $.Values.webhookPort }}
        name: webhook-server
        protocol: TCP
    resources:
      requests:
        cpu: {{ $.Values.managerCoreRequest }}
        memory: {{ $.Values.managerMemoryRequest }}
      limits:
        cpu: {{ $.Values.managerCoreLimit }}
        memory: {{ $.Values.managerMemoryLimit }}
    securityContext:
      allowPrivilegeEscalation: false
  - name: license-server
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) }}
    imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
command:
- "java"
- "-Xms{{ $.Values.licenseServerXms }}"
- "-Xmx{{ $.Values.licenseServerXmx }}"
- "-jar"
- "sa-server-all.jar"
- "--configFile"
- "/etc/licensing/server-id.json"
- "--port"
- {{ $.Values.licenseServerPort | quote }}
ports:
- containerPort: {{ $.Values.licenseServerPort }}
  protocol: TCP
securityContext:
  # 65532 is ID of nonroot user
  runAsUser: 65532
  allowPrivilegeEscalation: false
env:
  {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
resources:
  requests:
    cpu: {{ $.Values.licenseServerCoreRequest }}
    memory: {{ $.Values.licenseServerMemoryRequest }}
  limits:
    cpu: {{ $.Values.licenseServerCoreLimit }}
    memory: {{ $.Values.licenseServerMemoryLimit }}
volumeMounts:
- mountPath: /home/nonroot
  name: disk
- mountPath: /etc/licensing/server-id.json
  name: license-config
  subPath: server-id.json
volumes:
- name: disk
  persistentVolumeClaim:
    claimName: {{ include "aegis.metadata.fullname" (list $ "server") }}
- name: license-config
  configMap:
    name: {{ include "aegis.metadata.fullname" (list $ "config") }}
    {{- if ne $global.platform "kind" }}
    imagePullSecrets:
      name: registrcn
    {{- end }}
  terminationGracePeriodSeconds: 10
  {{- end }}
---
```yaml
apiVersion: v1
kind: Service
metadata:
  name: {{ include "aegis.metadata.fullname" (list $ "server") }}
spec:
  ports:
    - protocol: TCP
      port: 80
      targetPort: {{ $.Values.licenseServerPort }}
type: ClusterIP
```

```go
package controllers

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"  ".github.com/onsi/ginkgo"  ".github.com/onsi/gomega"  
autoscalingv1 "k8s.io/api/autoscaling/v1"  
m metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
"k8s.io/apimachinery/pkg/types"  
"strings"  
)

var _ = Describe("Common Test", func () {
  It("serialNumber", func () {
    serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())
    Expect(len(serialNum)).Should(Equal(11))
    Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))
    Expect(serialNum).Should(Equal("F0529A6CDD9"))
  })
  It("containsString", func () {
    list := []string{"one", "two", "three"}
    Expect(containsString(list, "three")).Should(BeTrue())
    Expect(containsString(list, "four")).Should(BeFalse())
  })
  It("removeString", func () {
    list := []string{"one", "two", "three"}
    Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
    Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
  })
  It("filterLicensesByState", func () {
```

```
licenses := []v1.SmartLicense{
    
    ObjectMeta: metav1.ObjectMeta{
        Name: "license1",
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Deregistered,
    },
    
    ObjectMeta: metav1.ObjectMeta{
        Name: "license2",
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Registered,
    },
}

filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
    
    ObjectMeta: metav1.ObjectMeta{
        Name: "license1",
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Deregistered,
    },
}))

filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
Expect(filteredLicenses).Should(BeEmpty())

It("filterLicensesByKind", func() {
    var licenses v1.SmartLicenseList
    licenses.Items = []v1.SmartLicense{
        
        Spec: v1.SmartLicenseSpec{
            ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
        },
    },
    
        
        
        Spec: v1.SmartLicenseSpec{
            ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
        },
    },
    
        
        
        Spec: v1.SmartLicenseSpec{

ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
},
},
}

filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
    },
}})

filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
Expect(filteredLicenses).Should(BeNil())

filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
    },
}})

It("pendingLicenseExists", func() {
    licenses := []v1.SmartLicense{
        {
            Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance},
        },
        {
        },
    }

    Expect(pendingLicenseExists(licenses)).Should(BeFalse())
    licenses = append(licenses, v1.SmartLicense{
        Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState},
    })

    Expect(pendingLicenseExists(licenses)).Should(BeTrue())
})

It("setLicenseLabel", func() {
    meta := metav1.ObjectMeta{}
    res := setLicenseLabel(&meta, LicenseHolderLabel, true)
    Expect(res).Should(BeTrue())
    val, ok := meta.Labels[LicenseHolderLabel]
    Expect(ok).Should(BeTrue())
    Expect(val).Should(Equal("true"))
Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing. There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.

---

# Smart Licensing

* Licensing a kASA cluster involves licensing every ASA instance running in the cluster. Since the ASA instances are ephemeral, a license server runs locally in your cluster to manage the license lifecycle of these ASA instances. This server is responsible for registering the set of ASA instances you license with the Cisco Smart Software Manager, obtain or release the licenses based on the number of cores those instances use, and releasing all the licenses back to your Smart account when you deregister the cluster.

* After kASA bundle is successfully installed with licensing enabled, to license the cluster, you need a token from your Smart Account that has Secure Firewall (SFW) licenses. Go to [software.cisco.com](www.software.cisco.com) and navigate to Smart Software Licensing. Find `asac-dev` virtual account that has the SFW licenses and generate a token from it.

    For development purposes, we have created a token that you can use:

    ```
    YTRkNWFlM2MtZWEzYi00MWEzLWI2MDEtZmIzMzdjZGQ2OTIzMDgzMjcyMDA3OTIwMTA0MCwwLSdpZGdyb3VuZCBSdWVzdG9yZSBNZXRh
    ```

---

res = setLicenseLabel(&meta, LicenseHolderLabel, true)
Expect(res).Should(BeFalse())

res = setLicenseLabel(&meta, LicenseHolderLabel, false)
Expect(res).Should(BeTrue())
If this token has expired, please send an email to sfcn-controlplane@cisco.com

* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create
  a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc)
  and a service type (e.g. `Deployment` or `HorizontalPodAutoscaler`).

* Examples of the secret and the Smart License object are located
  [here](../../license-broker/config/samples/sfcn.cisco.com_v1_smartlicense.yaml).

```yaml
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  creationTimestamp: null
name: broker-role
rules:
  - apiGroups:
    - apps
      resources:
        - deployments
      verbs:
        - get
        - list
        - update
        - watch
    - apiGroups:
      - apps
        resources:
          - replicasets
        verbs:
          - get
          - list
          - watch
    - apiGroups:
      - autoscaling
        resources:
          - horizontalpodautoscalers
        verbs:
          - get
          - list
          - update
          - watch
    - apiGroups:
      - ""
```

---

Open Source Used In kASA v1.5  559
Licensing setup comprises two components - the License Server, and the License Controller. References to Server and Controller in this document mean the License Server and License Controller.
1. User creates a Smart License resource and applies it to the Kubernetes API Server
2. Kubernetes API Server sends a notification to License Controller.
3. License Controller inspects the configuration in the Smart License resource

   1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server, which then talks to CSSM to reserve the licenses and responds back to the Controller

   2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server

4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.
5. The License Server checks its pool to see if it has sufficient licenses to grant the request

   1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates this status to ASAc.

   2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.

## Packaging

Licensing components are packaged into two Kubernetes Deployment resources targeting different namespaces and distributed via Helm as part of the `sfcn-bundle` Helm chart

### License Broker

The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

License Broker is set to be deployed once per Cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode).

The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.
## License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the [Controller](https://kasa.sz.com/license-controller), sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.

## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart
License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the [License Server](#license-server). It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests](#unauthorized-requests) for more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the form of events on that resource.

### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart License resource in the same namespace.

Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
# license type can be blank or not set explicitly to let the system use the default value
# At present, there is only one license type for kASA, so this field is reserved for future use.
LICENSE_TYPE: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by
obtaining a token from the [Virtual Account](terminology#smart-and-virtual-accounts) and doing a base64 encoding of that text. This can be done from a shell as follows

```shell
echo "your-token" | base64
```

And, use that content in the Secret as follows

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: cssm-token
  namespace: cisco-systems
data:
  # this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
  token: "TXpJMk1UVXhOV1V0Tm1Jd1ppMDBORFUzTFRnd09ETXRNamMyWm1JMVltWTBORGhtTFRFMk16YzBNamcyJTBBTVRBVk16QjhVSFE1U25WVGNHbEpRMEZWU2paSk5FeDRZbHAxYnpkdGFHcGFZbIQVDFGFWFOyMURjR3h4JTBBVFUxVkJEMCUzRCUwQQ=="
```

The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual account as you are expecting the number of vCPUs in your cluster namespace.

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`. The resource specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a minimum of 1 license and upto 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA license type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request for upto 10 vCPUs.

Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing configuration thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

 Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the License Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the
license configuration.
In the example here, the Deployment replica count would be set to 2.

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more replicas, the License Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to the account. Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.

### Using the Scaling Factor

When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient number of licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to retry the operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the `scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or down, it reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may ask the pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the pod is assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its pool.

Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the virtual account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following configuration, the Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this number to the number of vCPUs the enforcer pods will be using.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
```
### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates unregistration and on successfully unregistering from the virtual account, the Controller deletes the resource.

### The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

```yaml
namespace: cisco-systems
spec:
  action: "REGISTER"
tokenSecret:
    name: cssm-token
    namespace: cisco-systems
licenseType: ""
minLicenseCount: 1
maxLicenseCount: 10
# scaling factor of 4 implies the license reservations change in increments/decrements of 4
scalingFactor: 4
scalingRef:
  kind: Deployment
  name: sfcn-enforcer
```

```yaml
### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates unregistration and on successfully unregistering from the virtual account, the Controller deletes the resource.

### The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

```yaml
namespace: cisco-systems
spec:
  action: "REGISTER"
tokenSecret:
    name: cssm-token
    namespace: cisco-systems
licenseType: ""
minLicenseCount: 1
maxLicenseCount: 10
# scaling factor of 4 implies the license reservations change in increments/decrements of 4
scalingFactor: 4
scalingRef:
  kind: Deployment
  name: sfcn-enforcer
```
### Licensing ASA

When the ASA comes up, it does not hold a license and therefore runs at a low-bandwidth mode, typically 100kbps and has very restricted capabilities and features it supports. The Manager tries to get a license from the License Server and if successful communicates the status to ASA. Once licensed, ASA runs at its full potential.

The Manager periodically verifies the status of the license it obtained, with the License Server, and if the license is not valid anymore either because the License Server has insufficient licenses, or the Manager failed to verify the validity despite several retries, it will revoke the license of ASA and keeps retrying to fetch the license.

```yaml
apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

type: application

version: 0.1.0
appVersion: 1.16.0

dependencies:
- name: aegis-common
  version: "0.1.0"
  repository: "file:///aegis-common"

module css.cisco.com/kasa/license-broker

dependencies:
- name: aegis-common
  version: "0.1.0"
  repository: "file:///aegis-common"

module css.cisco.com/kasa/license-broker
```

go 1.14
require (  
css.cisco.com/kasa/pkg/predicates v0.0.0  
css.cisco.com/licensing/client-agent v0.1.11  
github.com/go-logr/logr v0.3.0  
github.com/golang/mock v1.3.1  
github.com/onsi/ginkgo v1.14.1  
github.com/onsi/gomega v1.10.2  
k8s.io/api v0.19.2  
k8s.io/apimachinery v0.19.2  
k8s.io/client-go v0.19.2  
k8s.io/utils v0.0.0-20200912215256-4140de9c8800  
sigs.k8s.io/controller-runtime v0.7.2  
)  
replace css.cisco.com/kasa/pkg/predicates v0.0.0 => ../pkg/predicates  
// Code generated by MockGen. DO NOT EDIT.  
// Source: css.cisco.com/licensing/client-agent (interfaces: AllotmentService)  

// Package mocks is a generated GoMock package.  
package mocks  

import (  
proto "css.cisco.com/licensing/client-agent/proto"  
service "css.cisco.com/licensing/client-agent/service"  
gomock "github.com/golang/mock/gomock"  
reflect "reflect"  
)  

// MockAllotmentService is a mock of AllotmentService interface  
type MockAllotmentService struct {  
ctrl *gomock.Controller  
recorder *MockAllotmentServiceMockRecorder  
}  

// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService  
type MockAllotmentServiceMockRecorder struct {  
mock *MockAllotmentService  
}  

// NewMockAllotmentService creates a new mock instance  
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {  
mock := &MockAllotmentService{ctrl: ctrl}  
mock.recorder = &MockAllotmentServiceMockRecorder{mock}  
return mock  
}  

// EXPECT returns an object that allows the caller to indicate expected use  
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {  
}
return m.recorder
}

// LeaseAllotment mocks base method
func (m *MockAllotmentService) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "LeaseAllotment", arg0)
  ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
  ret1, _ := ret[1].(error)
  return ret0, ret1
}

// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Register", arg0, arg1)
  ret0, _ := ret[0].(error)
  return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
}

// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
  ret0, _ := ret[0].(error)
  return ret0
}

// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReleaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).ReleaseAllotment), arg0)
}
// ReportAllotment mocks base method
func (m *MockAllotmentService) ReportAllotment(arg0 *proto.AllotmentReport) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReportAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReportAllotment indicates an expected call of ReportAllotment
func (mr *MockAllotmentServiceMockRecorder) ReportAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReportAllotment", reflect.TypeOf((*MockAllotmentService)(nil).ReportAllotment), arg0)
}

// Status mocks base method
func (m *MockAllotmentService) Status(arg0 *proto.Tenant) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Status", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Status indicates an expected call of Status
func (mr *MockAllotmentServiceMockRecorder) Status(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Status", reflect.TypeOf((*MockAllotmentService)(nil).Status), arg0)
}

---
title: "Terminology"
weight: 1
description: >
Terms and acronyms of Cisco Smart Licensing and their descriptions

---

##### Cisco Smart Software Manager (CSSM)

Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage
the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any
licensing activity outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed
There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html) often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.

**Warning**

kASA Licensing currently supports only direct access to CSSM. The system is NOT tested for accessing CSSM from behind an HTTPs proxy or via Satellite, and the behavior is unknown; though, in theory, it may work.

### Smart License

Smart License is the license that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that license from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).

### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.
Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited to. The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account. You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased. This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation

License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product. The reservation process requires connectivity to internet and only on successful reservation can you use the product in
Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR).
PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does not mean the product supports it. You should check the product documentation to verify the support for license reservation

```{{% alert title="Warning" color="warning" %}}
kASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.
{{% /alert %}}
```

### References

If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

/****************************/

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package integ_tests

import (  
"context"  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
"github.com/onsi/ginkgo"  
"github.com/onsi/gomega"  
autoscalingv1 "k8s.io/api/autoscaling/v1"  
corev1 "k8s.io/api/core/v1"  
metav1 "k8s.io/api/machinery/pkg/apis/meta/v1"  
"k8s.io/apimachinery/pkg/types"
)

var _ = Describe("SmartLicense Webhook Test", func() {
const defaultNamespace = "default"
var defaultCount uint32 = 1

var secret *corev1.Secret
var hpa *autoscalingv1.HorizontalPodAutoscaler

BeforeEach(func()) {
    secret = &corev1.Secret{
        Data:       map[string][]byte{"token": []byte("MTIz")},
    }
    Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())
    hpa = &autoscalingv1.HorizontalPodAutoscaler{
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: 3,
        },
    }
    Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
}

AfterEach(func()) {
    Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
    Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
}

Context("Mutating Webhook", func() {
    It("should fill in values on creation", func() {
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
            },
        }
        err := k8sClient.Create(testCtx, license)
        Expect(err).ShouldNot(HaveOccurred())
        err = k8sClient.Get(testCtx, types.NamespacedName{
            Namespace: defaultNamespace,
            Name: "foo",
        }, license)
        Expect(err).ShouldNot(HaveOccurred())
        Expect(license.Spec.Action).To(Equal(v1.Register))
        Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
        Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
        Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
    })
})
Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
})

It("has fields validations", func() {
  //given
  var zeroLicenses uint32 = 0
  license := v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      MinLicenseCount: &zeroLicenses,
      MaxLicenseCount: &zeroLicenses,
      ScalingFactor: &zeroLicenses,
    },
  }
  //when
  err := k8sClient.Create(testCtx, license)
  //then
  Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: [" + "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1"]"))
})

It("should return error if max value is less then min value", func() {
  //given
  var minLicenses uint32 = 5
  var maxLicenses uint32 = 3
  license := v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      MinLicenseCount: &minLicenses,
      MaxLicenseCount: &maxLicenses,
      ScalingFactor: &maxLicenses,
    },
  }
  //when
  err := k8sClient.Create(testCtx, license)
  //then
  Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: [" + "spec.minLicenseCount: Invalid value: 0x3: must be greater than or equal to 5, " + "spec.maxLicenseCount: Invalid value: 0x3: must be greater than or equal to 5, " + "spec.scalingFactor: Invalid value: 0x3: must be greater than or equal to 5"]"))
})
MinLicenseCount: &minLicenses,
MaxLicenseCount: &maxLicenses,

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))

It("should return error when creating license with non-REGISTER action", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action:    v1.Deregister,
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))
}

It("should return error when secret does not exist", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)
//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
}

It("should return error when secret does not token key", func() {
  //given
  secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
  Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }
  //when
  err := k8sClient.Create(context.TODO(), license)
  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))
})

It("should return error when invalid scalingRef kind is specified", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }
  //when
  err := k8sClient.Create(context.TODO(), license)
  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.scalingRef.kind: Unsupported value: "Pod": supported values: \"Deployment\", \"HorizontalPodAutoscaler\"\"))
})

It("should return error when scalingRef does not exist", func() {
  //given
  license := &v1.SmartLicense{

Spec: v1.SmartLicenseSpec{
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found"))

It("should not allow changing licenseType after registration", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
    Status.RegistrationState = v1.Registered
    Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())
  }
  license.Status.RegistrationState = v1.Registered
  Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())

  //when
  license.Spec.LicenseType = "buzz"
  err := k8sClient.Update(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: broker-role-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: broker-role
subjects:
- kind: ServiceAccount
  name: default
  namespace: system
package controllers_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"
    ".github.com/onsi/ginkgo"
    ".github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})
package handlers_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"
    ".github.com/onsi/ginkgo"
    ".github.com/onsi/gomega"
)

func TestHandlers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {
    Expect(v1.AddToScheme(scheme.Scheme)).To(Succeed())
})

/*******************************************************************************/
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/*******************************************************************************/
package integ_tests

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "github.com/go-logr/logr"
    "github.com/onsi/ginkgo"
    "k8s.io/api/machinery/pkg/runtime"
    "k8s.io/client-go/rest"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
}

func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))

    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }

    close(done)
    if err := mgr.Start(ctx); err != nil {
        return err
    }

    return nil
}

package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "fmt"
    "github.com/golang/mock/gomock"
}
var _ = Describe("Deployment License Controller Test", func() {

deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
var (
    reconciler *controllers.DeploymentLicenseReconciler
    fakeClient     client.Client
    mockCtrl      *gomock.Controller
    deployment   *appsv1.Deployment
    smartLicense *v1.SmartLicense
    recorder     *record.FakeRecorder
    replicasCalculatorMock *mocks.MockReplicasCalculator
)

BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    recorder = record.NewFakeRecorder(1024)
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

    reconciler = &controllers.DeploymentLicenseReconciler{
        Client: fakeClient,
        Log:    logf.NullLogger{},
        Recorder: recorder,
        ReplicasCalculator: replicasCalculatorMock,
    }

    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    }

    deployment = &appsv1.Deployment{
        Spec: appsv1.DeploymentSpec{
            Replicas: initialDeploymentReplicas,
        },
        Status: appsv1.DeploymentStatus{
            ObservedGeneration: int64(1),
            Replicas: int32(initialDeploymentReplicas),
        },
    }
})
Spec: v1.SmartLicenseSpec{
    Action:     v1.Register,
    LicenseType: licenseType,
    MinLicenseCount: &minLicenseCount,
    MaxLicenseCount: &maxLicenseCount,
    ScalingFactor: &scalingFactor,
},
Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:      epDeploymentName,
        Namespace: defaultNs,
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
        },
    },
    Spec: appsv1.DeploymentSpec{
        Replicas: &replicas,
    },
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())
}

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
    mockCtrl.Finish()
})

It("should skip if Deployment does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})

It("should skip if Deployment SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})
It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(4), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(2))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
        Deployment to initial replicas number 3")))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's
        Replicas to 2")))
})

It("should an event if initial replica number annotation is incorrect", func() {

replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(2), nil)

deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: deploymentNsName})
Expect(err).To(HaveOccurred())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial-
replicas-count label is not correct. Please, update it to correct number.")))
}

It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
  *deployment.Spec.Replicas = 0
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(25), nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: deploymentNsName})
Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
})

It("should send a warning if deployment controlled by HPA", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(4), nil)
hpa := &autoscalingv1.HorizontalPodAutoscaler{
  ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
  Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
    MaxReplicas: initialHPAMaxReplicas,
  },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: deploymentNsName})
Expect(err).To(BeNil())
Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf(}

hpa := &autoscalingv1.HorizontalPodAutoscaler{
  ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
  Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
    MaxReplicas: initialHPAMaxReplicas,
  },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: deploymentNsName})
Expect(err).To(BeNil())
Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf(}

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"Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA",
epDeploymentName, epHpaName, epHpaName))))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3")))
})
})
package handlers

import (  
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "fmt"
  coreV1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/util/workqueue"
  ctrl "sigs.k8s.io/controller-runtime"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/event"
  "sigs.k8s.io/controller-runtime/pkg.handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {  
  return handler.Funcs{
    UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
      if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
        licenseList := v1.SmartLicenseList{}
        err := c.List(context.TODO(), &licenseList)
        if err != nil {
          secretLog.Error(err,
            "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
          panic(err.Error())
        }
        for _, smartLicense := range licenseList.Items {
          if smartLicense.Spec.TokenSecret.Name == secret.Name &&
            if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
              smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
              q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                Namespace: smartLicense.Namespace,
                Name: smartLicense.Name,
              }})
            }
          }
        }
      }
    }
  }
  }
}
} else {
    secretLog.Error(fmt.Errorf("cannot cast %T to Secret", evt.ObjectNew), "event is ignored")
}

package v1_test

import {
    v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
    "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1/mocks"
    dispatcherMock "cisco.com/kasa/operator/enforcementpoint/dispatcher/mocks"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    clientagent "css.cisco.com/licensing/client-agent"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
}

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService

var _ = Describe("SmartLicense Controller Test", func()

    const {
        podName = "sfcn-enforcer"
        podNamespace = "sfcn-system"
    }
nodeName = "aws-eks-node0"

var tenant, podNamespacedName = &clientagent.Tenant{
    Name: podNamespace + ""/" + podName,
    Attributes: map[string]string{
        "role": "license-requestor",
    },
}, types.NamespacedName{
    Namespace: podNamespace,
    Name:      podName,
}

newPod := func(name, namespace, nodeName string) *coreV1.Pod {
    return &coreV1.Pod{
        TypeMeta: metaV1.TypeMeta{
            Kind:    "Pod",
            APIVersion: "v1",
        },
        ObjectMeta: metaV1.ObjectMeta{
            Name:      name,
            Namespace: namespace,
            Labels:    tenant.Attributes,
        },
        Spec: coreV1.PodSpec{
            NodeName: nodeName,
            Containers: []coreV1.Container{
                {
                    Name: "ep-container",
                    Resources: coreV1.ResourceRequirements{
                        Limits: map[coreV1.ResourceName]resource.Quantity{
                            "cpu": resource.MustParse("2000m"),
                        },
                    },
                },
            },
        }
    }
}

newNode := func(name string) *coreV1.Node {
    return &coreV1.Node{
        TypeMeta: metaV1.TypeMeta{Kind: "Node", APIVersion: "v1"},
        ObjectMeta: metaV1.ObjectMeta{Name: name},
        Status: coreV1.NodeStatus{
            Capacity: map[coreV1.ResourceName]resource.Quantity{
                "cpu": resource.MustParse("4"),
            },
        },
    }
}

var (
pod              *coreV1.Pod
node             *coreV1.Node
reconciler      *v1.SmartLicenseReconciler
fakeClient      client.Client
mockCtrl        *gomock.Controller
licensingClient *mocks.MockLicensingClient
allotmentService *mocks.MockAllotmentService
dispatcher      *dispatcherMock.MockGatewayClient
recorder         *record.FakeRecorder
)

resetRecorder := func() {
    recorder = record.NewFakeRecorder(1024)
    reconciler.Recorder = recorder
}

reconcileAndExpectFail := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred()) // failure is determined by requeue after duration
    Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration}))
}

reconcileAndExpectSuccess := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred())
    Expect(result).To(Equal(ctrl.Result{}))
}

recordedEvents := func() []string {
    close(recorder.Events)
    var events []string
    for event := range recorder.Events {
        events = append(events, event)
    }
    return events
}

lastRecordedEvent := func() string {
    events := recordedEvents()
    if len(events) == 0 {
        return ""
    }
    return events[0]
}

BeforeEach(func() {

Open Source Used In kASA v1.5 588
pod = newPod(podName, podNamespace, nodeName)
node = newNode(nodeName)
data := [client.Object{pod, node}]
mockCtrl = gomock.NewController(GinkgoT())
scheme := runtime.NewScheme()
Expect(coreV1.AddToScheme(scheme)).To(Succeed())
fakeClient = fakeNewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
recorder = record.NewFakeRecorder(1024)
reconciler = &v1.SmartLicenseReconciler{
  CoreClient: coreV1Client.New(fakeClient, context.Background),
  Licenser:   licensingClient,
  Log:        logf.NullLogger{},
  Recorder:   recorder,
  Dispatcher: dispatcher,
}
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
It("should revoke ASAc license after failing multiple attempts of registration", func() {
  numAttempts := 0
  for numAttempts < v1.MaxRetryAttempts {
    reconcileAndExpectFail()
    numAttempts += 1
    if numAttempts == 1 {
      // on the first attempt expect an event is recorded
      Expect(lastRecordedEvent()).Should(ContainSubstring("Warning AwaitingLicense ASA operating at full potential but not licensed"))
    } else {
      Expect(lastRecordedEvent()).Should(ContainSubstring("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
    }
  }
  reconcileAndExpectFail()
  Expect(lastRecordedEvent()).Should(ContainSubstring("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
}
ItReconcileSuccessfullyWithExpectedNumberOfCores := func(numCores uint32) {
  allotmentService.EXPECT().Register(gomock.Any(), gomock.Any()).Return(nil)
  allotmentService.EXPECT().Status(gomock.Any()).Return(nil, nil)
  allotmentService.EXPECT().LeaseAllotment(gomock.Any()).Return(nil, nil)
  reconcileAndExpectSuccessfull(numCores, 1)
}

pod = newPod(podName, podNamespace, nodeName)
node = newNode(nodeName)
data := [client.Object{pod, node}]
mockCtrl = gomock.NewController(GinkgoT())
scheme := runtime.NewScheme()
Expect(coreV1.AddToScheme(scheme)).To(Succeed())
fakeClient = fakeNewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
recorder = record.NewFakeRecorder(1024)
reconciler = &v1.SmartLicenseReconciler{
  CoreClient: coreV1Client.New(fakeClient, context.Background),
  Licenser:   licensingClient,
  Log:        logf.NullLogger{},
  Recorder:   recorder,
  Dispatcher: dispatcher,
}
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
PoolName: podNamespace,
Tenant: tenant,
NumCores: numCores, // this is the limit specified for the container
}).Return(&clientagent.AllotmentRequestStatus{
ContextId: "test-context",
Tenant: tenant,
NumCores: numCores,
SmartAccountName: "test-domain",
VirtualAccountName: "test-account",
ExportControlled: true,
}, nil)
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().GrantLicense(true)
reconcileAndExpectSuccess()
Expect(recordedEvents()).Should(ConsistOf(
HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),
HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),
HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified")))
}

It("should verify the license status and request on successful registration", func() {
ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
Name: "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
})
Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})

It("should revoke ASAc license after successful registration but fails to get a lease", func() {
allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil).AnyTimes()
allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
PoolName: podNamespace,
Tenant: tenant,
NumCores: 2, // this is the limit specified for the container
})).Return(nil, fmt.Errorf("test insufficient cores")).AnyTimes()

numAttempts := 0
for numAttempts < v1.MaxRetryAttempts {
reconcileAndExpectFail()
numAttempts += 1
}
if numAttempts == 1 {
    // on the first attempt expect an event is recorded
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
} else {
    Expect(lastRecordedEvent()).Should(BeEmpty())
}
reconcileAndExpectFail()
Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because it failed to obtain a license"))
})

It("should revoke ASAc license when server requests to the release the allotment", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
    ContextId: "test-context",
    Tenant:    tenant,
})).Return(nil)

ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
}));Return(nil)

Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license"))
})

It("should report the allotment it holds when the server requests so", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

    allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
        ContextId: "test-context",
        Tenant:    tenant,
        NumCores:  2,
    }));Return(nil)

    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type: proto.AllotmentEvent_REPORT_ALLOTMENT,
    Message: "testing release allotment request",
    Tenant: tenant,
})
Expect(lastRecordedEvent()).Should(BeEmpty())
})

It("should mark tenant as unregistered if license server is unavailable and retry again", func() {
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil,
        fmt.Errorf("some error occurs: %w", lca.ErrLicenseServerUnavailable))
    res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: podNamespacedName})
    Expect(err).Should(BeNil())
    Expect(res).ShouldNot(BeNil())
    Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
})

AfterEach(func() {
    mockCtrl.Finish()
})

/*******************************************************************************/
/* Copyright (c) 2021 Cisco Systems, Inc.                                        */
/* All rights reserved.                                                         */
/* Unauthorized redistribution prohibited.                                     */
/*******************************************************************************/

package controllers

import (
    "context"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"
corePredicate "sigs.k8s.io/controller-runtime/pkg/predicate"
"sigs.k8s.io/controller-runtime/pkg/source"

v1 "css.cisco.com/kasa/license-broker/api/v1"
coreV1 "k8s.io/api/core/v1"
"time"
)

const SFCNProductId = "SFW"

const (  
  registrationReason = "Registration"
  deregistrationReason = "Deregistration"
  FinalizerName = "sfcn.cisco.com/license-degistration-finalizer"
)

// SmartLicenseReconciler reconciles a SmartLicense object
type SmartLicenseReconciler struct {
  Client client.Client
  LicensingClient licensing.LicensingClient
  Log logr.Logger
  Recorder record.EventRecorder
  Scheme *runtime.Scheme
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
  return ctrl.NewControllerManagedBy(mgr).
    For(&v1.SmartLicense{}, builder.WithPredicates(&corePredicate.GenerationChangedPredicate{])).
    Watches(&source.Channel{Source: oobChangeNotifier}, &handler.EnqueueRequestForObject{}).
    Complete(r)
}

// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses,verbs=get;list;watch;create;update;patch;delete
// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses/status,verbs=get;update;patch
// +kubebuilder:rbac:groups=core,resources=secrets,verbs=get;list;watch
// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list;watch;update;delete
// +kubebuilder:rbac:groups=apps,resources=deployments,verbs=get;list;watch;update
// +kubebuilder:rbac:groups=apps,resources=replicsets,verbs=get;list;watch
// +kubebuilder:rbac:groups=autoscaling,resources=horizontalpodautoscalers,verbs=get;list;watch;update

func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {

log.V(1).Info("reconciliation started")
start := time.Now()
def log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
}

var license v1.SmartLicense
if err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
    if apiErrors.IsNotFound(err) {
        log.Info("SmartLicense does not exist, nothing to reconcile")
    }
    return ctrl.Result{}, client.IgnoreNotFound(err)
}

if license.ObjectMeta.DeletionTimestamp.IsZero() {
    if err := r.addFinalizerIfMissing(&license); err != nil {
        return ctrl.Result{}, err
    }
} else {
    // the license is being deleted, need to deregister it first
    return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
}

switch license.Spec.Action {
case v1.Register:
    err := r.registerPlatform(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, registrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
    }

er = r.scaleEntitlements(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, registrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
    }

    if err = r.recordSuccessAndUpdateStatus(&license, registrationReason); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
    }
    return ctrl.Result{}, nil

case v1.Deregister:
    err := r.deregisterPlatform(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, deregistrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to deregister the platform: %w", err)
    }
if err = r.recordSuccessAndUpdateStatus(license, deregistrationReason); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
}
return ctrl.Result{}, nil

default:
    // should not happen due to CRD validation, but not returning an error as subsequent reconciliations will not fix the issue anyway
    return ctrl.Result{}, nil
}

func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
    if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
        r.licenseLogger(license).Info("added finalizer")
    }
    return nil
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    if containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        if license.Status.RegistrationState == v1.Registered {
            if err := r.deregisterPlatform(license); err != nil {
                //TODO: return error and do not remove finalizer when corner cases are tested
                log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
            }
            else {
                log.Info("removing finalizer without deregistration as platform is not registered")
            }
        }
        if license.Status.RegistrationState != v1.Registered {
            if err := r.deregisterPlatform(license); err != nil {
                //TODO: return error and do not remove finalizer when corner cases are tested
                log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
            }
        }
    }
    license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
    if err := r.Client.Update(context.Background(), license); err != nil {
        return err
    }
    log.Info("removed finalizer")
    return nil
}

func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {
licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
log := r.licenseLogger(license)
token, err := r.getToken(license)
if err != nil {
    return fmt.Errorf("failed to retrieve licensing token: %w", err)
}

log.Info("trying to register platform", "platformName", licenseNsName.String())
deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client, ctrl.Log.WithName("listeners").WithName("DeregistrationListener"), r.Recorder, oobChangeNotifier)
registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
    Uuid:         string(license.UID),
    Name:         licenseNsName.String(),
    SerialNumber: serialNumber(licenseNsName.String()),
    ProductId:    SFCNProductId,
    PoolName:     license.Namespace,
}, token, deregistrationListener)
if err != nil {
    license.Status.RegistrationState = v1.RegistrationFailed
    license.Status.LicenseState = v1.Unlicensed
    return fmt.Errorf("failed to complete registration call: %w", err)
}
log.Info("registered the platform in CSSM", "registrationInfo", registration)
license.Status.RegistrationState = v1.Registered

// we don't want to change license state to Pending if a platform is already registered and a user just updates some field.
if !registration.IsRegistered {
    license.Status.LicenseState = v1.PendingLicenseState
}
license.Status.AccountDomain = registration.SmartAccountName
license.Status.AccountName = registration.VirtualAccountName
license.Status.ContextId = registration.ContextId
license.Status.ExportControlled = registration.ExportControlled

entitlementListener := &listeners.EntitlementListener{
    Log: ctrl.Log.WithName("listeners").WithName("EntitlementListener"),
    Client: r.Client,
    LicenseNsName: licenseNsName,
}
if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
    if errors.Is(err, licensing.ErrDuplicateListener) {
        log.Info("entitlement listener is already added", "contextId", registration.ContextId)
        return nil
    }
    return fmt.Errorf("failed to subscribe to entitlement notifications: %w", err)
}
log.Info("added entitlement listener", "contextId", registration.ContextId)
return nil
func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
    if license.Status.RegistrationState != v1.Registered {
        return fmt.Errorf("platform must be registered before license reservation")
    }

    log := r.licenseLogger(license)

    log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
    err := r.LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
        ContextId:       license.Status.ContextId,
        EntitlementId:   license.Spec.LicenseType,
        MinEntitlements: *license.Spec.MinLicenseCount,
        MaxEntitlements: *license.Spec.MaxLicenseCount,
        ScalingFactor:   *license.Spec.ScalingFactor,
    })
    if err != nil {
        return fmt.Errorf("failed to enable licensing scaling: %w", err)
    }

    log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
    return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)

    state := license.Status.RegistrationState
    if state == v1.Deregistered {
        log.Info("platform is already deregistered, skipping deregistration")
        return nil
    }

    err := r.LicensingClient.Registration().Deregister(license.Status.ContextId)
    if err != nil {
        license.Status.RegistrationState = v1.DeregistrationFailed
        return fmt.Errorf("failed to complete deregistration call: %w", err)
    }

    log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.EstimatedMaxReplicas = 0
    license.Status.CoresPerLicense = 0
    license.Status.LicenseNumber = 0
    return nil
}

func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
secretNamespacedName := types.NamespacedName{
    Namespace: license.Spec.TokenSecret.Namespace,
    Name:      license.Spec.TokenSecret.Name,
}
var tokenSecret coreV1.Secret
if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
    return "", fmt.Errorf("failed to get token secret: %w", err)
}
return string(tokenSecret.Data[v1.TokenKeyName]), nil
}

func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error) {
    r.Recorder.Event(license, coreV1.EventTypeError, reason,
    fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
    license.Status.ErrorReason = err.Error()
    if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
        r.Log.Error(statusErr, "failed to update SmartLicense status")
    }
}

func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
    r.Recorder.Event(license, coreV1.EventTypeError, reason, "SmartLicense state updated.
    license.Status.ErrorReason = ""
    if err := r.Client.Status().Update(context.Background(), license); err != nil {
        return err
    }
    return nil
}

func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
    return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
}

package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/api/machinery/pkg/apis/meta/v1"
    "k8s.io/api/machinery/pkg/types"
"k8s.io/client-go/kubernetes/scheme"
"k8s.io/client-go/tools/record"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/registration.go css.cisco.com/licensing/client-agent RegistrationService
//go:generate mockgen -package=mocks -destination=./mocks/entitlement.go css.cisco.com/licensing/client-agent EntitlementService

const (  
  smartLicenseName = "license-sample"
  secretName = "secret-sample"
  defaultNs = "default"
  licenseType = "L-ASAV10S-STD"
  secretToken = "MTIz"
)

var (  
  minLicenseCount uint32 = 1
  maxLicenseCount uint32 = 5
  newMaxLicenseCount uint32 = 10
  scalingFactor uint32 = 2
)

var _ = Describe("SmartLicense Controller Test", func() {

  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var reconciler *controllers.SmartLicenseReconciler
  var fakeClient client.Client
  var mockCtrl *gomock.Controller

  var licensingClient *mocks.MockLicensingClient
  var registrationService *mocks.MockRegistrationService
  var entitlementService *mocks.MockEntitlementService

  var (  
    smartLicense *v1.SmartLicense
    secret       *corev1.Secret
  )

 BeforeEach(func() {

  })
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()

registrationService = mocks.NewMockRegistrationService(mockCtrl)
entitlementService = mocks.NewMockEntitlementService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
reconciler = &controllers.SmartLicenseReconciler{
  Client:          fakeClient,
  LicensingClient: licensingClient,
  Log:             logf.NullLogger{},
  Recorder:        record.NewFakeRecorder(1024),
}

licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()

secret = &corev1.Secret{
  ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},
  Data:       map[string][]byte{
    "token": []byte(secretToken),
  }
}
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())

smartLicense = &v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
  Spec: v1.SmartLicenseSpec{
    Action: v1.Register,
    TokenSecret: corev1.SecretReference{
      Name:      secretName,
      Namespace: defaultNs,
    },
    LicenseType: licenseType,
    MinLicenseCount: &minLicenseCount,
    MaxLicenseCount: &maxLicenseCount,
    ScalingFactor: &scalingFactor,
  },
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

AfterEach(func() {
  mockCtrl.Finish()
})

Context("platform registration", func() {
  It("should register platform in licensing system", func() {
    registrationService.EXPECT().Register(&licensing.Platform{
      Uuid:         string(smartLicense.UID),
      Name:         licenseNsName.String(),
    })
  })
})
SerialNumber: "8B201B63BB8",
ProductId: controllers.SFCNProductId,
PoolName: defaultNs,
}, secretToken, gomock.Any()).Return(&licensing.Registration{
  ContextId: "testContextId",
  SmartAccountName: "TestAccountName",
  VirtualAccountName: "TestVirtualName",
  ExportControlled: true,
  IsRegistered: false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
  ContextId: "testContextId",
  EntitlementId: licenseType,
  MinEntitlements: minLicenseCount,
  MaxEntitlements: maxLicenseCount,
  ScalingFactor: scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))
}

It("should ignore ErrDuplicateListener error", func() {
  registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
gomock.Any()).Return(&licensing.Registration{
    ContextId: "testContextId",
    IsRegistered: false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(
  fmt.Errorf("entitlement listener already exists: %w", licensing.ErrDuplicateListener))
entitlementService.EXPECT().ScaleEntitlement(gomock.Any()).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Context("platform deregistration", func() {
It("should deregister platform in licensing system", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.ContextId = "testContextId"
    smartLicense.Status.RegistrationState = v1.Registered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
})

It("should skip deregistration if platform is already deregistered", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})

It("should deregister platform on resource deletion", func() {
    smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
    now := metav1.Now()
    smartLicense.DeletionTimestamp = &now
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.RegistrationState = v1.Deregistered
    smartLicense.Status.ContextId = "testContextId"
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
// cannot check finalizer removal due to a bug in fakeClient: https://github.com/kubernetes/client-go/issues/607
// Expect(smartLicense.Finalizers).ShouldNot(ContainElement(finalizerName))
})
})

Context("smart license updating", func() {
It("license state should not be updated", func() {
Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
licenseStateBeforeUpdate := smartLicense.Status.LicenseState
smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
gomock.Any()).Return(&licensing.Registration{
    ContextId:    "testContextId",
    IsRegistered: true,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
    ContextId:       "testContextId",
    EntitlementId:   licenseType,
    MinEntitlements: minLicenseCount,
    MaxEntitlements: newMaxLicenseCount,
    ScalingFactor:   scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))
})
})
})

package subscribers

import (licensing "css.cisco.com/licensing/client-agent"
"css.cisco.com/licensing/client-agent/proto"
"github.com/go-logr/logr"
coreV1 "k8s.io/api/core/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"sigs.k8s.io/controller-runtime/pkg/apis/meta/v1"
"strings"
func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
    return &subscriptionListener{
        channel: channel,
        log:     log,
    }
}

type subscriptionListener struct {
    channel chan event.GenericEvent
    log     logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)
    switch e.Type {
        case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED, proto.AllotmentEvent_ALLOTMENT_DENIED:
            l.log.V(1).Info("scheduling event for PodLicenseReconciler")
            l.sendEventToChannel(e.Tenant.Name)
    }
}

func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
    pod := &coreV1.Pod{
            Name:      namespacedName[1],
            Namespace: namespacedName[0],
        },
    }
    l.channel <- event.GenericEvent{Object: pod}
}

package listeners

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
}
func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger, recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
    log:    log, 
    client: client, 
    licenseNsName: licenseNsName, 
    recorder: recorder, 
    notifierChannel: notifierChannel, 
    }
}

const MaxRetries = 10

type deregistrationListener struct {
    log             logr.Logger 
    client          client.Client 
    licenseNsName   types.NamespacedName 
    recorder        record.EventRecorder 
    notifierChannel chan event.GenericEvent 
    retries         int 
}

// OnAutoDeregistration updates SmartLicense status to be in deregistered state.
//
// The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
    log := d.log.WithValues("smartlicense", d.licenseNsName)
    log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)

    if err := d.warnSmartLicenseDeregistered(msg); err != nil {
        if d.retries < MaxRetries {
            log.Error(err, "failed to process auto-deregistration event. retrying...")
            d.retries++
            time.Sleep(1 * time.Second)
            d.OnAutoDeregistration(platform, msg)
            return
        }
        log.Error(err, "failed to process auto-deregistration event")
        return
    }
}
func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
    var license v1.SmartLicense
    if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.LicenseNumber = 0
    license.Status.CoresPerLicense = 0
    license.Status.EstimatedMaxReplicas = 0
    if err := d.client.Status().Update(context.Background(), &license); err != nil {
        return fmt.Errorf("failed to update SmartLicense status: %w", err)
    }
    d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
    d.notifierChannel <- event.GenericEvent{Object: &license}
    return nil
}

package controllers

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/pkg/predicates"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
//go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator
type ReplicasCalculator interface {
    CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error)
}

type DeploymentLicenseReconciler struct {
    client.Client
    Log                logr.Logger
    Recorder           record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
    For(&appsv1.Deployment{}, builder.WithPredicates(
        &predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey: InitialReplicasNumberAnnotation}).
    Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.DeploymentHandler()).
    Complete(c)
}

// Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value
// when it exceeds the replicas allowed by licensing config.
func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := c.Log.WithValues("deployment", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    deployment := &appsv1.Deployment{
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("Deployment does not exist, nothing to reconcile")
        }
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }

    licenseList := v1.SmartLicenseList{

    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("updated Deployment labels")
}

if len(deploymentLicenses) == 0 {
    log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentControlledByHPA", fmt.Sprintf("%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", deployment.Name, hpa.Name, hpa.Name))
}

if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
    initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
    if err != nil {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "WrongInitialReplicasNumber", ""
fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
return ctrl.Result{}, err
}

log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
*deployment.Spec.Replicas = int32(initialReplicasCountInt)
// delete initial replicas number from Deployment annotations to don't back to initial number on each reconciliation
delete(deployment.Annotations, InitialReplicasNumberAnnotation)
if err = c.Client.Update(context.Background(), deployment); err != nil {
return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.Recorder.Event(deployment, corev1.EventTypeNormal, "ScaledDeploymentToIntialReplicasNumber", 
fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))
}

if *deployment.Spec.Replicas > maxLicensedReplicas {
log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas", 
*deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
*deployment.Spec.Replicas = maxLicensedReplicas

if err = c.Client.Update(context.Background(), deployment); err != nil {
return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown", fmt.Sprintf("Decreased Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", maxLicensedReplicas))
log.Info("successfully scaled down deployment to max license limit", "updatedReplicas", 
*deployment.Spec.Replicas)
return ctrl.Result{}, nil
}

log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas", 
*deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment 
*appsv1.Deployment) (
*autoscalingv1.HorizontalPodAutoscaler, error) {

hpaList := &autoscalingv1.HorizontalPodAutoscalerList{
if err != nil {
return nil, err
}

for _, hpa := range hpaList.Items {

}
    return &hpa, err
}

return nil, err
}

package controllers

import (  
    "context"  
    "errors"  
    "fmt"  
    "strconv"  
    "time"

v1 "css.cisco.com/kasa/license-broker/api/v1"  
"css.cisco.com/kasa/pkg/predicates"  
licensing "css.cisco.com/licensing/client-agent"  
"github.com/go-logr/logr"  
appsv1 "k8s.io/api/apps/v1"  
autoscalingv1 "k8s.io/api/autoscaling/v1"  
coreV1 "k8s.io/api/core/v1"  
corev1 "k8s.io/api/core/v1"  
apiErrors "k8s.io/apimachinery/pkg/api/errors"  
"k8s.io/apimachinery/pkg/apis"  
"k8s.io/apimachinery/pkg/labels"  
"k8s.io/apimachinery/pkg/selection"  
"k8s.io/apimachinery/pkg/types"  
"k8s.io/client-go/tools/record"  
"k8s.io/utils/pointer"  
ctrl "sigs.k8s.io/controller-runtime"  
"sigs.k8s.io/controller-runtime/pkg/builder"  
"sigs.k8s.io/controller-runtime/pkg/client"  
"sigs.k8s.io/controller-runtime/pkg/event"  
"sigs.k8s.io/controller-runtime/pkg/handler"  
"sigs.k8s.io/controller-runtime/pkg/source"
)

type PodLicenseReconciler struct {
    client.Client
    LicensingClient licensing.LicensingClient
    Log        logr.Logger
    Recorder   record.EventRecorder
}

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent) error {
    return ctrl.NewControllerManagedBy(mgr).
For(&coreV1.Pod{}, builder.WithPredicates(&predicates.LabelExistsPredicate{Key: LicenseHolderLabel})).
Watches(&source.Channel{Source: eventChannel}, &handler.EnqueueRequestForObject{}).
Complete(c)
}

// Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
// a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
// On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    pod := coreV1.Pod{}
    podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
    err := c.Client.Get(ctx, podNsName, &pod)
    if err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("Pod does not exist, releasing allotments it might still hold")
            return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
        }
        return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
    }

    status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    shouldHaveLicensingLabel := status != nil && status.NumCores != 0
    changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
    if changed {
        if err = c.Client.Update(ctx, &pod); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
        }
        log.Info("updated Pod labels")
    }

    deployment, err := c.findPodDeployment(&pod)
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
    }
    if deployment == nil {

log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
if err := c.Client.Delete(context.Background(), &pod); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
}
c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration."))
log.Info("deleted orphan Pod")
return ctrl.Result{}, nil
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}
registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

serviceRole := getDeploymentServiceRole(deployment)
serviceRoleIsRegistered, err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
}
if !serviceRoleIsRegistered {
    if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
} else {
    if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
    if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
}

return ctrl.Result{}, nil

// releaseAllotmentsIfAny releases licensing allotments that Pod held in the licence-server
func (c *PodLicenseReconciler) releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
    log := c.Log.WithValues("pod", nsName.String())

tenant := &licensing.Tenant{Name: nsName.String()}
status, err := c.LicensingClient.Allotment().Status(tenant)
if err != nil {
    if errors.Is(err, licensing.ErrNotRegistered) {
log.Info("Pod tenant is not registered in license server, nothing to release")
return nil
}
return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
}

if status != nil && status.NumCores != 0 {
log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
if err := c.LicensingClient.Allotment().ReleaseAllotment(&licensing.AllotmentRelease{
    ContextId: status.ContextId,
    Tenant:    tenant,
}); err != nil {
    return fmt.Errorf("failed to release Pod allotments: %w", err)
}
log.Info("successfully released Pod allotments")
return nil
}

log.Info("Pod does not hold any allotments, nothing to release")
return nil
}

func (c *PodLicenseReconciler) podLogger(pod *coreV1.Pod) logr.Logger {
}

func toLicenseTenant(pod coreV1.Pod) *licensing.Tenant {
    podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
    return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each service role
// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is scaled down.
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the namespace")

    trialDeploymentList := appsv1.DeploymentList{}
    labelSelector := labels.NewSelector()
    trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals, []string{"true"})
    if err != nil {
        trialLicenseHolderRequirement = labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals, []string{"true"})
    }

    if err != nil {
        labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
    }
serviceRole := getDeploymentServiceRole(deployment)
serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals, []string{serviceRole})
if err == nil {
    labelSelector = labelSelector.Add(*serviceLabelRequirement)
}
if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
    Namespace:    deployment.Namespace,
    LabelSelector: labelSelector,
}); err != nil {
    return fmt.Errorf("failed to fetch Deployments with trial license label")
}
log.Info("Length of trial deployment list", "length", len(trialDeploymentList.Items))
var allowedReplicas int32 = 0
trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name == deployment.Name
if trialDeploymentIsAbsent || isDeploymentInTrial {
    log.Info("Deployment has to be marked as trial license holder")
    allowedReplicas = 1
}

trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
scaleDownRequired := *deployment.Spec.Replicas > allowedReplicas
if scaleDownRequired || trialLabelUpdated {
    initialReplicasNumber := strconv.Itoa(int(pointer.Int32PtrDerefOr(deployment.Spec.Replicas, 1)))
    log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
    deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
    deployment.Spec.Replicas = &allowedReplicas
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    if scaleDownRequired {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
        fmt.Sprintf("Decreased Deployment's Replicas to %d "+
        "as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. "+
        "Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas))
        log.Info("scaled Deployment", "replica count", allowedReplicas)
    }
}
return nil

// throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
// If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList []v1.SmartLicense, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
if err != nil {
    return fmt.Errorf("failed to determine licensed deployment names: %w", err)
}

if !containsString(licensedDeploymentNames, deployment.Name) {
    log.Info("scaling down Pod's Deployment to 0 as it requested license but does not belong to any licensed EP deployment")
    *deployment.Spec.Replicas = 0
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
    fmt.Sprintf("Decreased Deployment's Replicas to 0 "+
    "as it requested license but does not belong to any licensed EP deployment. "+
    "Please, check SmartLicense resources to update licensing configuration.")
    log.Info("scaled down Pod's Deployment to 0")
    return nil
}

log.Info("verified that Pod belongs to the licensed Deployment")
return nil

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
func (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment: %w", err)
        }
        log.Info("removed Deployment trial license label")
    }
    return nil
}

// getLicensedDeploymentNames collects names of all Deployments that have a corresponding SmartLicense resource.
func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
    var deploymentNames []string
    for _, license := range licenseList {
        switch license.Spec.ScalingRef.Kind {
        case v1.DeploymentKind:
            deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
        case v1.HPAKind:
            hpa := &autoscalingv1.HorizontalPodAutoscaler{
                hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
```go
if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
    return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
}
deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
default:
}
return deploymentNames, nil

// findPodDeployment tries to find Pod's Deployment if Pod is managed by Deployment.
// If Pod is not managed by Deployment controller, `nil` is returned.
func (c *PodLicenseReconciler) findPodDeployment(pod *coreV1.Pod) (*appsv1.Deployment, error) {
    log := c.podLogger(pod)
    if len(pod.OwnerReferences) != 1 || !*pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind != "ReplicaSet" {
        log.Info("pod is not owned by ReplicaSet")
        return nil, nil
    }
    replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
    replicaSet := &appsv1.ReplicaSet{}
    if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
        return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
    }
    if len(replicaSet.OwnerReferences) != 1 || !*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
        log.Info("pod's ReplicaSet is not owned by Deployment")
        return nil, nil
    }
    deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
    deployment := &appsv1.Deployment{}
    if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
        return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
    }
    return deployment, nil
}

// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in registeredLicenses.
// It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified service role label.
func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense,
```
namespace string, serviceRole string) (bool, error) {
licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
if err != nil {
    return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
}
for _, deploymentName := range licensedDeploymentNames {
    deployment := &appsv1.Deployment{
        deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
        err := c.Client.Get(context.Background(), deploymentNsName, deployment)
        if err != nil {
            return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
        }
        if getDeploymentServiceRole(deployment) == serviceRole {
            return true, nil
        }
    }
    return false, nil
}

func getDeploymentServiceRole(deployment *appsv1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: RegistrationService)

// Package mocks is a generated GoMock package.
package mocks

import {
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
}

// MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {
    ctrl     *gomock.Controller
    recorder *MockRegistrationServiceMockRecorder
}

// MockRegistrationServiceMockRecorder is the mock recorder for MockRegistrationService
type MockRegistrationServiceMockRecorder struct {


// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister", reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener) (*service.Registration, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
    ret0, _ := ret[0].(*service.Registration)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}

val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistrylessTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra

val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(":")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

ext {
    set("publishImages", listOf(
        project.findProperty("imageName") as String,
        project.findProperty("licenseServerImageName") as String
    ))
}

tasks {

    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }

    named("dockerBuild") {
        doLast {
            exec {
                environment("DOCKER_BUILDKIT", 1)
                commandLine("docker build -f ./Dockerfile -t $imageNameForPush ./" split(" "))
            }
            val artifactoryUser = project.findProperty("artifactoryUser")!! as String
            val artifactoryApiKey = project.findProperty("artifactoryApiKey")!! as String
            val saArtifactoryUrl = project.findProperty("saArtifactoryUrl")!! as String
            val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
        }
    }
}
if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
    exec {
        setWorkingDir("bin")
        commandLine = listOf(
            "bash", "-c",
            "curl -f -u $artifactoryUser:$artifactoryApiKey -O $downloadUrl"
        )
    }
}

exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}

val licenseServerImageName: String? by project
onlyIf {
    licenseServerImageName != null
}
doLast {
    val sourceTag: String? by project
    val sourceRepo: String? by project
    val imageTag: String? by project
    if (sourceTag == null || sourceRepo == null || imageTag == null) {
        val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please, specify them with: -PssourceTag=<srcImageTag> -PssourceRepo=<sourceRepoName> -PimageTag=<targetImageTag>"
        logger.error(msg)
        throw GradleException(msg)
    }
    val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
    val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split(':')[0]
    promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
}

named("check") {
    doLast {
        execCommands(listOf(
            "go fmt ./...",
            "go vet ./..."
        ))
    }
}
named("test") {
    doLast {
        execCommands(listOf(
            "go test -coverpkg=./... -coverprofile cover.out ./...",
            "go tool cover -func=cover.out -o ${project.name}-cover.txt"
        ))
    }
}

named("publish") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        println(execCommand("docker push $serverImageNameForPush"))
    }
}

named("manifests") {
    dependsOn("controller-gen")
    description = "Generates manifests for k8s deployment using Helm"
    doLast {
        execHelmCommand("helm dependency update")
        val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")} . --namespace $systemNamespace --set nameOverride=licenseapi")
        buildDir.deleteRecursively()
        buildDir.mkdir()
        File("$buildDir/license-broker.yaml").writeText(stdOut)
    }
}

named<Copy>("generateValuesFile") {
    expand(
        "platform" to project.findProperty("platform")!!,
        "registry" to project.findProperty("dockerRegistry")!!,
        "artifactoryRepo" to project.findProperty("imageDirectory")!!,
        "controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
        "licenseServerImage" to getRegistrylessTaggedImage(project.findProperty("licenseServerImageName")!! as String),
        "defaultImagePullPolicy" to project.findProperty("imagePullPolicy")!!,
        "logLevel" to project.findProperty("logLevel")!!,
        "logFormat" to project.findProperty("logFormat")!!,
        "licenseServerTransportUrl" to project.findProperty("licenseServerTransportUrl")!!)
named("generateControllerGenFiles") {
    dependsOn("controller-gen")
    doLast {
        execCommand("controllerGen $crdOpts rbac:roleName=broker-role webhook paths=./...
output:crd:artifacts:config=config/crd")
    }
}

register("generate") {
    dependsOn("controller-gen")
    description = "Executes code generators"
    doLast {
        execCommand("controllerGen object:headerFile=./hack/boilerplate.go.txt paths=./...")
    }
}

register("uninstall") {
    description = "Removes k8s objects from the active cluster"
    dependsOn("manifests")
    doLast {
        exec {
            isIgnoreExitValue = true
            commandLine("kubectl delete -f $buildDir".split(" "))
        }
    }
}

deploy) {
    dependsOn("installCertManager")
    dependsOn("manifests")
    doLast {
        exec {
            commandLine("kubectl apply -f $buildDir".split(" "))
        }
        createRegistrySecret(systemNamespace)
    }
}

loadImagesToKind) {
    doLast {
        val clusterName: String by project
        execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")
        execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
        execCommand("docker tag $imageNameForPush $imageNameForPull")
    }
}
Please review the EULA agreement and set the flag '--set global.acceptEULA=[yes, or agree]' for acknowledgement.

Cisco End User License Agreement

package integ_tests

import (  
  "context"  
v1 "css.cisco.com/kasa/license-broker/api/v1"  . "github.com/onsi/ginkgo"  . "github.com/onsi/gomega"  "k8s.io/apimachinery/pkg/api/errors"  "k8s.io/client-go/kubernetes/scheme"  "k8s.io/client-go/rest"  "path/filepath"  "sigs.k8s.io/controller-runtime/pkg/client"  "sigs.k8s.io/controller-runtime/pkg/envtest"  "sigs.k8s.io/controller-runtime/pkg/envtest/printer"  "sigs.k8s.io/controller-runtime/pkg/log/zap"  "strings"  "testing"  "time"

logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {  
  RegisterFailHandler(Fail)
  SetDefaultEventuallyTimeout(time.Minute)
  RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite", []Reporter{printer.NewlineReporter{}})
}

var _ = BeforeSuite(func(done Done) {  
  logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))
  By("bootstrapping test environment")  
  apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
testEnv = &envtest.Environment{
    WebhookInstallOptions: envtest.WebhookInstallOptions{
        Paths: []string{filepath.Join("..", "config", "webhook")},
    },
    CRDDirectoryPaths: []string{filepath.Join("..", "config", "crd")},
    KubeAPIServerFlags: apiServerFlags,
    ControlPlaneStartTimeout: 100 * time.Second,
    ControlPlaneStopTimeout: 100 * time.Second,
}

var err error
cfg, err = testEnv.Start()
Expect(err).ToNot(HaveOccurred())
Expect(cfg).ToNot(BeNil())

er = v1.AddToScheme(scheme.Scheme)
Expect(err).ToNot(HaveOccurred())

k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
Expect(err).ToNot(HaveOccurred())
Expect(k8sClient).ToNot(BeNil())

By("running webhook server")
go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done)
}, envtest.StartTimeout)

var _ = AfterSuite(func(done Done) {
    By("tearing down the test environment")
cancelCtx()
Expect(testEnv.Stop()).ToNot(HaveOccurred())

close(done)
}, envtest.StopTimeout)

func errCauses(err error) []string {
    var causes []string
    if statusError, ok := err.(*errors.StatusError); ok {
        for _, cause := range statusError.Status().Details.Causes {
            causes = append(causes, strings.Split(cause.Message, ": ")
        }
    }
    return causes
}

/* ***************************************************************************
 * Copyright (c) 2021 Cisco Systems, Inc.
 * All rights reserved.
 * */
package v1

import (  
    autoscalingv1 "k8s.io/api/autoscaling/v1"  
    v1 "k8s.io/api/core/v1"  
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
)

const TokenKeyName = "token"

type RegistrationAction string

cost (  
    Register  RegistrationAction = "REGISTER"  
    Deregister  RegistrationAction = "DEREGISTER"
)

// SmartLicenseSpec defines the desired state of SmartLicense

type SmartLicenseSpec struct {  
    // Action is the desired state of the Smart Agent license registration.  
    // +kubebuilder:validation:Enum=REGISTER;DEREGISTER  
    // +optional  
    Action RegistrationAction `json:"action"``

    // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.  
    TokenSecret v1.SecretReference `json:"tokenSecret"``

    // LicenseType defines the type of license to request/release, usually the SKU of the license.  
    // The default value is a SFW license tag being able to handle 1vCPU.  
    // +optional  
    LicenseType string `json:"licenseType"``

    // MinLicenseCount is a minimum number of licenses SFCN reserves for the product.  
    // The default value is 1.  
    // +optional  
    MinLicenseCount *uint32 `json:"minLicenseCount,omitempty"``

    // MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.  
    // The default value is equal to MinLicenseCount.  
    // +optional  
    MaxLicenseCount *uint32 `json:"maxLicenseCount,omitempty"``

    // ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down.
// The default value is 1.
// +optional
ScalingFactor *uint32 `json:"scalingFactor,omitempty"

// ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
ScalingRef autoscalingv1.CrossVersionObjectReference `json:"scalingRef,omitempty"
}

type LicenseState string

const (  
PendingLicenseState LicenseState = "PENDING"  
Unlicensed LicenseState = "UNLICENSED"  
InCompliance LicenseState = "IN_COMPLIANCE"  
OutOfCompliance LicenseState = "OUT_OF_COMPLIANCE"  
Overage LicenseState = "OVERAGE"
)

const (  
DeploymentKind = "Deployment"  
HPAKind = "HorizontalPodAutoscaler"
)

type RegistrationState string

const (  
PendingRegistrationState RegistrationState = "PENDING"  
Registered RegistrationState = "REGISTERED"  
RegistrationFailed RegistrationState = "REGISTRATION_FAILED"  
Deregistered RegistrationState = "DEREGISTERED"  
DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
)

// SmartLicenseStatus defines the observed state of SmartLicense

type SmartLicenseStatus struct {

// AccountDomain is the account domain in Cisco Software Central.
AccountDomain string `json:"accountDomain,omitempty"

// AccountName is the name of the virtual account in Cisco Software Central.
AccountName string `json:"accountName,omitempty"

// RegistrationState is the registration status of the SFCN product in Cisco Software Central.
// +kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DEREGISTRATION_FAILED
RegistrationState RegistrationState `json:"registrationState,omitempty"
// LicenseState is the state of the reserved licenses.
// +kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVER
// AGE
LicenseState LicenseState `json:"licenseState,omitempty"

// ErrorReason specifies the error due to which the the SFCN product was not registered in Cisco Software Central.
// ErrorReason string `json:"errorReason,omitempty"

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
LicenseNumber uint32 `json:"licenseNumber,omitempty"

// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicense,omitempty"

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and
// CoresPerLicense.
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicas,omitempty"

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while
// generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlled,omitempty"

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextId,omitempty"
}

// +kubebuilder:object:root=true
// +kubebuilder:subresource:status
// +kubebuilder:printcolumn:name="Age",type=date,JSONPath=".metadata.creationTimestamp"
// +kubebuilder:printcolumn:name="Registration State",type=string,JSONPath=".status.registrationState"
// +kubebuilder:printcolumn:name="License State",type=string,JSONPath=".status.licenseState"
// +kubebuilder:printcolumn:name="License Number",type=integer,JSONPath=".status.licenseNumber"
// +kubebuilder:printcolumn:name="Domain",type=string,priority=1,JSONPath=".status.accountDomain"
// +kubebuilder:printcolumn:name="Account",type=string,priority=1,JSONPath=".status.accountName"

// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
    metav1.TypeMeta `json:""`
    metav1.ObjectMeta `json:"metadata,omitempty"

    Spec SmartLicenseSpec `json:"spec,omitempty"
    Status SmartLicenseStatus `json:"status,omitempty"
}

// +kubebuilder:object:root=true

// SmartLicenseList contains a list of SmartLicense
type SmartLicenseList struct {
}
```go
func init() {
    SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}
```

// Package v1 contains API Schema definitions for the sfcn.cisco.com v1 API group
// +kubebuilder:object:generate=true
// +groupName=sfcn.cisco.com
package v1

import (
    "k8s.io/apimachinery/pkg/runtime/schema"
    "sigs.k8s.io/controller-runtime/pkg/scheme"
)

var (
)

// SchemeBuilder is used to add go types to the GroupVersionKind scheme
SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}

// AddToScheme adds the types in this group-version to the given scheme.
AddToScheme = SchemeBuilder.AddToScheme
)
domain: sfcn.cisco.com
repo: css.cisco.com/kasa/license-broker
resources:
  - group: sfcn.cisco.com
    kind: SmartLicense
    version: v1
    version: "2"
package controllers

import (``
const (
    LicenseHolderLabel = "sfcn.cisco.com/license-holder"
    TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder"
    ServiceRoleLabel = "sfcn.cisco.com/service-role"
    // DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set
    DefaultServiceRole = "default"
    InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"
)

// serialNumber generates platform's Serial Number for SmartLicense resource.
// According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {
    return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName)))[0:11]
}

func containsString(slice []string, s string) bool {
    for _, item := range slice {
        if item == s {
            return true
        }
    }
    return false
}

func removeString(slice []string, s string) (result []string) {
    for _, item := range slice {
        if item == s {
            continue
        }
        result = append(result, item)
    }
    return
}

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Status.RegistrationState == state {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}
// filterLicensesByKind filters SmartLicenses by given kind and name properties of ScalingRef field and returns the result.
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// pendingLicenseExists returns true if any license in the list is in Pending state.
func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status.LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

// setLicenseLabel makes sure that the licensing label is present when `shouldBePresent` is `true`
// and that the label is absent when `shouldBePresent` is `false`.
func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
        return true
    }
    if _, ok := meta.Labels[label]; ok && !shouldBePresent {
        delete(meta.Labels, label)
        return true
    }
    return false
}

package services
    return &ReplicasCalculator{client, logger}
}

type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and
calculates maximum amount of replicas based on licensing.
// If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    var maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 && deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods", "deployment", deployment.Name)
        return *deployment.Spec.Replicas, nil
    }
    err := error
    if coresQuantity == 0 && deployment.Status.ReadyReplicas != 0 {
        coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
        if err != nil {
            return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
        }
    }
    r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores", coresQuantity)
    for _, license := range licenses {
        if license.Status.LicenseState == v1.InCompliance {
            maxLicensedCores := int(*license.Spec.MaxLicenseCount) * int(license.Status.CoresPerLicense)
            maxLicensedReplicas := int32(maxLicensedCores / int32(coresQuantity))
r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)

maxLimit += maxLicensedReplicas
license.Status.EstimatedMaxReplicas = maxLicensedReplicas

if err := r.Client.Status().Update(ctx, &license); err != nil {
    return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
}
}

// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil
}

func (r *ReplicasCalculator) getCoresQuantity(deployment *appsv1.Deployment) uint32 {
    coresQuantity := resource.MustParse("0")
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
            return 0
        }
        coresQuantity.Add(containerLimit)
    }
    return uint32(coresQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
    podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    if err != nil {
        return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
    }
    pods := corev1.PodList{}
    if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
        return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
    }
    // TODO: do not rely on the fact that all nodes have the same CPU limit
    pod := pods.Items[0]
    node := corev1.Node{}
    nodeNsName := types.NamespacedName{Name: pod.Spec.NodeName}
    if err := r.Client.Get(ctx, nodeNsName, &node); err != nil {
        return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPULimit, nil

1.55 libpython3-7-minimal 3.7.3-2+deb10u3
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Python was created in the early 1990s by Guido van Rossum at Stichting
Mathematisch Centrum (CWI, see http://www.cwi.nl) in the Netherlands
as a successor of a language called ABC. Guido remains Python's
principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for
National Research Initiatives (CNRI, see http://www.cnri.reston.va.us)
in Reston, Virginia where he released several versions of the
software.

In May 2000, Guido and the Python core development team moved to
BeOpen.com to form the BeOpen PythonLabs team. In October of the same
year, the PythonLabs team moved to Digital Creations, which became
Zope Corporation. In 2001, the Python Software Foundation (PSF, see
https://www.python.org/psf/) was formed, a non-profit organization
created specifically to own Python-related Intellectual Property.
Zope Corporation was a sponsoring member of the PSF.

All Python releases are Open Source (see http://www.opensource.org for
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releases have also been GPL-compatible; the table below summarizes
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1.61 go-rootcerts 1.0.1

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http://www.w3.org/TR/2004/REC-DOM-Level-3-Core-20040407/  
http://www.w3.org/TR/2004/REC-DOM-Level-3-LS-20040407/  
http://www.w3.org/TR/2004/NOTE-DOM-Level-3-XPath-20040226/

The specification of DOM Level 2’s various parts is at:  
http://www.w3.org/TR/2000/REC-DOM-Level-2-Events-20001113/  
http://www.w3.org/TR/2000/REC-DOM-Level-2-Style-20001113/  
http://www.w3.org/TR/2000/REC-DOM-Level-2-Traversal-Range-20001113/  
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1.66 x-sys v0.0.0-20200519105757-
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A. HISTORY OF THE SOFTWARE

Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see http://www.cwi.nl) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see http://www.cnri.reston.va.us) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same
year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see https://www.python.org/psf/) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

All Python releases are Open Source (see http://www.opensource.org for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

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<label>
  <span>{{capitalize intent}}</span>
  <input type="radio" name="Action" value={{intent}} checked={{if (eq changeset.Action intent) 'checked'}}
          onchange={{action (changeset-set changeset 'Action') value="target.value"}} />
</label>

</div>
</div>
</fieldset>

<fieldset>
  <header>
    <h2>Path</h2>
  </header>
  
  <div>
    <group.Element
      @name="PathType"
      @type="select"
      as |el|>
      <el.Label>
        Path type
      </el.Label>
      <PowerSelect
        @options={{pathTypes}}
        @selected={{pathType}}
        @onChange={{action 'change' 'HTTP.PathType' changeset}} as |Type|>
          {{get pathLabels Type}}
      </PowerSelect>
    </group.Element>

    {{#if shouldShowPathField}}
      <group.Element
        @name="Path"
        @error={{changeset-get changeset 'error.HTTP.Path'}}
        as |el|>
        <el.Label>
          {{get pathLabels pathType}}
        </el.Label>
        <el.Text
          @value={{changeset-get changeset 'HTTP.Path'}}
          oninput={{action 'change' 'HTTP.Path' changeset}}
        />
        <State @state={{el.state}} @matches="error">

        </State>
    </group.Element>

    {{/if shouldShowPathField}}
  </div>
</fieldset>
<el.Error>
   {{#if (eq (changeset-get changeset 'HTTP.Path') 'Regex')}}
     Path Regex should not be blank
   {{else}}
     Path should begin with a '/'
   {{/if}}
</el.Error>
</State>
</group.Element>

</div>
</fieldset>

<fieldset>
   <h2>Methods</h2>
   <div class="type-toggle">
      <span>All methods are applied by default unless specified</span>
      <group.Element
         @name="allMethods"
         as |el|>
         <el.Checkbox
            checked={{if allMethods 'checked'}}
            onchange={{action 'change' 'allMethods' changeset}} />
         <el.Label>
            All Methods
         </el.Label>
      </group.Element>
   </div>
   {{#if shouldShowMethods}}
      <div class="checkbox-group" role="group">
         {{#each methods as |method|}}
            <label class="type-checkbox">
               <input type="checkbox"
                  name="method"
                  value={{method}}
                  checked={{if (contains method changeset.HTTP.Methods) 'checked'}}
                  onchange={{action 'change' 'method' changeset}} />
               <span>{{method}}</span>
            </label>
         {{/each}}
      </div>
   {{/if}}
</fieldset>
<fieldset>
<h2>Headers</h2>

<Consul::Intention::Permission::Header::List
   @items= [{changeset-get changeset 'HTTP.Header'}]
   @ondelete= [ {action 'delete' 'HTTP.Header' changeset}]

as [headerList]>

</Consul::Intention::Permission::Header::List>

<Consul::Intention::Permission::Header::Form
   @onsubmit= [ {action 'add' 'HTTP.Header' changeset}]

as [headerForm]>

<Ref @target= {{this}} @name="headerForm" @value= {{headerForm}} />
</Consul::Intention::Permission::Header::Form>

<button
data-test-add-header
type="button"
class="type-submit"
disabled= [ {if (not this.headerForm.isDirty) 'disabled'}]
onclick= [ {action this.headerForm.submit}]
>

Add [ {#if (gt (get (changeset-get changeset 'HTTP.Header') 'length') 0)} ] another [ {/if} ] header
</button>

<button
type="button"
class="type-cancel"
onclick= [ {action this.headerForm.reset}]
>

Cancel
</button>

</fieldset>
</FormGroup>
</div>

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Please keep the list sorted.

Alain Vongsouvahalainv <alainv@google.com>
Andrew Gerrand <adg@golang.org>
Brad Fitzpatrick <bradfitz@golang.org>
Eric Koleda <ekoleda+devrel@goolgers.com>
Francesc Campoy <campoy@golang.org>
Garrick Evans <garrick@google.com>
Glenn Lewis <gmlewis@google.com>
Ivan Krasin <krasin@golang.org>
Jason Hall <jasonhall@google.com>
Johan Euphrosine <proppy@google.com>
Kostik Shtoyk <kostik@google.com>
Kunpei Sakai <namusyaka@gmail.com>
Matthew Whisenhunt <matt.whisenhunt@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Nick Craig-Wood <nickcw@gmail.com>
Robbie Trencheny <me@robbiet.us>
Ross Light <light@google.com>
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Jason Mooberry <jasonmoo@me.com>
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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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https://github.com/golang/protobuf

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@import './skin';
@import './layout';
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The `license` command provides a datacenter-level view of the Consul Enterprise license. This was added in Consul 1.1.0 but Consul 1.10.0 removed the ability to set and reset the license using the CLI. See the [licensing documentation](/docs/enterprise/license/overview) for more information about Consul Enterprise license management.

If ACLs are enabled then a token with operator privileges may be required in order to use this command. Requests are forwarded internally to the leader if required, so this can be run from any Consul node in a cluster. See the [ACL Guide](https://learn.hashicorp.com/consul/security-networking/production-acls) for more information.

```
Usage: consul license <subcommand> [options] [args]
```
This command has subcommands for managing the Consul Enterprise license. Here are some simple examples, and more detailed examples are available in the subcommands or the documentation.

Install a new license from a file:

$ consul license put @consul.license

Install a new license from stdin:

$ consul license put -

Install a new license from a string:

$ consul license put "<license blob>"

Retrieve the current license:

$ consul license get

Inspect a license:

$ consul license inspect "<path to license file>"

Reset the current license:

$ consul license reset

For more examples, ask for subcommand help or view the documentation.

Subcommands:

get     Get the active license
inspect Inspect a signed license
put     Puts a new license in the datacenter
reset   Resets the license in the datacenter

## inspect

This command inspects and validates a license. Just like a Consul agent it can load the license from a file on disk or from the `CONSUL_LICENSE` and `CONSUL_LICENSE_PATH` environment variables.

Usage: `consul license inspect [options] [license file]`

Inspect a license contained in a file:
$ consul license inspect consul.hclic

Inspect a license loaded from the environment:

$ consul license inspect

This will look at the CONSUL_LICENSE environment variable first and if not present then we will look for the file specified by the CONSUL_LICENSE_PATH environment variable.

The output looks like this:

Source: /consul/config/consul.hclic (path from the CONSUL_LICENSE_PATH environment variable)
Product: consul
License ID: 6089174b-a713-74ef-4c8d-856b86f1ce50
Customer ID: 7c020610-60a2-7cc5-c210-20d899e5f3b4
Installation ID: *
Issue Time: 2020-09-14 19:45:56.212195875 +0000 UTC
Start Time: 2020-09-14 00:00:00 +0000 UTC
Expiration Time: 2021-09-14 23:59:59.999 +0000 UTC
Termination Time: 2021-09-14 23:59:59.999 +0000 UTC
Modules:
  Global Visibility, Routing and Scale
  Governance and Policy
Features:
  Automated Backups
  Automated Upgrades
  Enhanced Read Scalability
  Network Segments
  Redundancy Zone
  Advanced Network Federation
  Namespaces
  SSO
  Audit Logging
  Admin Partitions

License is valid

-> **Deprecation** The ability to manage the cluster's license via the CLI
was removed in Consul 1.10. While the CLI command still exists it will always return an error. This command will be fully removed in a future release.

This command sets the Consul Enterprise license.

Usage: `consul license put [options] LICENSE`

#### API Options

```text
License is valid
License ID: 2afbf681-0d1a-0649-cb6c-333ec9f0989c
Customer ID: 0259271d-8ffc-e85e-0830-c0822c1f5f2b
Expires At: 2019-05-22 03:59:59.999 +0000 UTC
Datacenter: *
Package: premium
Licensed Features:
   Automated Backups
   Automated Upgrades
   Enhanced Read Scalability
   Network Segments
   Redundancy Zone
   Advanced Network Federation
```

## get

This command gets the Consul Enterprise license.

Usage: `consul license get [options]`

#### API Options

```text
License is valid
License ID: 2afbf681-0d1a-0649-cb6c-333ec9f0989c
```
Customer ID: 0259271d-8ffc-e85e-0830-c0822c1f5f2b
Expires At: 2019-05-22 03:59:59.999 +0000 UTC
Datacenter: *
Package: premium
Licensed Features:
  Automated Backups
  Automated Upgrades
  Enhanced Read Scalability
  Network Segments
  Redundancy Zone
  Advanced Network Federation
```
## reset

-> **Deprecated** The ability to manage the cluster's license via the CLI was removed in Consul 1.10. While the CLI command still exists it will always return an error. This command will be fully removed in a future release.

Resets license for the datacenter to the one built in Consul binary, if it is still valid. If the builtin license is invalid, the current one stays active.

Usage: `consul license reset [options]`

#### API Options

@include 'http_api_options_client.mdx'

@include 'http_api_options_server.mdx'

The output looks like this:

```text
License is valid
License ID: 2afbf681-0d1a-0649-cb6c-333ec9f0989c
Customer ID: 0259271d-8ffc-e85e-0830-c0822c1f5f2b
Expires At: 2019-05-22 03:59:59.999 +0000 UTC
Datacenter: *
Package: premium
Licensed Features:
  Automated Backups
  Automated Upgrades
  Enhanced Read Scalability
  Network Segments
  Redundancy Zone
  Advanced Network Federation
```
@import './skin';
@import './layout';
.consul-intention-permission-list > ul > li {
    @extend %list-row-200;
}
.consul-intention-permission-list:not(.readonly) > ul > li {
    @extend %with-composite-row-intent;
}
.consul-intention-permission-list strong {
    @extend %pill-500;
}
.consul-intention-permission-list .intent-allow {
    @extend %pill-allow;
}
.consul-intention-permission-list .intent-deny {
    @extend %pill-deny;
}
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          </dt>
          <dd>
            {{item.Name}} {{route-match item}}
          </dd>
        </dl>
      {{/each}}
    </div>
  </BlockSlot>
{{/if}}

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>>> docker_libnetwork-fd27f22aaa35e3d57f88688f919d05b744f431fd

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Go support for leveled logs, analogous to https://code.google.com/google-glog

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>>> golang_groupcache_lru-72d04f9fcdec7d3821820cc4a6f150eae553639a

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>>> vishvananda_netns-604eaf189ee867d8c147fafe28def2394e878d25

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>>> armon_go-radix-4239b77079c7b5d1243b7b4736304ce8dd6b6f0f2

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>>> asaskevich_govalidator-9699ab6b38bee2e02cd3fe8b99ecf67665395c96

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>>> azure_go-ansiterm-70b2c90b260171e829f1ebd7c17f600c11858dbe

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>>> cenkalti_backoff-b02f2bbce11d7ea6b97f282ef1771b0fe2f65ef3

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>>> client9_misspell-9a1fc2456ac9e8c9b4cbe9d005b6e7adac0d357f

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>>> go-check_check-20d25e2804050c1cd24a7eea1e7a6447dd0e74ec

Gocheck - A rich testing framework for Go

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>>> go-nfs-client-42fca177a36031d648551c751de1daf5f55dd4f0

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>>> godbus_dbus-230e4b23db2fd81c53eaa0073f76659d4849ce51

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>>> gogo_protobuf_gogoprotostar-a92c871a8f5333cf106b2cdf937567208dbb2b7

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protobuf-6a92c871a8f5333cf106b2cdf937567208dbb2b7/codec/codec.go

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```bash
$ gogo_protobuf_types-6a92c871a8f5333cf106b2cd937567208dbb2b7
```

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>>> mattrn_go-runewidth-14207d285c6c197daabb5c9793d63e7af9ab2d50

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```bash
>>> mdlayher/arp-7140e8e22da120cb3efc8e1096f299933624024e
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tools-381149a2d6e5d8f319ccf04bfefe71e03a78b868/cmd/goyacc/yacc.go

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```bash
>>> x_tools_go_gccompiler15-381119a2d5e5d8f319ccf04bfefc71e03a78b868
```

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package short

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Re-implemented by Vincent Sanders <vince@kyllikki.org> with extensive reference to original curl example code

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lib/gssapi/mechglue/g__acquire_cred.c
lib/gssapi/mechglue/g__canon_name.c
lib/gssapi/mechglue/g__compare_name.c
lib/gssapi/mechglue/g__context_time.c
lib/gssapi/mechglue/g__delete_sec_context.c
and the initial implementation of incremental propagation, including the following new or changed files:

include/iprop_hdr.h
kadmin/server/ipropd_svc.c
lib/kdb/iprop.x
lib/kdb/kdb_convert.c
lib/kdb/kdb_log.c
lib/kdb/kdb_log.h
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Since the original authors were generous enough to donate their work to the public domain, I feel compelled to match their generosity.

Tim Kientzle, February 2009.

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rijndael-alg-fst.c

@version 3.0 (December 2000)

Optimised ANSI C code for the Rijndael cipher (now AES)

@author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
@author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
@author Paulo Barreto <paulo.barreto@terra.com.br>

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SHA-1 in C
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Upstream source http://invisible-island.net/ncurses/ncurses-examples.html

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-- vile: txtmode file-encoding=utf-8

>>> openssh-7.5p1-11.ph2

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@version 3.0 (December 2000)

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@author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
@author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
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>>> pcre-8.41-1.ph2

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University of Illinois at Urbana-Champaign

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chkconfig:   2345 11 89
description: sets up CBQ-based traffic control

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IPv6 Hop Limit Target module
Maciej Soltysiak <solt@dns.toxicfilms.tv>
Based on HW's ttl target
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SYN signatures. Those signatures work for SYN packets only (duh!).

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>>> linux-esx-4.9.154-1.ph2

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Written by David Howells (dhowells@redhat.com)

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his C header file is part of the SoftFloat IEC/IEEE Floating-point
Arithmetic Package, Release 2.

Written by John R. Hauser. This work was made possible in part by the International Computer Science Institute, located at Suite 600, 1947 Center Street, Berkeley, California 94704. Funding was partially provided by the National Science Foundation under grant MIP-9311980. The original version of this code was written as part of a project to build a fixed-point vector processor in collaboration with the University of California at Berkeley, overseen by Profs. Nelson Morgan and John Wawrzynek. More information is available through the Web page http://www.jhauser.us/arithmetic/SoftFloat-2b/SoftFloat-source.txt

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```

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```

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This code offers a very basic support for this EISA bus present in the SGI Indigo-2. It currently only supports PIO (forget about DMA for the time being). This is enough for a low-end ethernet card, but forget about your favorite SCSI card...

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A more complete resource is the third edition of "Linux Device Drivers" by Jonathan Corbet, Alessandro Rubini, and Greg Kroah-Hartman. LDD3 is available for free (under Creative Commons License) from:

http://lwn.net/Kernel/LDD3/

However, keep in mind that all documents are subject to "bit rot". Refer to the source code if things are not working as described here.

Please send questions/comments/patches about Linux PCI API to the "Linux PCI" <linux-pci@atrey.karlin.mff.cuni.cz> mailing list.

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util-linux-2.32/misc-utils/uuidparse.c

uuidparse.c --- Interpret uuid encoded information. This program violates the UUID abstraction barrier by reaching into the guts of a UUID.

Based on libuuid/src/uuid_time.c
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From Simon Josefsson
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util-linux-2.32-1.ph2.src.rpm\util-linux-2.32-1.ph2.src.cpio\util-linux-2.32.tar.xz\util-linux-2.32.tar\util-linux-2.32\login-utils\setpwnam.c
setpwnam.c -- edit an entry in a password database.

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Edited 11/10/96 (DD/MM/YY ;-) by Nicolai Langfeldt (janl@math.uio.no) to read /etc/passwd directly so that passwd, chsh and chfn can work on machines that run NIS (previously YP). Changes will not be made to usernames starting with +.

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Usage:
1) get a struct passwd from getpwnam().
You should assume a struct passwd has an infinite number of fields, so you should not try to create one from scratch.
2) edit the fields you want to edit.
3) call setpwnam() with the edited struct passwd.

A _normal user_ program should never directly manipulate etc/passwd but /use getpwnam() and (family, as well as) setpwnam().

But, setpwnam was made to _edit_ the password file. For use by chfn, chsh and passwd. _I_ _HAVE_ to read and write /etc/passwd directly. Let those who say nay be forever silent and think about how getpwnam (and family) works on a machine running YP.

Added checks for failure of malloc() and removed error reporting to stderr, this is a library function and should not print on the screen, but return appropriate error codes.
27-Jan-97 - poe@daimi.aau.dk

Thanks to "two guys named Ian".

$Author: poer $
$Revision: 1.13 $
$Date: 1997/06/23 08:26:29 $

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Python bindings for the libmount library.

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Written by Ondrej Oprala and Karel Zak

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Bison implementation for Yacc-like parsers in C


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A Bison parser, made by GNU Bison 3.0.4.

Bison interface for Yacc-like parsers in C


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/ Bison implementation for Yacc-like parsers in C


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The general concept of this implementation is to keep track of all alloca-allocated blocks, and reclaim any that are found to be deeper in the stack than the current invocation. This heuristic does not reclaim storage as soon as it becomes invalid, but it will do so eventually.

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alloca.c -- allocate automatically reclaimed memory
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This implementation of the PWB library alloca function, which is used to allocate space off the run-time stack so that it is automatically reclaimed upon procedure exit, was inspired by discussions with J. Q. Johnson of Cornell. J.Otto Tennant <jot@cray.com> contributed the Cray support.

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The general concept of this implementation is to keep track of all alloca-allocated blocks, and reclaim any that are found to be deeper in the stack than the current invocation. This heuristic does not reclaim storage as soon as it becomes invalid, but it will do so eventually.

As a special case, alloca(0) reclaims storage without allocating any. It is a good idea to use alloca(0) in your main control loop, etc. to force garbage collection.

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kmod-24.tar.xz\kmod-24.tar\kmod-24\tools\rmmod.c

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DRBG: Deterministic Random Bits Generator
Based on NIST Recommended DRBG from NIST SP800-90A with the following properties:
CTR DRBG with DF with AES-128, AES-192, AES-256 cores
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with and without prediction resistance

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Test Socket Type

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Finally, software patents pose a constant threat to the existence of
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restrictive license from a patent holder. Therefore, we insist that
any patent license obtained for a version of the library must be
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libraries into non-free programs.

When a program is linked with a library, whether statically or using
a shared library, the combination of the two is legally speaking a
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General Public License therefore permits such linking only if the
entire combination fits its criteria of freedom. The Lesser General
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the library.

We call this license the "Lesser" General Public License because it
does Less to protect the user's freedom than the ordinary General
Public License. It also provides other free software developers Less
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For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

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its purpose remains meaningful.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.
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d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

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Version 3, 29 June 2007

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Mozilla Public License

Version 2.0

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---------------------------------------

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-------------------------

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<div
  ...
  class="consul-intention-permission-header-form"
>
</FormGroup
<fieldset>
  <div>
    <group.Element
      @name="HeaderType"
      @type="select"
      as |el|>
      <el.Label>Header type</el.Label>
      <PowerSelect
        @options={{headerTypes}}
        @selected={{headerType}}
        @onChange={{action 'change' 'HeaderType' changeset}} as |Type|>
        {{get headerLabels Type}}
      </PowerSelect>
    </group.Element>
  </div>
</fieldset>

<group.Element
  @name="Name"
  @error={{changeset-get changeset 'error.Name'}}
  as |el|>
  <el.Label>Header name</el.Label>
  <el.Text
    @value={{changeset-get changeset 'Name'}}
    oninput={{action 'change' 'Name' changeset}} />
  <State @state={{el.state}} @matches="error">
    <el.Error>
      {{changeset-get changeset 'error.Name.validation'}}
    </el.Error>
  </State>
</group.Element>

{{#if shouldShowValueField}}
  <group.Element
    @name="Value"
    @error={{changeset-get changeset 'error.Value'}}
    as |el|>
  {{/if}}
package api

import (
    "fmt"
    "io/ioutil"
    "time"
)

type License struct {
    // The unique identifier of the license
    LicenseID string `json:"license_id"

    // The customer ID associated with the license
    CustomerID string `json:"customer_id"

    // If set, an identifier that should be used to lock the license to a
    // particular site, cluster, etc.
    InstallationID string `json:"installation_id"

    // The time at which the license was issued
    IssueTime time.Time `json:"issue_time"

    // The time at which the license starts being valid
    StartTime time.Time `json:"start_time"

    // The time after which the license expires
    ExpirationTime time.Time `json:"expiration_time"

    // The time at which the license ceases to function and can
    // no longer be used in any capacity
    TerminationTime time.Time `json:"termination_time"
}
// The product the license is valid for
Product string `json:"product"

// License Specific Flags
Flags map[string]interface{} `json:"flags"

// Modules is a list of the licensed enterprise modules
Modules []string `json:"modules"

// List of features enabled by the license
Features []string `json:"features"

}

type LicenseReply struct {
    Valid    bool
    License  *License
    Warnings []string
}

func (op *Operator) LicenseGet(q *QueryOptions) (*LicenseReply, error) {
    var reply LicenseReply
    if _, err := op.c.query("/v1/operator/license", &reply, q); err != nil {
        return nil, err
    } else {
        return &reply, nil
    }
}

func (op *Operator) LicenseGetSigned(q *QueryOptions) (string, error) {
    r := op.c.newRequest("GET", "/v1/operator/license")
    r.params.Set("signed", "1")
    r.setQueryOptions(q)
    _, resp, err := requireOK(op.c.doRequest(r))
    if err != nil {
        return "", err
    }
    defer closeResponseBody(resp)
    data, err := ioutil.ReadAll(resp.Body)
    if err != nil {
        return "", err
    }
    return string(data), nil
}

// LicenseReset will reset the license to the builtin one if it is still valid.
// If the builtin license is invalid, the current license stays active.
//
// DEPRECATED: Consul 1.10 removes the corresponding HTTP endpoint as licenses
// are now set via agent configuration instead of through the API
func (*Operator) LicenseReset(_ *WriteOptions) (*LicenseReply, error) {
    return nil, fmt.Errorf("Consul 1.10 no longer supports API driven license management.")
}

// LicensePut will configure the Consul Enterprise license for the target datacenter
//
// DEPRECATED: Consul 1.10 removes the corresponding HTTP endpoint as licenses
// are now set via agent configuration instead of through the API
func (*Operator) LicensePut(_ string, _ *WriteOptions) (*LicenseReply, error) {
    return nil, fmt.Errorf("Consul 1.10 no longer supports API driven license management.")
}

---

layout: docs
page_title: Consul Enterprise License
description: Consul Enterprise License Overview.
---

# Consul Enterprise License

## Licensing

All Consul Enterprise agents must be licensed when they are started. Where that license comes from will depend
on which binary is in use, whether the agent is a server, client or snapshot agent and whether ACLs have been
enabled for the cluster.

> ** Consul Enterprise 1.10.0 removed temporary licensing.** In previous versions Consul Enterprise
agents could start without a license and then have a license applied to them later on via the CLI
or API. That functionality has been removed and replaced with the ability to load licenses from the
agent's configuration or environment. Also prior to 1.10.0 server agents would automatically propagate
the license between themselves. This no longer occurs and the license must be present on each server
when they are started.

> Visit the [Enterprise License Tutorial](https://learn.hashicorp.com/tutorials/nomad/hashicorp-enterprise-license?in=consul/enterprise) for detailed steps on how to install the license key.

### Binaries with Built In Licenses

If you are downloading Consul from Amazon S3, then the license is included
in the binary and you do not need to take further action. This is the
most common use case.

In the S3 bucket you will find three Enterprise zip packages. The packages with `+pro` and
`+prem` in the name, are the binaries that include the license. The package
with `+ent` in the name does not include the license.
When using these binaries no further action is necessary to configure the license.

### Binaries Without Built In Licenses

For Consul Enterprise 1.10.0 or greater, binaries that do not include built in licenses a license must be available at the time the agent starts.

For server agents this means that they must either have the `license_path` configuration set or have a license configured in the servers environment with the `CONSUL_LICENSE` or `CONSUL_LICENSE_PATH` environment variables. Both the configuration item and the `CONSUL_LICENSE_PATH` environment variable point to a file containing the license whereas the `CONSUL_LICENSE` environment variable should contain the license as the value. If multiple of these are set the order of precedence is:

1. `CONSUL_LICENSE` environment variable
2. `CONSUL_LICENSE_PATH` environment variable
3. `license_path` configuration item.

Both client agents and the snapshot agent may also be licensed in the very same manner. However to prevent the need to configure the license on many client agents and snapshot agents those agents have the capability to retrieve the license automatically under specific circumstances.

#### Client Agent License Retrieval

When a client agent starts without a license in its configuration or environment, it will try to retrieve the license from the servers via RPCs. That RPC always requires a valid non-anonymous ACL token to authorize the request but the token doesn't need any particular permissions. As the license is required before the client actually joins the cluster, where to make those RPC requests to is inferred from the `start_join` or `retry_join` configurations. If those are both unset or no `agent` token is set then the client agent will immediately shut itself down.

If all preliminary checks pass the client agent will attempt to reach out to any server on its RPC port to request the license. These requests will be retried for up to 5 minutes and if it is unable to retrieve a license within that time frame it will shut itself down.

If ACLs are disabled then the license must be provided to the client agent through one of the three methods listed below. Failure in providing the client agent with a licence will prevent the client agent from joining the cluster.

1. `CONSUL_LICENSE` environment variable
2. `CONSUL_LICENSE_PATH` environment variable
3. `license_path` configuration item.

#### Snapshot Agent License Retrieval

The snapshot agent has similar functionality to the client agent for automatically retrieving the license. However, instead of requiring a server agent to talk to, the snapshot agent can request the license from the server or
client agent it would use for all other operations. It still requires an ACL token to authorize the request. Also like client agents, the snapshot agent will shut itself down after being unable to retrieve the license for 5 minutes.

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#
# https://developers.google.com/open-source/cla/individual
# https://developers.google.com/open-source/cla/corporate
#
# Names should be added to this file as:
# Name <email address>
Raul Silvera <rsilvera@google.com>
Tipp Moseley <tipp@google.com>
Hyoun Kyu Cho <netforce@google.com>
Martin Spier <spiernar@gmail.com>
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consul-intention-permission-form {
  h2 {
    border-top: 1px solid $blue-500;
    @extend %h200;
  }
  button.type-submit {
    @extend %frame-blue-300;
  }
  button.type-submit:hover:not(:disabled),
  button.type-submit:focus:not(:disabled) {
    @extend %frame-blue-500;
  }
  button.type-submit:disabled {
    @extend %frame-blue-200;
  }
}
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# Notice

Presentational component for informational/warning/error banners/notice.
```
hbs preview-template
<Notice
  @type={{this.type}}
as |notice|
  <notice.Header>
    <h3>Header</h3>
  </notice.Header>
  <notice.Body>
    <p>
      Body
    </p>
  </notice.Body>
  <notice.Footer>
    <p>
      Footer link</p>
    </p>
  </notice.Footer>
</Notice>

<figure>
  <figcaption>Provide a widget to change the <code>@type</code></figcaption>
  <select
    onchange={{action (mut this.type) value="target.value"}}
  >
    <option>info</option>
    <option>success</option>
    <option>warning</option>
    <option>error</option>
  </select>
</figure>

## Arguments

<table>
<thead>
<tr>
<th>Argument/Attribute</th>
<th>Type</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>type</code></td>
<td><code>String</code></td>
<td><code>info</code></td>
<td>Type of notice [info|warning|error]</td>
</tr>
</tbody>
</table>

## See

- [Template Source Code](./index.hbs)

---

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@import './skin';
@import './layout';

%notice {
  margin: 1em 0;
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%notice {
    border-radius: $decor-radius-100;
    border: $decor-border-100;
    color: $black;
}
%notice::before {
    @extend %as-pseudo;
}
%notice header > * {
    @extend %h300;
}
%notice footer * {
    @extend %p3;
    font-weight: $typo-weight-bold;
}
%notice-success, %notice-info, %notice-highlight, %notice-error, %notice-warning {
@extend %notice;

%notice-success {
  background-color: $green-050;
  border-color: $green-500;
}
%notice-info {
  border-color: $blue-100;
  background-color: $gray-010;
}
%notice-info header * {
  color: $blue-700;
}
%notice-highlight {
  background-color: $gray-050;
  border-color: $gray-300;
}
%notice-highlight header * {
  color: $gray-700;
}
%notice-warning {
  background-color: $yellow-100;
  background-color: $yellow-050;
}
%notice-warning header * {
  color: $yellow-800;
}
%notice-error {
  background-color: $red-050;
  border-color: $red-500;
}
%notice-success::before {
  @extend %with-check-circle-fill-mask;
  color: $green-500;
}
%notice-info::before {
  @extend %with-info-circle-fill-mask;
  color: $blue-500;
}
%notice-highlight::before {
  @extend %with-star-fill-mask;
  color: $yellow-500;
}
%notice-warning::before {
  @extend %with-alert-triangle-mask;
  color: $orange-500;
}
%notice-error::before {

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===============

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---

layout: api
page_title: License - Operator - HTTP API
description: |

The /operator/license endpoint allows for retrieving the Consul Enterprise License.

---

# License - Operator HTTP API

<EnterpriseAlert />

The licensing functionality described here is available only in [Consul Enterprise](https://www.hashicorp.com/products/consul/) version 1.1.0 and later.
## Getting the Consul License

This endpoint gets information about the current license.

<table>
<thead>
<tr>
<th>Method</th>
<th>Path</th>
<th>Produces</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>GET</code></td>
<td><code>/operator/license</code></td>
<td><code>application/json</code></td>
</tr>
</tbody>
</table>

The table below shows this endpoint's support for
[blocking queries](/api/features/blocking),
[consistency modes](/api/features/consistency),
[agent caching](/api/features/caching), and
[required ACLs](/api#authentication).

<table>
<thead>
<tr>
<th>Blocking Queries</th>
<th>Consistency Modes</th>
<th>Agent Caching</th>
<th>ACL Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>NO</code></td>
<td><code>all</code></td>
<td><code>none</code></td>
<td><code>none</code></td>
</tr>
</tbody>
</table>

### Parameters

- `.dc` `(string: "")` - Specifies the datacenter whose license should be retrieved.
  This will default to the datacenter of the agent serving the HTTP request.
  This is specified as a URL query parameter.

### Sample Request

```shell-session
$ curl http://127.0.0.1:8500/v1/operator/license
```

### Sample Response

```json
{
  "Valid": true,
  "License": {  
    "license_id": "2afbf681-0d1a-0649-cb6c-333ec9f0989c",
    "customer_id": "0259271d-8ffc-e85e-0830-c0822c1f5f2b",
    "installation_id": "*",
    "issue_time": "2018-05-21T20:03:35.911567355Z",
    "start_time": "2018-05-21T04:00:00Z",
    "expiration_time": "2019-05-22T03:59:59.999Z",
    "product": "consul",
    "flags": { 
      "package": "premium"
    },
    "features": [
```


"Automated Backups",
"Automated Upgrades",
"Enhanced Read Scalability",
"Network Segments",
"Redundancy Zone",
"Advanced Network Federation"
],
"temporary": false
},
"Warnings": []
}
```

## Updating the Consul License

-> **Deprecated** This endpoint was removed in Consul v1.10.0 along with the ability to manage the cluster's license via the API.

This endpoint updates the Consul license and returns some of the license contents as well as any warning messages regarding its validity.

<table>
<thead>
<tr>
<th>Method</th>
<th>Path</th>
<th>Produces</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUT</td>
<td><code>/operator/license</code></td>
<td><code>application/json</code></td>
</tr>
</tbody>
</table>

The table below shows this endpoint's support for [blocking queries](/api/features/blocking), [consistency modes](/api/features/consistency), [agent caching](/api/features/caching), and [required ACLs](/api#authentication).

<table>
<thead>
<tr>
<th>Blocking Queries</th>
<th>Consistency Modes</th>
<th>Agent Caching</th>
<th>ACL Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>NO</code></td>
<td><code>none</code></td>
<td><code>none</code></td>
<td><code>operator:write</code></td>
</tr>
</tbody>
</table>

### Parameters

- `dc` `(string: "")` - Specifies the datacenter whose license should be updated. This will default to the datacenter of the agent serving the HTTP request. This is specified as a URL query parameter.

### Sample Payload

The payload is the raw license blob.

### Sample Request

```shell-session
```
```
$ curl
   --request PUT
   --data @consul.license
   http://127.0.0.1:8500/v1/operator/license
```

### Sample Response

```
```json
{
   "Valid": true,
   "License": {
      "license_id": "2afbf681-0d1a-0649-cb6c-333ec9f0989c",
      "customer_id": "0259271d-8ffc-e85e-0830-c0822c1f5f2b",
      "installation_id": "*",
      "issue_time": "2018-05-21T20:03:35.911567355Z",
      "start_time": "2018-05-21T04:00:00Z",
      "expiration_time": "2019-05-22T03:59:59.999Z",
      "product": "consul",
      "flags": {
         "package": "premium"
      },
      "features": [
         "Automated Backups",
         "Automated Upgrades",
         "Enhanced Read Scalability",
         "Network Segments",
         "Redundancy Zone",
         "Advanced Network Federation"
      ],
      "temporary": false
   },
   "Warnings": []
}
```

## Resetting the Consul License

-> **Deprecated** This endpoint was removed in Consul v1.10.0 along with the ability to manage the cluster's license via the API.

This endpoint resets the Consul license to the license included in the Enterprise binary. If the included license is not valid, the replace will fail.

<table>
<thead>
<tr>
<th>Method</th>
<th>Path</th>
<th>Produces</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>DELETE</code></td>
<td><code>/operator/license</code></td>
<td><code>application/json</code></td>
</tr>
</tbody>
</table>
The table below shows this endpoint's support for
[blocking queries](/api/features/blocking),
[consistency modes](/api/features/consistency),
[agent caching](/api/features/caching), and
[required ACLs](/api#authentication).
| Blocking Queries | Consistency Modes | Agent Caching | ACL Required
| ---------------- | ----------------- | ------------- | ---------------- |
| `NO`
| `none`
| `none`
| `operator:write` |

|

### Parameters
- `dc` `(string: "")` - Specifies the datacenter whose license should be updated.
This will default to the datacenter of the agent serving the HTTP request.
This is specified as a URL query parameter.
### Sample Request
```shell-session
$ curl \
--request DELETE \
http://127.0.0.1:8500/v1/operator/license
```
### Sample Response
```json
{
"Valid": true,
"License": {
"license_id": "2afbf681-0d1a-0649-cb6c-333ec9f0989c",
"customer_id": "0259271d-8ffc-e85e-0830-c0822c1f5f2b",
"installation_id": "*",
"issue_time": "2018-05-21T20:03:35.911567355Z",
"start_time": "2018-05-21T04:00:00Z",
"expiration_time": "2019-05-22T03:59:59.999Z",
"product": "consul",
"flags": {
"package": "premium"
},
"features": [
"Automated Backups",
"Automated Upgrades",
"Enhanced Read Scalability",
"Network Segments",
"Redundancy Zone",
"Advanced Network Federation"
],

Open Source Used In kASA v1.5 1445


"temporary": false
",
"Warnings": []
}
```
@import './skin';
@import './layout';
.consul-intention-permission-header-list {
    ul > li {
        @extend %list-row-200;
    }
}
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            </Action>
        </Actions>
    </BlockSlot>
</ListCollection>
Are you sure you want to delete this header?

<p>
</p>

<BlockSlot>
<BlockSlot @name="confirm" as |Confirm|>
<Confirm>Delete</Confirm>
</BlockSlot>
</Confirmation>
</BlockSlot>
</Action>
</Actions>
</BlockSlot>
</ListCollection>

.package datatypes

/**
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 */

/**
 * AUTOMATICALLY GENERATED CODE - DO NOT MODIFY
 */

package datatypes
type Legal_RegulatedWorkload struct {
    Entity

    Account *Account `json:"account,omitempty" xmlrpc:"account,omitempty"`

    AccountId *int `json:"accountId,omitempty" xmlrpc:"accountId,omitempty"`

    EnabledFlag *bool `json:"enabledFlag,omitempty" xmlrpc:"enabledFlag,omitempty"`

    Id *int `json:"id,omitempty" xmlrpc:"id,omitempty"`

    Type *Legal_RegulatedWorkload_Type `json:"type,omitempty" xmlrpc:"type,omitempty"`

    WorkloadTypeId *int `json:"workloadTypeId,omitempty" xmlrpc:"workloadTypeId,omitempty"
}

// no documentation yet

type Legal_RegulatedWorkload_Type struct {
    Entity

    Id *int `json:"id,omitempty" xmlrpc:"id,omitempty"`

    KeyName *string `json:"keyName,omitempty" xmlrpc:"keyName,omitempty"`

    Name *string `json:"name,omitempty" xmlrpc:"name,omitempty"
}

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Portions of the client are based on code at:
https://github.com/google/go-github/ and
https://github.com/digitalocean/godo

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Brian Goff <cpuguy83@gmail.com>
Clayton Coleman <ccoleman@redhat.com>
Denis Smirnov <denis.smirnov.91@gmail.com>
DongYun Kang <ceram1000@gmail.com>
Dwayne Schultz <dschultz@pivotal.io>
Georg Apitz <gapitz@pivotal.io>
Gustav Paul <gustav.paul@gmail.com>
Johan Brandhorst <johan.brandhorst@gmail.com>
John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
Laurent <laurent@adyoulike.com>
Patrick Lee <patrick@dropbox.com>
Peter Edge <peter.edge@gmail.com>
Roger Johansson <rogeralsing@gmail.com>
Sam Nguyen <sam.nguyen@sendgrid.com>
Sergio Arbeo <serabe@gmail.com>
Stephen J Day <stephen.day@docker.com>
Tamir Duberstein <tamird@gmail.com>
Todd Eisenberger <teisenberger@dropbox.com>
Tormod Erevik Lea <tormodlea@gmail.com>
Vyacheslav Kim <kane@sendgrid.com>
Walter Schulze <awalterschulze@gmail.com>

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# Frequently Asked Questions (FAQ)

This FAQ is for the license changes introduced in Consul Enterprise version 1.10.0. Consul Enterprise automatically loads Consul licenses when the server agent starts.

## Q: Can I get a quick summary of the Consul changes?

Starting with Consul Enterprise 1.10.0, the license enablement process is different.

HashiCorp Enterprise servers will no longer start without a license. Servers require licenses to be provided from either an environment variable or file.

If the license is missing, invalid, or expired, the server will immediately exit.

This check is part of the server boot-up process.

In previous versions of HashiCorp enterprise products, one server could distribute a license to other servers via the Raft protocol.
This will no longer work since each server must be able to find a valid license during the startup process.

## Q: What are the upgrade requirements?

All customers on Consul Enterprise 1.8/1.9 must first upgrade their client and server agents to the latest patch release.

During the upgrade the license file must also be configured on client agents in an environment variable or file path, otherwise the Consul agents will fail to retrieve the license with a valid agent token.

The upgrade process varies if ACLs are enabled or disabled in the cluster.

Refer to the instructions on [upgrading to 1.10.x](/docs/upgrading/instructions/upgrade-to-1-10-x) for details.

## Q: Is there a tutorial available for the license configuration steps?

Please visit the [Enterprise License Tutorial](https://learn.hashicorp.com/tutorials/nomad/hashicorp-enterprise-license?in=consul/enterprise).

## Q: What resources are available?

The list below is a great starting point for learning more about the license changes introduced in Consul Enterprise 1.10.0+ent.

- [Consul Enterprise Upgrade Documentation](https://www.consul.io/docs/enterprise/upgrades)
- [Consul License Documentation](/docs/enterprise/license)
- [License configuration values documentation](/docs/enterprise/license/overview#binaries-without-built-in-licenses)
- [Install a HashiCorp Enterprise License Tutorial](https://learn.hashicorp.com/tutorials/nomad/hashicorp-enterprise-license?in=consul/enterprise)

## Q: Do these changes impact all customers/licenses?

The license changes introduced in 1.10.0 only affect Consul Enterprise.

This impacts customers that have an enterprise binary (evaluation or non-evaluation licenses) downloaded from https://releases.hashicorp.com.

The license changes do not impact customers with the baked-in licensed binaries. In a later release of Consul Enterprise, baked-in binaries will be deprecated.

## Q: What is the product behavior change introduced by the licensing changes?

Starting with Consul Enterprise 1.10.0, a valid license is required on-disk (auto-loading) or as an environment variable for Consul Enterprise to successfully boot-up.

The in-storage license feature will not be supported starting with Consul Enterprise 1.10.0+ent. All Consul Enterprise clusters using 1.10.0+ent must ensure that there is a valid license on-disk (auto-loaded) or as an environment variable.

## Q: What is the impact on evaluation licenses due to this change?
The 6-hour trial period for evaluation licenses will be deprecated as of Consul Enterprise 1.10.0. This means that any clusters deployed with Consul 1.10.0+ent binaries will need to have a valid license on the disk (auto-loaded) or as an environment variable. Failure to provide a valid license key will result in the Consul server agent not starting.

## Q: Is there a grace period when licenses expire?

A license includes an `expiration_date` and a `termination_date`. An enterprise binary will cease to function once the `termination_date` has passed. Licenses will now have a 24 hrs grace period. The grace period is the time between license expiry until the time it terminates.

As Consul Enterprise approaches the expiration date, warnings will be issued in the system logs.

## Q: Does this affect client agents?

There are upgrade requirements that affect Consul Enterprise clients. Please review the [upgrade requirements](faq#q-what-are-the-upgrade-requirements) documentation.

## Q: Does this affect snapshot agents?

Same behavior as Consul clients. See answer for [Does this affect client agents?](faq#q-does-this-affect-client-agents)

## Q: What is the behavior if the license is missing?

Consul server agents will detect the absence of the license and immediately exit.

Consul client agents will attempt to retrieve the license from servers if certain conditions are met:

- ACLs are enabled.
- An ACL token is provided to the client agent.
- The client agents configuration contains `start_join/retry_join` addresses.
- The start/retry join addresses are addresses of the Consul servers.

Consul snapshot agents will attempt to retrieve the license from servers if certain conditions are met: ACLs are enabled, a ACL token is provided to the client agent, the client agents configuration contains `start_join/retry_join` addresses, the start/retry join addresses are addresses of the Consul servers.

## Q: Where can users get a trial license for Consul Enterprise?

Visit https://www.consul.io/trial for a free 30-day trial license.

## Q: Are the license files locked to a specific cluster?

The license files are not locked to a specific cluster or cluster node. The above changes apply to all nodes in a cluster.
## Q: Will this impact HCP Consul?

This will not impact HCP Consul.

## Q: Does this need to happen every time a node restarts, or is this a one-time check?

Consul Enterprise binaries starting with 1.10.0+ent, will be subject to EULA check. Release 1.10.0+ent introduces the EULA check for evaluation licenses (non-evaluation licenses already go through EULA check during contractual agreement).

The agreement to a EULA happens only once (when the user gets their license), Consul Enterprise **will check for the presence of a valid license every time a node restarts**.

When a customer upgrades existing clusters to a 1.10.0+ent release, they need to have a valid license to successfully upgrade. This valid license must be auto-loaded.

When a customer deploys new clusters to a 1.10.0+ent release, they need to have a valid license to successfully upgrade. This valid license must be on-disk (auto-loaded).

## Q: What are the scenarios that a customer must plan for because of these changes?

New Consul cluster deployments using 1.10.0+ent will need to have a valid license on servers to successfully deploy.

This valid license must be on-disk (auto-loaded) or as an environment variable.

Please see the [upgrade requirements](faq#q-what-are-the-upgrade-requirements).

## Q: What is the migration path for customers who want to migrate from their existing license-as-applied-via-the-CLI flow to the license on disk flow?

### VM

1. Run `['consul license get -signed']` to extract the license from their running cluster. Store the license in a secure location on disk.
1. Set up the necessary configuration so that when Consul Enterprise reboots it will have access to the required license. This could be via the client agent configuration file or an environment variable.
1. Visit the [Enterprise License Tutorial](https://learn.hashicorp.com/tutorials/nomad/hashicorp-enterprise-license?in=consul/enterprise) for detailed steps on how to install the license key.
1. Follow the Consul upgrade [documentation](/docs/upgrading).

### Kubernetes

**NOTE:** If you are not upgrading Consul or your Helm chart version then no action is required.

1. In order to use Consul Enterprise 1.10.0 or greater on Kubernetes you must use version 0.32.0 or greater of the Helm chart.
1. You should already have a Consul Enterprise license set as a Kubernetes secret. If you do not, then if you are an existing HashiCorp enterprise customer you may contact your organization’s customer success manager (CSM) or email support-softwaredelivery@hashicorp.com for information on how to get your organization’s enterprise license.
Once you have the license then create a Kubernetes secret containing the license as described in [Kubernetes - Consul Enterprise](/docs/k8s/installation/deployment-configurations/consul-enterprise).

1. Follow the [Kubernetes Upgrade Docs](/docs/k8s/upgrade) to upgrade. No changes to your `values.yaml` file are needed to enable enterprise autoload license since this support is built in to consul-helm 0.32.0 and greater.

   --> **WARNING:** If you are upgrading the Helm chart but **not** upgrading the Consul version, you must set `server.enterpriseLicense.enableLicenseAutoload: false`. See [Kubernetes - Consul Enterprise](/docs/k8s/installation/deployment-configurations/consul-enterprise) for more details.

### Q: What is the migration path for customers who want to migrate from their existing perpetually-licensed binaries to the license on disk flow?

#### VM

1. Acquire a valid Consul Enterprise license. If you are an existing HashiCorp enterprise customer you may contact your organization’s customer success manager (CSM) or email support-softwaredelivery@hashicorp.com for information on how to get your organization’s enterprise license.

1. Store the license in a secure location on disk.

1. Set up the necessary configuration so that when Consul Enterprise reboots it will have the required license. This could be via the client agent configuration file or an environment variable.

   Visit the [Enterprise License Tutorial](https://learn.hashicorp.com/tutorials/nomad/hashicorp-enterprise-license?in=consul/enterprise) for detailed steps on how to install the license key.

1. Follow the Consul upgrade [documentation](/docs/k8s/upgrading).

#### Kubernetes

1. Acquire a valid Consul Enterprise license. If you are an existing HashiCorp enterprise customer you may contact your organization’s customer success manager (CSM) or email support-softwaredelivery@hashicorp.com for information on how to get your organization’s enterprise license.

1. Set up the necessary configuration so that when Consul Enterprise reboots it will have the required license. This could be via the client agent configuration file or an environment variable.

   Visit the [Enterprise License Tutorial](https://learn.hashicorp.com/tutorials/nomad/hashicorp-enterprise-license?in=consul/enterprise) for detailed steps on how to install the license key.

1. Proceed with the `helm` upgrade [instructions](/docs/k8s/upgrade)

### Q: Will Consul downgrades/rollbacks work?

When downgrading to a version of Consul before 1.10.0+ent, customers will need to follow the previous process for applying an enterprise licenses to Consul Enterprise.

### Q: Are there potential pitfalls when downgrading or upgrading Consul server instances?

   --> Verify that you meet the [upgrade requirements](faq#q-what-are-the-upgrade-requirements).

Assume a scenario where there are three Consul server nodes:

- Node A: v1.9.5
- Node B: v1.10.0 [Leader]
The command `consul license put` is issued from Node A. This will result in an error due to how Consul routes calls to the server node, Node B in this example.

Because Node A is a follower when the call `consul license put` is issued, the call will be redirected to Node B (leader).

The `consul license put` operation will fail due to being removed from 1.10.0.

This is a scenario that could occur if a customer downgrades from 1.10.0+ and the Consul leadership has not transferred back over to a node not running 1.10.0+.

This also has the potential of occurring when upgrading if scheduled license updates or autoscaling groups recoveries are in place.

## Q: Any impacts to Consul Kubernetes?

If you are using a Consul Enterprise version prior to 1.10.0 and decide to upgrade the Helm chart to version 0.32.0 or newer, but not the Consul version.

You will need to add the following configuration.

```yaml
server:
  enterpriseLicense:
    enableLicenseAutoload: false
```

---

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Bits of Go-lang’s `once.Do()` were cribbed and reused here, too.

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1.100 x-net v0.0.0-20210324051636-2c4c8ecb7826

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1.105 go 1.16.4

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#
# Please keep the list sorted.

Aamir Khan <syst3m.w0rm@gmail.com>
Aaron Beitch <aaronb@arista.com>
Aaron Bieber <deftly@gmail.com>
Aaron Cannon <cannona@fireantproductions.com>
Aaron France <aaron.l.france@gmail.com>
Aaron Jacobs <jacobsa@google.com>
Aaron Jensen <jensen.aaro@gmail.com>
Aaron Kemp <kemp.aaron@gmail.com>
Aaron Patterson <tenderlove@ruby-lang.org>
Aaron Stein <aaronstein12@gmail.com>
Aaron Torres <tcboox@gmail.com>
Aaron Zinman <aaron@azinman.com>
Aarti Parikh <aarti.parikh@gmail.com>
Abdullah Al Maruf <mymail.maruf@gmail.com>
Abe Haskins <abeisgreat@abeisgreat.com>
Abhinav Gupta <abhinav.g90@gmail.com>
Adam Azarchs <adam.azarchs@10xgenomics.com>
Adam Bender <abender@google.com>
Adam Eijdenberg <adam@continusec.com>
Adam Harvey <aharvey@php.net>
Adam Kisala <adam.kisala@gmail.com>
Adam Langley <agl@golang.org>
Adam Medzinski <adam.medzinski@gmail.com>
Adam Shannon <adamkshannon@gmail.com>
Adam Shelton <aashelt90@gmail.com>
Adam Sindelar <adamsh@google.com>
Adam Thomason <athomason@gmail.com>
Adam Williams <pwnfactory@gmail.com>
Adam Woodbeck <adam@woodbeck.net>
Adarsh Ravichandran <adarshravichandran91@gmail.com>
Aditya Harindar <aditya.harindar@gmail.com>
Aditya Mukerjee <dev@chimeracoder.net>
Adrian Hesketh <adrianhesketh@hushmail.com>
Adrian Nos <nos.adrian@gmail.com>
Adrian O'Grady <elpollouk@gmail.com>
Adrien Bustany <adrien-xx-google@bustany.org>
Adrien Delorme <adrien.delorme@icloud.com>
Adrien Petel <peteladrien@gmail.com>
Acio Jnior <aeciodantasjunior@gmail.com>
Aeneas Rekkas (arekkas) <aeneas@ory.am>
Afanasev Stanislav <phpprogger@gmail.com>
Agis Anastasopoulos <agis.anast@gmail.com>
Agniva De Sarker <agnivade@yahoo.co.in>
Ahmed Wahed <oneofone@gmail.com>
Ahmet Alp Balkan <ahmetb@google.com>
Ahmet Soormally <ahmet@mangomm.co.uk>
Ahmy Yulrizka <yulrizka@gmail.com>
Ahsun Ahmed <ahmed.ahsun@gmail.com>
Aidan Coyle <packrat386@gmail.com>
Aiden Scandella <ai@uber.com>
Ainar Garipov <gugl.zadolbal@gmail.com>
Aishraj Dahal <aishraj@users.noreply.github.com>
Ajanthan Balachandran <balaajanthan@gmail.com>
Akhil Indurty <aindurty@gmail.com>
Akihiro Suda <suda.kyoto@gmail.com>
Akshat Kumar <seed@mail.nanosouffle.net>
Al Cutter <al@google.com>
Alan Braithwaite <alan@ipaddr.org>
Alan Donovan <adonovan@google.com>
Alan Shreve <alan@inconshreveable.com>
Albert Nigmatzianov <albertnigma@gmail.com>
Albert Strasheim <fullung@gmail.com>
Albert Teoh <albert.teoh@gmail.com>
Albert Yu <yukinying@gmail.com>
Alberto Bertogli <albertito@blitiri.com.ar>
Alberto Donizetti <alb.donizetti@gmail.com>
Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>
Alec Benzer <alec.benzer@gmail.com>
Aleksa Sarai <cyphar@cyphar.com>
Aleksandar Dezelin <dezelin@gmail.com>
Aleksandr Lukinykh <a.lukinykh@xsolla.com>
Aleksandr Razumov <ar@cydev.ru>
Alekssev Artem <a.artem060@gmail.com>
Alessandro Arzilli <alessandro.arzilli@gmail.com>
Alessandro Baffa <alessandro.baffa@gmail.com>
Alex A Skinner <alex@lx.lc>
Alex Brainman <alex.brainman@gmail.com>
Alex Bramley <abramley@google.com>
Alex Browne <stephenalexbrowne@gmail.com>
Alex Buchanan <buchanae@gmail.com>
Alex Carol <alex.carol.c@gmail.com>
Alex Gaynor <alex@alloy.us>
Alex Harford <alex.harford@saucelabs.com>
Alex Hays <alex.hays@leftfieldlabs.com>
Alex Jin <toalexjin@gmail.com>
Alex Kohler <alexjohnkohler@gmail.com>
Andrew G. Morgan <agm@google.com>
Andrew Gerrand <adg@golang.org>
Andrew Harding <andrew@spacemonkey.com>
Andrew Jackura <ajackura@gmail.com>
Andrew Kemm <andrewwkemm@gmail.com>
Andrew Louis <alouis@digitalocean.com>
Andrew Lutomirski <andy@luto.us>
Andrew Medvedev <andrew.y.medvedev@gmail.com>
Andrew Pilloud <andrewpilloud@igneoussystems.com>
Andrew Pogrebov <absourd.noise@gmail.com>
Andrew Poydence <apoydence@pivotal.io>
Andrew Pritchard <awpritchard@gmail.com>
Andrew Radev <andreylara@gmail.com>
Andrew Skiba <skibaa@gmail.com>
Andrew Stormont <astormont@racktopsystems.com>
Andrew Stribblehill <ads@wompom.org>
Andrew Szeto <andrew@jabagwee.com>
Andrew Todd <andrew.todd@wework.com>
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>
Andrew Wilkins <axwalk@gmail.com>
Andrew Williams <williams.andrew@gmail.com>
Andrew Z Allen <me@andrewzallen.com>
Andrey Bokhanov <andreybokhanov@gmail.com>
Andrey Mirtchovski <mirtchovski@gmail.com>
Andrey Petrov <andrey.petrov@shazow.net>
Andrii Soldatenko <andrii.soldatenko@gmail.com>
Andrii Soluk <isoluchok@gmail.com>
Andriy Lytvynov <lytvynov.a.v@gmail.com>
Andrzej eel <andrii.zhezhel@gmail.com>
Andy Balholm <andy@balholm.com>
Andy Davis <andy@bigandian.com>
Andy Finkenstadt <afinkenstadt@zynga.com>
Andy Lindeman <andy@lindeman.io>
Andy Maloney <asmaloney@gmail.com>
Andy Pan <panj2000@gmail.com>
Andy Walker <walkeraj@gmail.com>
Andy Wang <cbewu.andy@gmail.com>
Andy Williams <andy@andy.xyz>
Andzej Maciusovic <andzej.maciusovic@gmail.com>
Anfernee Yongkun Gui <anfernee.gui@gmail.com>
Angelo Bulfone <mbulfone@gmail.com>
Anh Hai Trinh <anh.hai.trinh@gmail.com>
Anit Gandhi <anitgandhi@gmail.com>
Ankit Goyal <ankit3goyal@gmail.com>
Anmol Sethi <anmol@aubble.com>
Annirudh Prasad <annirudh@wandb.com>
Anschel Schaffer-Cohen <anschelsc@gmail.com>
Anthony Alves <cbballa3g0@gmail.com>
Anthony Canino <anthony.canino1@gmail.com>
Anthony Eufemio <anthony.eufemio@gmail.com>
Anthony Fok <foka@debian.org>
Anthony Martin <ality@pbrane.org>
Anthony Sottile <asottile@umich.edu>
Anthony Starks <ajstarks@gmail.com>
Anthony Voutas <voutasaurus@gmail.com>
Anthony Woods <awoods@raintank.io>
Antoine GIRARD <sapk@sapk.fr>
Antoine Martin <antoine97.martin@gmail.com>
Anton Gyllenberg <anton@iki.fi>
Anton Kuksin <anton.a.kuksin@gmail.com>
Antonin Amand <antonin.amand@gmail.com>
Antonio Antelo <santelov87@gmail.com>
Antonio Bibiano <antbhn@gmail.com>
Antonio Huete Jimenez <tuxillo@quantumachine.net>
Antonio Murdaca <runcom@redhat.com>
Antonio Troina <thoeni@gmail.com>
Anze Kolar <me@akolar.com>
Aofei Sheng <aofei@aofeisheng.com>
Apisak Darakananda <pongad@gmail.com>
Aram Hvrneanu <aram@mgk.ro>
Araragi Hokuto <kanseihonbucho@protonmail.com>
Arash Bina <arash@arash.io>
Arda Gl <ardaguclu@gmail.com>
Areski Belaid <areski@gmail.com>
Ariel Mashraki <ariel@mashraki.co.il>
Arkadi Pyuro <arkadi@gmail.com>
Arlo Breault <arlolra@gmail.com>
Arnaud Ysmal <arnaud.ysmal@gmail.com>
Arne Hormann <arnehormann@gmail.com>
Arnout Engelen <arnout@bzzt.net>
Aron Nopanen <aron.nopanen@gmail.com>
Artem Alekseev <artem.alekseev@intel.com>
Artem Khvastunov <artem.khvastunov@jetbrains.com>
Artem Kolin <artemkaxboy@gmail.com>
Arthur Fabre <arthur@arthurfabre.com>
Arthur Khashaev <arthur@khashaev.ru>
Artyom Pervukhin <artyom.pervukhin@gmail.com>
Arvindh Rajesh Tarnimani <art@a-30.net>
Ashish Gandhi <ag@ashishgandhi.org>
Asim Shankar <asimshankar@gmail.com>
Assel Meher <asselmeher@gmail.com>
Atin Malaviya <amalaviy@akamai.com>
Ato Araki <sato.araki@gmail.com>
Atsushi Toyama <atsushi.toyama.160.333@gmail.com>
Audrey Lim <audreylh@gmail.com>
Audrius Butkevicius <audrius.butkevicius@gmail.com>
Augusto Roman <aroman@gmail.com>
Aulus Egnatius Varialus <varialus@gmail.com>
Aurlien Rainone <aurelien.rainone@gmail.com>
Aurlio A. Heckert <aurium@gmail.com>
Austin Clements <austin@google.com> <aclements@csail.mit.edu>
Avi Flax <avi@timehop.com>
Aviv Klasquin Komissar <avivklas@gmail.com>
awaw fumin <awawfumin@gmail.com>
Awn Umar <awn@cryptolosophy.io>
Axel Wagner <axel.wagner.hh@googlemail.com>
Ayan George <ayan@ayan.net>
Ayanamist Yang <ayanamist@gmail.com>
Ayke van Laethem <aykevanlaethem@gmail.com>
Aymerick Jhanne <aymerick@jehanne.org>
Ayzat Sadykov <ayzat.ziko.93@gmail.com>
Azat Kaumov <kaumov.a.r@gmail.com>
Baiju Muthukadan <baiju.m.mail@gmail.com>
Balaram Makam <bmakam.qdt@qualcommdatcenter.com>
Balazs Lecz <leczb@google.com>
Baokun Lee <nototon@gmail.com>
Barnaby Keene <accounts@southcla.ws>
Bartosz Grzybowski <melkorm@gmail.com>
Bartosz Oler <brtsz@google.com>
Bastian Ike <bastian.ike@gmail.com>
Ben Burkert <ben@benburkert.com>
Ben Cartwright-Cox <Ben@Benjojo.co.uk>
Ben Eitzen <eitzenb@golang.org>
Ben Fried <ben.fried@gmail.com>
Ben Haines <bhainesva@gmail.com>
Ben Hoyt <benhoyt@gmail.com>
Ben Kraft <benkraft@khanacademy.org>
Ben Laurie <ben@links.org> <benl@google.com>
Ben Lubar <ben.lubar@gmail.com>
Ben Lynn <benlynn@gmail.com>
Ben Olive <sionide21@gmail.com>
Ben Schwartz <bemasc@google.com>
Ben Shi <powerman1st@163.com>
Ben Toews <mastahyeti@gmail.com>
Benjamin Barenblat <bbaren@google.com>
Benjamin Black <b@b3k.us>
Benjamin Cable <cable.benjamin@gmail.com>
Benjamin Hsieh <tanookiben@users.noreply.github.com>
Benjamin Peterson <benjamin@python.org>
Benjamin Prosnitz <bprosnitz@google.com>
Benjamin Wester <bwester@squareup.com>
Benjamin Wuethrich <benjamin.wuethrich@gmail.com>
Benny Siegert <bsiegert@gmail.com>
Benoit Sigoure <tsunanet@gmail.com>
Cuong Manh Le <cuong@orijtech.com>
Curtis La Graff <curtis@lagraff.me>
Cyrill Schumacher <cyrill@schumacher.fm>
Dai Jie <gzdaijie@gmail.com>
Daisuke Fujita <dtanshi45@gmail.com>
Daisuke Suzuki <daisuzu@gmail.com>
Daker Fernandes Pinheiro <daker.fernandes.pinheiro@intel.com>
Damian Gryski <dgryski@gmail.com>
Damien Lespiau <damien.lespiau@gmail.com> <damien.lespiau@intel.com>
Damien Mathieu <dmathieu.com>
Damien Neil <dneil@google.com>
Damien Tournoud <damien@platform.sh>
Dan Ballard <dan@mindstab.net>
Dan Caddigan <goldcaddy77@gmail.com>
Dan Callahan <dan.callahan@gmail.com>
Dan Harrington <harringtond@google.com>
Dan Jacques <dnj@google.com>
Dan Johnson <computerdruid@google.com>
Dan Peterson <dpidd@y@gmail.com>
Dan Pupius <dan@medium.com>
Dan Scales <danscales@gmail.com>
Dan Sinclair <dan.sinclair@gmail.com>
Daniel Cohen <dc@uatach.edu>
Daniel Cormier <danielc@knowbe4.com>
Dann Fleischman <daniel@fleischman@gmail.com>
Daniel Ingram <ingramsds@appstate.edu>
Daniel Johansson <dajo2002@gmail.com>
Daniel Kerwin <d.kerwin@gini.net>
Daniel Kessler <dkess@google.com>
Daniel Kresse <eikeon@eikeon.com>
Daniel Kurum <rdkurum@gmail.com>
Daniel Langner <s8572327@gmail.com>
Daniel Lidn <daniel.liden.87@gmail.com>
Daniel Lublin <daniel@lublin.se>
Daniel Mangum <georgedanielmangum@gmail.com>
Daniel Martin <mvdan@mvdan.cc>
Daniel McCarney <cpu@letsencrypt.org>
Daniel Morsing <daniel.morsing@gmail.com>
Daniel Nadasi <dnadasi@gmail.com>
Daniel Nepkin <dnephin@gmail.com>
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>
Daniel S. Fava <danielsfava@gmail.com>
Daniel Skinner <dan@dasa.cc>
Daniel Speichert <daniel@speichert.pl>
Daniel Theophanes <kardianos@gmail.com>
Daniel Upton <d@floppy.co>
Daniela Petruzalek <daniela.petruzalek@gmail.com>
Danish Dua <danishdua@google.com>
Danish Prakash <grafitykoncept@gmail.com>
Danny Rosseau <daniel.rosseau@gmail.com>
Daria Kolistratova <daria.kolistratova@intel.com>
Darien Raymond <admin@v2ray.com>
Darren Elwood <darren@textnode.com>
Darren Grant <darren.e.grant@gmail.com>
Darren McCleary <darren.mcc@gmail.com>
Darshan Parajuli <parajuli@darshan@gmail.com>
Datong Sun <ndnx@idndx.com>
Dave Borowitz <dborowitz@google.com>
Dave Bort <dbort@golang.org>
Dave Cheney <dave@cheney.net>
Dave Day <djd@golang.org>
Dave Grijalva <dgrijalva@ngmoco.com>
Dave MacFarlane <driusan@gmail.com>
Dave Pfke <dave@pfke.org>
Dave Russell <forfuncsafe@gmail.com>
David Anderson <danderson@gmail.com>
David Barnett <dbarnett@gmail.com>
David Benjamin <davidben@gmail.com>
David Bond <davidsbond93@gmail.com>
David Brophy <dave@brophy.uk>
David Brgin <676c7473@gmail.com>
David Calavera <david.calavera@gmail.com>
David Carlier <devnexen@gmail.com>
David Carter <fresco.raja@gmail.com>
David Chase <dchase@google.com>
David Covert <davidhcovert@gmail.com>
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>
David du Colombier <ointro@gmail.com>
David Finkel <david.finkel@gmail.com>
David Forsythe <dforsythe@gmail.com>
David G. Andersen <dave.andersen@gmail.com>
David Glasser <glasser@meteor.com>
David Golden <david@autopragmatic.com>
David Heuschmann <heuschmann.d@gmail.com>
David Howden <dhowden@gmail.com>
David Hubbard <dsp@gmail.com>
David Jakob Fritz <david.jakob.fritz@gmail.com>
David Jones <dxjones@gmail.com>
David Lazar <lazard@golang.org>
David Leon Gil <coruus@gmail.com>
David McLeish <davemc@gmail.com>
David Ndungu <dnjuguna@gmail.com>
David NewHamlet <david@newhamlet.com>
David Presotto <presotto@gmail.com>
David Qu <davidqu12345@gmail.com>
Open Source Used In kASA v1.5

David R. Jenni <david.r.jenni@gmail.com>
David Sansome <me@davidsansome.com>
David Stainton <dstainton415@gmail.com>
David Symonds <dsymonds@golang.org>
David Thomas <davidthomas426@gmail.com>
David Timm <dtimm@pivotal.io>
David Titarenco <david.titarenco@gmail.com>
David Tolpin <david.tolpin@gmail.com>
David Url <david@urld.io>
David Volquartz Lebech <david@lebech.info>
David Wimmer <davidlwimmer@gmail.com>
Davies Liu <davies.liu@gmail.com>
Davor Kapsa <davor.kapsa@gmail.com>
Dean Eigenmann <7621705+decanus@users.noreply.github.com>
Dean Prichard <dean.prichard@gmail.com>
Deepak Jois <deepak.jois@gmail.com>
Denis Bernard <db047h@gmail.com>
Denis Brandolini <denis.brandolini@gmail.com>
Denis Isaev <idex@yandex.com>
Denis Nagorny <denis.nagorny@intel.com>
Dennis Kuhnert <mail.kuhnert@gmail.com>
Denys Honsiorovskiy <honsiorovskiy@gmail.com>
Denys Smirnov <denis.smirnov.91@gmail.com>
Derek Buitenhuys <derek.buitenhuys@gmail.com>
Derek Che <drc@yahoo-inc.com>
Derek McGowan <derek@mcgstyle.net>
Derek Parker <parkerderek86@gmail.com>
Derek Phan <derekphan94@gmail.com>
Derek Shockey <derek.shockey@gmail.com>
Dev Ojha <dojha12@gmail.com>
Dev Zhoujun <dev.zhoujun@gmail.com>
Devon H. O'Dell <devon.odell@gmail.com>
Dhaivat Pandit <dhaivatpandit@gmail.com>
Dhananjay Nakrani <dhananjayn@google.com>
Dhiru Kholia <dhiru.kholia@gmail.com>
Dhruv Dutt Jadhav <dhruvdutt.jadhav@gmail.com>
Di Xiao <dixiao@google.com>
Didier Spezia <didier.06@gmail.com>
Diego Siqueira <diego9889@gmail.com>
Dieter Plaetinck <dieter@raintank.io>
Dimitri Sokolyuk <sokolyuk@gmail.com>
Dimitri Tcaciuc <dtcaciuc@gmail.com>
Dina Garmash <dgrmsh@gmail.com>
Diogo Pinela <diogoid7400@gmail.com>
Dirk Gadsden <dirk@esherido.com>
Diwaker Gupta <diwakergupta@gmail.com>
Dmitri Goutnik <dgoutnik@gmail.com>
Dmitri Popov <operator@cv.dp-net.com>
Eivind Uggedal <eivind@uggedal.com>
Elbert Flick <eflick@gmail.com>
Eldar Rakhimberdin <ibeono@gmail.com>
Elena Grahovac <elena@grahovac.me>
Eli Bendersky <eliben@google.com>
Elias Naur <email@eliasnaur.com> <elias.naur@gmail.com>
Elliot Morrison-Reed <elliottmr@gmail.com>
Ellison Leao <ellisonleao@gmail.com>
Emerson Lin <linyintor@gmail.com>
Emil Bektimirov <lefelys@gmail.com>
Emil Hessman <emil@hessman.se>
Emil Mursalimov <mursalimovee@eliasnaur.com>
Emilien Kenler <hello@emilienkenler.com>
Emmanuel Odeke <emmanuel.odeke@gmail.com> <odeke@ualberta.ca>
Emrecan Bati <emrecanbati@gmail.com>
Eno Compton <enocom@google.com>
Eoghan Sherry <ejsherry@gmail.com>
Eric Biggers <ebiggers@gmail.com>
Eric Brown <browne@vmware.com>
Eric Chiang <eric.chiang.m@gmail.com>
Eric Clark <zerohp@gmail.com>
Eric Daniels <eric@erdaniels.com>
Eric Engestrom <eric@engestrom.ch>
Eric Garrido <ekg@gmail.com>
Eric Koleda <ekoleda@vmware.com>
Eric Lagergren <ericlagergren@gmail.com>
Eric Milliken <emiliken@gmail.com>
Eric Pauley <eric@pauley.me>
Eric Ponce <tricokun@gmail.com>
Eric Rescorla <ekr@rtfm.com>
Eric Roshan-Eisner <eric.roshan@gmail.com>
Eric Rutherford <erutherford@gmail.com>
Eric Rykwalder <e.rykwalder@gmail.com>
Eric Tryzelaar <e.tryzelaar@gmail.com>
Eric Aigner <aigner.eric@gmail.com>
Eric Dubbelboer <eric@dubbelboer.com>
Erik St. Martin <alakriti@gmail.com>
Erik Staab <estaab@gmail.com>
Erik Westrup <erik.westrup@gmail.com>
Erin Masatsugu <erin.masatsugu@gmail.com>
Ernest Chiang <ernest.chiang@htc.com>
Erwin Oegema <blablaechthema@hotmail.com>
Esko Luontola <esko.luontola@gmail.com>
Ethan Burns <eaburns@google.com>
Ethan Miller <eamiller@us.ibm.com>
Euan Kemp <euan@euan.com>
Eugene Formanenko <mo4islona@gmail.com>
Eugene Kalinin <e.v.kalinin@gmail.com>
Open Source Used In kASA v1.5 1621

Evan Broder <evan@stripe.com>
Evan Brown <evanbrown@google.com>
Evan Digby <evandigby@gmail.com>
Evan Hicks <evan.hicks2@gmail.com>
Evan Jones <ej@evanjones.ca>
Evan Klitzke <evan@eklitzke.org>
Evan Kroske <evankroske@gmail.com>
Evan Martin <evan.martin@gmail.com>
Evan Phoenix <evan@phx.io>
Evan Shaw <chickencha@gmail.com>
Evgeniy Kulikov <tuxuls@gmail.com>
Evgeniy Polyakov <zbr@iremap.net>
Ewan Chou <coocood@gmail.com>
Ewan Valentine <ewan.valentine89@gmail.com>
Eyal Posener <posener@gmail.com>
Fabian Wickborn <fabian@wickborn.net>
Fabian Zaremba <fabian@youremail.eu>
Fabrizio Milo <mistobaan@gmail.com>
Faiyaz Ahmed <ahmedf@vmware.com>
Fan Hongjian <fan.howard@gmail.com>
Fangming Fang <fangming.fang@arm.com>
Fannie Zhang <fannie.zhang@arm.com>
Fatih Arslan <fatih@arslan.io>
Fazal Majid <majid@apsalar.com>
Fazlul Shahriar <fshahriar@gmail.com>
Federico Bond <federicobond@gmail.com>
Federico Guerinoni <guerinoni.federico@gmail.com>
Federico Simoncelli <fisimonce@redhat.com>
Fedor Indutny <fedor@indutny.com>
Fedor Korotkiy <dartslon@gmail.com>
Felipe Oliveira <felipeweb.programador@gmail.com>
Felix Bnemann <Felix.Buenemann@gmail.com>
Felix Cornelius <9767036+fcorneius@users.noreply.github.com>
Felix Geisendrfer <haimuiiba@gmail.com>
Felix Kollmann <fk@konsorten.de>
Ferenc Szabo <frncmx@gmail.com>
Filip Gruszczyski <gruszczys@gmail.com>
Filip Haglund <drathier@users.noreply.github.com>
Filip Stanis <fstanis@google.com>
Filippo Valsorda <filippo@golang.org> <filippo@cloudflare.com> <hi@filippo.io>
Firmansyah Adiputra <frm.adiputra@gmail.com>
Florian Forster <octo@google.com>
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>
Florian Weimer <fw@deneb.enyo.de>
Florin Patan <florinpatan@gmail.com>
Folke Behrens <folke@google.com>
Ford Hurley <ford.hurley@gmail.com>
Francesc Campoy <campoy@golang.org>
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George Shammas <george@shamm.as> <georgyo@gmail.com>
George Tsilias <tsiliasg@gmail.com>
Gerasimos (Makis) Maropoulou <kataras2006@hotmail.com>
Gerasimos Dimitriadis <gedimitr@gmail.com>
Gergely Brautigam <karlso777@gmail.com>
Gernot Vormayr <gvormayr@gmail.com>
Gert Cuykens <gert.cuykens@gmail.com>
Getulio Sanchez <valentin2507@gmail.com>
Ghazni Nattarshah <ghazni.nattarshah@gmail.com>
Gianguido Sora` <g.sora4@gmail.com>
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>
Giles Lean <giles.lean@pobox.com>
Giovanni Bajo <rasky@develer.com>
GitHub User @aca (50316549) <acadx0@gmail.com>
GitHub User @ajnrirp (1688456) <ajnirp@users.noreply.github.com>
GitHub User @ajz01 (4744634) <ajzdenek@gmail.com>
GitHub User @alkesh26 (1019076) <alkesh26@gmail.com>
GitHub User @andig (184815) <cpuiddle@gmx.de>
GitHub User @andrius4669 (4699695) <andrius4669@gmail.com>
GitHub User @as (8127015) <as.utf8@gmail.com>
GitHub User @bakape (7851952) <bakape@gmail.com>
GitHub User @bgadrian (830001) <aditza8@gmail.com>
GitHub User @bontequero (2674999) <bontequero@gmail.com>
GitHub User @cch123 (384546) <buaa.cch@gmail.com>
GitHub User @chainhelen (7046329) <chainhelen@gmail.com>
GitHub User @chanxuehong (3416908) <chanxuehong@gmail.com>
GitHub User @cncai (23520240) <flycalvin@qq.com>
GitHub User @DQNEO (188741) <dqneoo@gmail.com>
GitHub User @Dreamacro (8615343) <chuainian@gmail.com>
GitHub User @dupoxy (1143957) <dupoxy@users.noreply.github.com>
GitHub User @erifan (31343225) <eric.fang@arm.com>
GitHub User @esell (9735165) <eujon.sellers@gmail.com>
GitHub User @fatedier (7346661) <fatedier@gmail.com>
GitHub User @frenknie (6499251) <mail@rhab.de>
GitHub User @geechin (11672310) <geechin@gmail.com>
GitHub User @GrigoriyMikhalkin (3637857) <grigoriymikhalkin@gmail.com>
GitHub User @hengwu0 (41297446) <41297446+hengwu0@users.noreply.github.com>
GitHub User @hitzhangjie (3725760) <hit.zhangjie@gmail.com>
GitHub User @itchyny (375258) <itchyny@hatena.ne.jp>
GitHub User @jinniaoluo (39730824) <jinmiaoluo@icloud.com>
GitHub User @jopbrown (6345470) <mssshane2008@gmail.com>
GitHub User @kazyshr (30496953) <kazysrht0301@gmail.com>
GitHub User @kc1212 (1093806) <kc1212@users.noreply.github.com>
GitHub User @Kropekk (13366453) <kamikropiewnicki@gmail.com>
GitHub User @linguohua (3434367) <lghchinaide@gmail.com>
GitHub User @LotusFenn (13775899) <fenn.lotus@gmail.com>
GitHub User @ly303550688 (11519839) <yang.liu636@gmail.com>
GitHub User @madiganz (18340029) <zacharywmadigan@gmail.com>
GitHub User @maltalex (10195391) <code@bit48.net>
GitHub User @markruler (38225900) <csu0414@gmail.com>
GitHub User @Matts966 (28551465) <Matts966@users.noreply.github.com>
GitHub User @mcncim (21333876) <mcncim@gmail.com>
GitHub User @mkishere (224617) <224617+mkishere@users.noreply.github.com>
GitHub User @nu50218 (40682920) <nu_ll@icloud.com>
GitHub User @OlgaVlPetrova (44112727) <OVPpetrova@gmail.com>
GitHub User @pityonline (438222) <pityonline@gmail.com>
GitHub User @po3rin (29445112) <abctail30@gmail.com>
GitHub User @popokutuna (57545) <popopopopokutuna@gmail.com>
GitHub User @pytimer (17105586) <elixin20101023@gmail.com>
GitHub User @ramenjuniti (32011829) <ramenjuniti@gmail.com>
GitHub User @saitarunreddy (21041941) <saitarunreddypalla@gmail.com>
GitHub User @shogo-ma (9860598) <Choroma194@gmail.com>
GitHub User @skanehira (7888591) <sho19921005@gmail.com>
GitHub User @soolaugust (10558124) <soolaugust@gmail.com>
GitHub User @surechen (7249331) <surechen17@gmail.com>
GitHub User @tatsumack (4510569) <tatsu.mack@gmail.com>
GitHub User @tell-k (26263) <ffk2005@gmail.com>
GitHub User @tennashio (10219626) <tennashio@gmail.com>
GitHub User @uhei (2116845) <uhei@users.noreply.github.com>
GitHub User @uropek (39370426) <uropek@gmail.com>
GitHub User @utkarsh-extc (53217283) <utkarsh.extc@gmail.com>
GitHub User @witchard (4994659) <witchard@hotmail.co.uk>
GitHub User @yah01 (12216890) <kagaminehuan@gmail.com>
GitHub User @yuanhh (1298735) <yuan415030@gmail.com>
GitHub User @zikaeroh (48577114) <zikaeroh@gmail.com>
GitHub User @ZZMarquis (7624583) <zhonglingjian3821@163.com>
Giulio Iotti <dullgiulio@gmail.com>
Giulio Micheloni <giulio.micheloni@gmail.com>
Giuseppe Valente <gvalente@arista.com>
Gleb Stepanov <glebstepanov1992@gmail.com>
Glenn Brown <glennb@google.com>
Glenn Lewis <gmlewis@google.com>
Gordon Klaus <gordon.klaus@gmail.com>
Gordon Tyler <gordon@doxxx.net>
Graham King <graham4king@gmail.com>
Graham Miller <graham.miller@gmail.com>
Grant Griffiths <gpp493@gmail.com>
Green Lightning <GreenLightning.git@googlemail.com>
Greg Poirier <greg.istehbest@gmail.com>
Greg Steuck <gnezdo+github@google.com>
Greg Thelen <gthelen@google.com>
Greg Ward <greg@gerg.ca>
Gregoire Delatte <gregoire.delatte@gmail.com>
Gregory Man <gregory@gregory.com>
Gregory Petrosyan <gregory.petrosyan@gmail.com>
Guilherme Caruso <gui.martinscaruso@gmail.com>
Guilherme Garnier <guilherme.garnier@gmail.com>
Guilherme Goncalves <guilhermeaugustosg@gmail.com>
Guilherme Rezende <guilhermebr@gmail.com>
Guillaume J. Charmes <guillaume.charmes.net>
Guillaume Sottas <guillamesottas@gmail.com>
Gnther Noack <gnoack@gmail.com>
Guobiao Mei <meiguobiao@gmail.com>
Guoliang Wang <siamwgliang@gmail.com>
Gustav Paul <gustav.paul@gmail.com>
Gustav Westling <gustav@westling.xyz>
Gustavo Franco <gustavofranco@gmail.com>
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>
Gwenael Treguier <gwenn.kahz@gmail.com>
Gyu-Ho Lee <gyuhox@gmail.com>
H. brahim Gngr <sigungor@gmail.com>
Hajime Hoshi <hajimehoshi@gmail.com>
Hallgrimir Gunnarsson <halg@google.com>
HAMANO Tsukasa <hamano@osstech.co.jp>
Han-Wen Nienhuys <hanwen@gmail.com>
Hang Qian <hangqian90@gmail.com>
Hanjun Kim <hallazzang@gmail.com>
Hanlin Shi <shihanlin9@gmail.com>
Haoran Luo <haoran.luo@chaitin.com>
Haosdent Huang <haosdent@gmail.com>
Harald Nordgren <haraldnordgren@gmail.com>
Hari haran <hariharan.uno@gmail.com>
Hariharan Srinath <srinathh@gmail.com>
Harley Laue <losinggeneration@gmail.com>
Harry Moreno <moreno149@gmail.com>
Harshavardhana <hrshvardhana@gmail.com>
Hasan Ozgan <hasan@ozgan.net>
Hasit Bhatt <hasit.p.bhatt@gmail.com>
Hauke Lffler <hloeffler@users.noreply.github.com>
Hvard Haugen <havard.haugen@gmail.com>
He Liu <liulonnie@gmail.com>
Hector Chu <hectorchu@gmail.com>
Hector Martin Cantero <hector@marcansoft.com>
Hein Khant Zaw <heinkhantzaw1@gmail.com>
Henning Schmiedehausen <henning@schmiedehausen.org>
Henrik Edwards <henrik.edwards@gmail.com>
Henrik Hodne <henrik@hodne.io>
Henrique Vicente <henriquevicente@gmail.com>
Henry Adi Sumarto <henry.adisumarto@gmail.com>
Henry Bubert <google@mindeco.de>
Henry Chang <mr.changyueng@gmail.com>
Henry Clifford <h.a.clifford@gmail.com>
Henry Wong <liushuai.wang@elastic.co>
Herbert Georg Fischer <herbert.fischer@gmail.com>
Herbie Ong <herbie@google.com>
Heschi Kreinick <heschi@google.com>
Hidetatsu Yaginuma <ygnmhdtt@gmail.com>
Hilko Bengen <bengen@hilluzination.de>
Hiroaki Nakamura <hnakamur@gmail.com>
Hiromichi Ema <ema.hiro@gmail.com>
Hironao OTSUBO <motemen@gmail.com>
Hiroshi Ioka <hirochachacha@gmail.com>
Hitoshi Mitake <mitake.hitoshi@gmail.com>
Holden Huang <ttyh061@gmail.com>
Songlin Jiang <hollowman@hollowman.ml>
Hong Ruiqi <hongruiqi@gmail.com>
Hongfei Tan <feilengci008@gmail.com>
Horacio Duran <horacioduran@gmail.com>
Horst Rutter <hrutter@gmail.com>
Hossein Sheikh Attar <hattar@google.com>
Howard Zhang <howard.zhang@arm.com>
Hsin Tsao <tsao@google.com>
Hsin-Ho Yeh <yhh92u@gmail.com>
Hu Keping <hukeping@huawei.com>
Huan Du <i@huandu.me>
Hugues Bruant <hugues.bruant@gmail.com>
Huy Le <shuy.dinh.le.89@gmail.com>
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>
Hyoyoung Chang <hyoyoung@gmail.com>
Ian Cottrell <iancottrell@gmail.com>
Ian Davis <nospam@iandavis.com>
Ian Gudger <ian@loosescr.ws>
Ian Haken <ihaken@netflix.com>
Ian Kent <iankent85@gmail.com>
Ian Lance Taylor <iant@golang.org>
Ian Leue <ian@appboy.com>
Ian Tay <iantay@gmail.com>
Ian Zapolsky <ianzapolsky@gmail.com>
Ibrahim AshShohail <ibra.sho@gmail.com>
Icarus Sparry <golang@icarus.freeuk.com>
Iccha Sethi <icchasethi@gmail.com>
Idora Shinatose <idora.shinatose@gmail.com>
Ignacio Hagopian <jsign.uy@gmail.com>
Igor Bernstein <igorb Bernstein@gmail.com>
Igor Bolotnikov <igor.v.bolotnikov@gmail.com>
Igor Dolzhikov <bluesriverz@gmail.com>
Igor Vashyst <ivashyst@gmail.com>
Igor Zhilianin <igor.zhilianin@gmail.com>
Ikko Ashimine <eltociear@gmail.com>
Ilya Yalovsky <yalovsky@gmail.com>
Ilya Sinelnikov <sidhmangh@gmail.com>
Ilya Tocar <ilya.tocar@intel.com>
INADA Naoki <songofacandy@gmail.com>
Inanc Gumus <m@inanc.io>
Ingo Gottwald <in.gottwald@gmail.com>
Ingo Krabbé <ikrabbé.ask@gmail.com>
Ingo Oeser <nightlyone@goolemail.com> <nightlyone@gmail.com>
Ioannis Georgoulas <geototiti21@hotmail.com>
Irbe Krumina <irbekrm@gmail.com>
Irfan Sharif <irfanmahmoudsharif@gmail.com>
Irieda Noboru <ririeda@gmail.com>
Isaac Ardis <isaac.ardis@gmail.com>
Isaac Wagner <ibw@isaacwagner.me>
Irfan Azhabil <isfanazhabil@gmail.com>
Iskander Sharipov <iskander.sharipov@intel.com> <quasilyte@gmail.com>
Issac Trotts <issactrotts@google.com>
Ivan Babrou <ivan@cloudflare.com>
Ivan Bertona <ivan.bertona@gmail.com>
Ivan Krasin <krasin@golang.org>
Ivan Kutuzov <arbrx@gmail.com>
Ivan Markin <sw@nogoest.net>
Ivan Moscoso <moscoso@gmail.com>
Ivan Osadchyi <ivan.osadchii@gmail.com>
Ivan Sharavuev <shipiwan@gmail.com>
Ivan Trubach <mr.trubach@icloud.com>
Ivan Ukhov <ivan.ukhov@gmail.com>
Ivy Evans <ivy@ivyevans.net>
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>
Jaap Aarts <jaap.aarts1@gmail.com>
Jack Britton <jackxbritton@gmail.com>
Jack Lindamood <jlindamo@justin.tv>
Jacob Baskin <jbaskin@gmail.com>
Jacob Blain Christen <dweomer5@gmail.com>
Jacob H. Haven <jacob@cloudflare.com>
Jacob Hoffman-Andrews <github@hoffman-andrews.com>
Jacob Walker <jacobwalker0814@gmail.com>
Jaden Teng <long.asyn@gmail.com>
Jae Kwon <jae@tendermint.com>
Jake B <doogie1012@gmail.com>
Jakob Borg <jakob@nym.se>
Jakob Weisblat <jakobw@mit.edu>
Jakub ajka <jcajka@redhat.com>
Jakub Kaczmarzyk <jakubk@mit.edu>
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>
Jakub Warczarek <jakub.warczarek@gmail.com>
Jamal Carvalho <jamal.a.carvalho@gmail.com>
James Aguilar <jaguilar@google.com>
James Bardin <j.bardin@gmail.com>
James Chacon <jchacon@gmail.com>
James Clarke <jrtc27@jrtc27.com>
James Cowgill <James.Cowgill@imgtec.com>
James Craig Burley <james-github@burleyarch.com>
James David Chalfant <james.chalfant@gmail.com>
James Eady <jmeady@google.com>
James Fyh <james.fyh@gmail.com>
James Gray <james@james4k.com>
James Hartig <fastest963@gmail.com>
James Kasten <jdkasten@gmail.com>
James Lawrence <jljatone@gmail.com>
James Meneghello <rawrz0r@gmail.com>
James Myers <jfmeyers9@gmail.com>
James Naftel <james.naftel@gmail.com>
James Neve <jamesoneve@gmail.com>
James Nugent <james@jen20.com>
James P. Cooper <jamespcooper@gmail.com>
James Robinson <jamesr.google.com> <jamesr.gatech@gmail.com>
James Schofield <james@shoeboxapp.com>
James Smith <jrs1995@icloud.com>
James Sweet <james.sweet88@gmail.com>
James Toy <nil@opensesame.st>
James Treanor <jtoreanor3@gmail.com>
James Tucker <raggi.google.com>
James Whitehead <jnw@whiteh.com>
Jamie Beverly <jamie.r.bevery@gmail.com>
Jamie Gennis <jgennis@gmail.com> <jgennis@gmail.com>
Jamie Kerr <jkerr113@gmail.com>
Jamie Liu <jamieliu@gmail.com>
Jamie Stackhouse <contin673@gmail.com>
Jamie Turner <jamwt@dropbox.com>
Jamie Wilkinson <jaq@spacepants.org>
Jamil Djadala <djadala@gmail.com>
Jan Berktold <jan@berktold.co>
Jan H. Hosang <jan.hosang@gmail.com>
Jan Kratochvil <jan.kratochvil@redhat.com>
Jan Lehnardt <jan@apache.org>
Jan Mercel <0xjnml@gmail.com> <befelempeseveze@gmail.com>
Jan Newmarch <jan.newmarch@gmail.com>
Jan Pilzer <jan.pilzer@gmx.de>
Jan Steinke <jan.steinke@gmail.com>
Jan Ziai <0xe2.0x9a.0x9b@gmail.com>
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>
Jannis Andrija Schnitzer <jannis@schnitzer.im>
Jared Allard <jaredallard@users.noreply.github.com>
Jared Culp <jculp14@gmail.com>
Jaroslavas Poeppo <jp@webmaster.ms>
Jason A. Donenfeld <Jason@zx2c4.com>
Jason Baker <jason-baker@users.noreply.github.com>
Jason Barnett <jason.w.barnett@gmail.com>
Jason Bubere <jbubere@google.com>
Jason Chu <jonchujc@gmail.com>
Jason Del Ponte <delpontej@gmail.com>
Jason Hall <jonshall@google.com>
Jason Keene <jonkeene@gmail.com>
Jason LeBrun <jblebrun@gmail.com>
Jason Smale <jsmale@zendesk.com>
Jason Travis <infomaniac7@gmail.com>
Jason Wangsadinata <jwangsadinata@gmail.com>
Javier Kohen <jckohen@gmail.com>
Javier Revillas <jrevillas@massivedynamic.io>
Javier Segura <javism@gmail.com>
Jay Conrod <jayconrod@gmail.com>
Jay Lee <BusyJayLee@gmail.com>
Jay Taylor <outtatime@gmail.com>
Jay Weisskopf <jay@jaychwa.net>
Jean de Klerk <deklerk@gmail.com>
Jean-Andre Santoni <jean andre santoni@gmail.com>
Jean-Francois Bustarret <jfb@bustarret.com>
Jean-Francois Cantin <jfcantin@gmail.com>
Jean-Marc Eurin <jmeurin@gmail.com>
Jean-Nicolas Moal <jn.moal@gmail.com>
Jed Denlea <jed@fastly.com>
Jedrzej Szczepaniak <jszczepaniak@gmail.com>
Jeet Parekh <jeetparekh96@gmail.com>
Jeevanandam M <jeeva@myjeeva.com>
Jeff (Zhefu) Jiang <jeffjiang@gmail.com>
Jeff Craig <jeffcraig@gmail.com>
Jeff Dupont <jeff.dupont@gmail.com>
Jeff Hodges <jeff@somethingsimilar.com>
Jeff Johnson <jrjohnson@gmail.com>
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>
Jeff Sickel <jas@corpus-callosum.com>
Jeff Wendling <jeff@spacemonkey.com>
Jeffrey H <jeffreyh192@gmail.com>
Jelte Fennema <github-tech@jeltef.nl>
Jens Frederich <jfrederich@gmail.com>
Jeremiah Harmsen <jeremiah@gmail.com>
Jeremy Banks <jeremy.ca>
Jeremy Canady <jcanady@gmail.com>
Jeremy Faller <jeremy@golang.org>
Jeremy Jackins <jeremyjackins@gmail.com>
Jeremy Jay <jeremy@pbnjay.com>
Jeremy Schlatter <jeremy.schlatter@gmail.com>
Jeroen Bobbeldijk <jerob62@gmail.com>
Jeroen Simonetti <jeroen@simonetti.nl>
Jrme Doucet <jerdt@gmail.com>
Jerrin Shaji George <jerrinng@gmail.com>
Jess Frazelle <me@jessfraz.com>
Jesse Szwedko <jesse.szwedko@gmail.com>
Jess Espino <jespinog@gmail.com>
Jia Zhan <jzhan@uber.com>
Jiacai Liu <jiacai2050@gmail.com>
Jiahao Lu <lujijh@gmail.com>
Jianing Yu <jnyu@google.com>
Jianqiao Li <jianqiaoli@google.com>
Jiayu Yi <yijiayu@gmail.com>
Jie Ma <jienius@outlook.com>
Jihyun Yu <yjh0502@gmail.com>
Jim Cote <jfcote87@gmail.com>
Jim Kingdon <jim@bolt.me>
Jim McGrath <jimmc2@gmail.com>
Jim Minter <jminter@redhat.com>
Jimmy Frasche <soapboxcicero@gmail.com>
Jimmy Zelinskie <jimmyzelinskie@gmail.com>
Jin-wook Jeong <jeweljar@hanmail.net>
Jingcheng Zhang <diogin@gmail.com>
Jingguo Yao <yaojingguo@gmail.com>
Jingnan Si <jingnan.si@gmail.com>
Jinkun Zhang <franksnolf@gmail.com>
Jiong Du <londevil@gmail.com>
Jirka Dank <dnk@mail.muni.cz>
Jiulong Wang <jiulongw@gmail.com>
Joakim Sernbrant <serbaut@gmail.com>
Joe Bowbeer <joe.bowbeer@gmail.com>
Joe Cortopassi <joe@joe corticali.com>
Joe Farrell <joe2farrell@gmail.com>
Joe Harrison <joe@hazzers.com>
Joe Henke <joe.henke@gmail.com>
Joe Kyo <xunianzu@gmail.com>
Joe Poirier <jdpoirier@gmail.com>
Joe Richey <joerichey@stologic.com>
Joe Shaw <joe@joeshaw.org>
Joe Sylve <joe.sylve@gmail.com>
Joe Tsai <joe@tsai.com>
Joel Sing <joel@stologic.com>
Joel Stemmer <jstemmer@gmail.com>
Joel Stemmer <jstemmer@gmail.com>
Joey Geiger <jgeiger@users.noreply.github.com>
Johan Brandhorst <johan.brandhorst@gmail.com>
Johan Euphrosine <proppy@stologic.com>
Johan Jansson <johan.jansson@iki.fi>
Johan Knutzen <johan@senri.se>
Johan Sageryd <j@1616.se>
John Asmuth <jasmuth@gmail.com>
John Beisley <huin@stologic.com>
Jordan Rhee <jordanrh@microsoft.com>
Jordan Rupprecht <rupprecht@google.com>
Jordi Martin <jordimartin@gmail.com>
Jorge Araya <jorgejavieran@yahoo.com.mx>
Jorge L. Fatta <jorge.fatta@auth0.com>
Jos Visser <jsov@google.com>
Josa Gesell <josa@gesell.me>
Jose Luis Vquez Gonzalez <josvazg@gmail.com>
Joseph Bonneau <jcb@google.com>
Joseph Holsten <joseph@josephholsten.com>
Josh Baum <joshbaum@google.com>
Josh Bleecher Snyder <josharian@gmail.com>
Josh Chorlton <jchorlton@gmail.com>
Josh Deprez <josh.deprez@gmail.com>
Josh Goebel <dreamer3@gmail.com>
Josh Hoak <jhoak@google.com>
Josh Holland <jrh@joshh.co.uk>
Josh Roppo <joshroppo@gmail.com>
Josh Varga <josh.varga@gmail.com>
Joshua Bezaleel Abednego <joshua.bezaleel@gmail.com>
Joshua Boelter <joshua.boelter@intel.com>
Joshua Chase <jcjoshuchase@gmail.com>
Joshua Crowgey <jcrowgey@uw.edu>
Joshua M. Clulow <josh.clulow@joyent.com>
Joshua Rubin <joshua@rubixconsulting.com>
Josselin Costanzi <josselin@costanzi.fr>
Jostein Stuhaug <js@solidsystem.no>
JP Sugarbroad <jpsugar@google.com>
JT Olds <jtolds@xnet5.com>
JT Olio <hello@jtolio.com>
Juan Carlos <juanjcsr@gmail.com>
Juan Pablo Civile <elementohb@gmail.com>
Jude Pereira <judebpereria@gmail.com>
Jukka-Pekka Kekkonen <karatepekkka@gmail.com>
Julia Hansbrough <flowerhack@google.com>
Julian Kornberger <jk+github@digineo.de>
Julian Pastarmov <pastarmovj@google.com>
Julian Phillips <julian@quantumfyre.co.uk>
Julian Tibble <julian.tibble@gmail.com>
Julie Qiu <julie@golang.org>
Julien Kauffmann <julien.kauffmann@freelan.org>
Julien Salleyron <julien.salleyron@gmail.com>
Julien Schmidt <google@julienschmidt.com>
Julio Montes <julio.montes@intel.com>
Jun Zhang <jim.zoumo@gmail.com>
Junchen Li <junchen.li@arm.com>
Junda Liu <junda@CELER.network>
Jungho Ahn <jhahn@google.com>
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>
Ken Sedgwick <ken@bonsai.com>
Ken Thompson <ken@golang.org>
Kenichi Tsunokawa <kenichi.tsunokawa@gmail.com>
Kenji Kaneda <kenji.kaneda@gmail.com>
Kenji Yano <kenji.yano@gmail.com>
Kenneth Shaw <kenshaw@gmail.com>
Kenny Grant <kennygrant@gmail.com>
Kensei Nakada <handbomusic@gmail.com>
Kenta Mori <zoncoen@gmail.com>
Kerollos Magdy <kerolloz@yahoo.com>
Ketan Parmar <ketanbparmar@gmail.com>
Kevan Swanberg <kevswanberg@gmail.com>
Kevin Ballard <kevin@sb.org>
Kevin Burke <kev@inburke.com>
Kevin Gillette <extemporalgenome@gmail.com>
Kevin Kirsche <kev.kirsche@gmail.com>
Kevin Klues <klueska@gmail.com> <klueska@google.com>
Kevin Malachowski <chowski@google.com>
Kevin Parsons <kevpar@microsoft.com>
Kevin Ruffin <kruffin@gmail.com>
Kevin Vu <kevin.m.vu@gmail.com>
Kevin Zita <bleedgreenandgold@gmail.com>
Keyan Pishdadian <kpishdadian@gmail.com>
Keyuan Li <keyuanli123@gmail.com>
Kezhu Wang <kezhuw@gmail.com>
Khosrow Moossavi <khos2ow@gmail.com>
Kieran Colford <kieran@kcolford.com>
Kim Shrier <kshrier@racktopsystems.com>
Kim Yongbin <kybinz@gmail.com>
Kir Kolyshkin <kolyshkin@gmail.com>
Kirill Korotaev <kirillx@gmail.com>
Kirill Motkov <Motkov.Kirill@gmail.com>
Kirill Smelkov <kir@nexedi.com>
Kirill Tatchihin <kirabsuir@gmail.com>
Kirk Han <kirk91 han@gmail.com>
Kirklin McDonald <kirklin.mcdonald@gmail.com>
KJ Tsanaktsidis <ktsanaktsidis@zendesk.com>
Klaus Post <klauspost@gmail.com>
Kodie Goodwin <kodiegoodwin@gmail.com>
Koichi Shiraishi <zchee.io@gmail.com>
Koki Ide <niconegoto@yahoo.co.jp>
Koki Tomoshige <tomocy.dev@gmail.com>
Komu Wairagu <komuw05@gmail.com>
Konstantin <konstantin8105@gmail.com>
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>
Koya IWAMURA <kiwamura0314@gmail.com>
Lily Chung <lilithkchung@gmail.com>
Lingchao Xin <douglarek@gmail.com>
Lion Yang <lion@aosc.xyz>
Liz Rice <liz@lizrice.com>
Lloyd Dewolf <foolswisdom@gmail.com>
Lorenz Bauer <lmb@cloudflare.com>
Lorenz Brun <lorenz@brun.one>
Lorenz Nickel <mail@lorenznickel.de>
Lorenzo Masini <ruuginoso@develer.com>
Lorenzo Stoakes <lstoakes@gmail.com>
Louis Kruger <louisk@google.com>
Luan Santos <cfcluan@gmail.com>
Lubomir I. Ivanov <neolit123@gmail.com>
Luca Bruno <luca.bruno@coreos.com>
Luca Greco <luca.greco@alcacoop.it>
Luca Spiller <luca@stackednotion.com>
Lucas Bremgartner <lucas.bremgartner@gmail.com>
Lucas Clemente <lclemente@google.com>
Lucien Stuker <lucien.stuker@gmail.com>
Lucio De Re <lucio.dere@gmail.com>
Ludi Rehak <ludi317@gmail.com>
Luigi Riefolo <luigi.riefolo@gmail.com>
Luit van Drongelen <luitvd@gmail.com>
Luka Zakrajek <tr00.g33k@gmail.com>
Luka Zitnik <luka.zitnik@gmail.com>
Lukasz Milewski <lmmilewski@gmail.com>
Luke Champine <luke.champine@gmail.com>
Luke Curley <qpingu@gmail.com>
Luke Granger-Brown <git@lukegb.com>
Luke Young <bored-engineer@users.noreply.github.com>
Luna Duclos <luna.duclos@palmstonegames.com>
Luuk van Dijk <lvd@golang.org> <lvd@google.com>
Lyle Franklin <lylejfranklin@gmail.com>
Lynn Boger <laboger@linux.vnet.ibm.com>
Ma Peiqi <mapeiqi2017@gmail.com>
Maarten Bezemer <maarten.bezemer@gmail.com>
Maciej Dbski <maciejd@gmail.com>
Madhu Rajanna <madhupr007@gmail.com>
Magnus Hiie <magnus.hiie@gmail.com>
Mahdi Hosseini Moghaddam <seyed.mahdi.hosseini.moghaddam@ibm.com>
Maia Lee <maia.lee@leftfieldlabs.com>
Maicon Costa <maiconscosta@gmail.com>
Mak Kolybabi <mak@kolybabi.com>
Maksym Trykur <maksym.trykur@gmail.com>
Mal Curtis <mal@mal.co.nz>
Manfred Touron <m@42.am>
Manigandan Dharmalingam <manigandan.jeff@gmail.com>
Manish Goregaokar <manishmail@gmail.com>
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>
Mansour Rahimi <rahimi.mnr@gmail.com>
Manu Garg <manugarg@google.com>
Manu S Ajith <neo@codingarena.in>
Manuel Mendez <mmendez534@gmail.com>
Marat Khabibullin <marat.khabibullin@jetbrains.com>
Marc Sanmiquel <marcsanmiquel@gmail.com>
Marc Weistroff <marc@weistroff.net>
Marc-Antoine Ruel <maruel@chromium.org>
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>
Marcel van Lohuizen <mpvl@golang.org>
Marcelo Cantos <marcelo.cantos@gmail.com>
Marcelo E. Magallon <marcelo.magallon@gmail.com>
Marco Gazerro <gazerro@open2b.com>
Marco Hennings <marco.hennings@freiheit.com>
Marcus Weiner <marcus.weiner@gmail.com>
Marcus Willock <crazcalm@gmail.com>
Marga Manterola <marga@google.com>
Mariano Cano <mariano@smallstep.com>
Marin Bai <marin.basic02@gmail.com>
Mario Arranz <marioarranzr@gmail.com>
Marius A. Eriksen <marius@grailbio.com>
Marius Nuennerich <mnv@google.com>
Mark Adams <mark@markadams.me>
Mark Bucciarelli <mbucc@gmail.com>
Mark Dain <mark@markdain.net>
Mark Glines <mark@glines.org>
Mark Harrison <markhar@google.com>
Mark Percival <m@mdp.im>
Mark Pulford <mark@kyne.com.au>
Mark Rushakoff <mark.rushakoff@gmail.com>
Mark Ryan <mark.d.ryan@intel.com>
Mark Severson <miquella@gmail.com>
Mark Theunissen <mark.theunissen@gmail.com>
Mark Villacampa <m@markvillacampa.com>
Mark Wolfe <mark@wolfe.id.au>
Mark Zavislak <zavislak@google.com>
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>
Marko Kevac <marko@kevac.org>
Marko Kungla <marko.kungla@gmail.com>
Marko Mikulicic <mkm@google.com>
Marko Mudrinic <mudrinic.mare@gmail.com>
Marko Tiikkaja <marko@joh.to>
Markus Duft <markus.duft@salomon.at>
Markus Sonderegger <marraison@gmail.com>
Markus Zimmermann <zimmmski@gmail.com>
Marten Seemann <martenseemann@gmail.com>
Martin Asquino <martin.asquino@gmail.com>
Martin Bertschler <mbertschler@gmail.com>
Martin Garton <garton@gmail.com>
Martin Habbecke <marhab@google.com>
Martin Hamrlé <martin.hamrlé@gmail.com>
Martin Hoefling <martin.hoefling@gmx.de>
Martin Kreichgauer <martinkr@google.com>
Martin Kunc <martinkunc@users.noreply.github.com>
Martin Lindhe <martin.j.lindhé@gmai.com>
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>
Martin Neubauer <m.ne@gmx.net>
Martin Olsen <github.com@martinolsen.net>
Martin Olsson <martin@minimum.se>
Martin Probst <martin@probst.io>
Martin Sucha <antz.sk+git@gmail.com>
Martin Tournoij <martin@arp242.net>
Martin Sipenko <martins.sipenko@gmail.com>
Martynas Budrinas <mabu@google.com>
Marvin Stenger <marvin.stenger94@gmail.com>
Marwan Sulaiman <marwan.sulaiman@work.co>
Maryan Hratson <gmarik@gmail.com>
Masahiro Furudate <masahiro.furudate@gmail.com>
Masahiro Wakame <vvakame@gmail.com>
Masaki Yoshida <yoshida.masaki@gmail.com>
Masaya Watanabe <sfbgwm30@gmail.com>
Mat Byczkowski <mbyczkowski@gmail.com>
Mat Ryer <thatmatryer@gmail.com>
Mt Gulys <mgulyas86@gmail.com>
Matej Bao <matejbaco@gmail.com>
Mateus Amin <mateus.amin@gmail.com>
Mateusz Czapliski <czapkofan@gmail.com>
Matheus Alcantara <matheussilv97@gmail.com>
Mathias Beke <git@denbeke.be>
Mathias Hall-Andersen <mathias@hall-andersen.dk>
Mathias Leppich <mleppich@muhqu.de>
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>
Matt Aimonetti <mattaimonetti@gmail.com>
Matt Blair <me@matthewblair.net>
Matt Bostock <matt@mattbostock.com>
Matt Brown <mdbrown@google.com>
Matt Dee <mdee@hioscar.com>
Matt Drollette <matt@drollette.com>
Matt Harden <matt.harden@gmail.com>
Matt Jibson <matt.jibson@gmail.com>
Matt Joiner <anacrolix@gmail.com>
Matt Jones <mrjones@google.com>
Matt Juran <theadciet@gmail.com>
Matt Layher <mdlayher@gmail.com>
Mihail Minaev <minaev.mike@gmail.com>
Mikael Tillenius <miki42@gmail.com>
Mike Andrews <mra@xoba.com>
Mike Appleby <mike@app.leby.org>
Mike Danese <mikedianese@gmail.com>
Mike Houston <mike@kothar.net>
Mike Kabischev <kabischev@gmail.com>
Mike Rosset <mike.rosset@gmail.com>
Mike Samuel <mikesamuel@gmail.com>
Mike Solomon <msolo@gmail.com>
Mike Strosaker <strosake@us.ibm.com>
Mike Tsao <mike@sowbug.com>
Mike Wiacek <mjwiacek@gmail.com>
Mikhail Fesenko <proggga@gmail.com>
Mikhail Gusarov <dottedmag@dottedmag.net>
Mikhail Panchenko <m@mihasya.com>
Miki Tebeka <miki.tebeka@gmail.com>
Mikio Hara <mikioh.mikioh@gmail.com>
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>
Mikoaj Baranowski <mikolajb@gmail.com>
Milan Knezevic <milan.knezevic@mips.com>
Milan Patel <bicelot3@gmail.com>
Milutin Jovanovic <jovanovic.milutin@gmail.com>
MinJae Kwon <mingrammer@gmail.com>
Miquel Sabat Sol <mikisabate@gmail.com>
Mirko Hansen <baaazen@gmail.com>
Miroslav Genov <mgenov@gmail.com>
Misty De Meo <mistydeleo@gmail.com>
Mohamed Attahri <mohamed@attahri.com>
Mohit Agarwal <mohit@sdf.org>
Mohit kumar Bajoria <mohitbajo36@gmail.com>
Mohit Verma <mohit.93@gmail.com>
Momchil Velikov <momchil.velikov@gmail.com>
Monis Khan <mkhan@redhat.com>
Monty Taylor <mordred@inaugust.com>
Moritz Fain <moritz@fain.io>
Moriyoshi Koizumi <mozo@mozo.jp>
Morten Siebuhr <sbhr@sbr.dk>
Mshe van der Sterre <moshevds@gmail.com>
Mostyn Bramley-Moore <mostyn@antipode.se>
Mrunal Patel <mrunalp@gmail.com>
Muhammad Falak R Wani <falakreyyaz@gmail.com>
Muhammad Hamza Farrukh <hamzafarrukh141@gmail.com>
Muhammed Uluylol <uluyol0@gmail.com>
Muir Manders <muir@mnd.rs>
Mukesh Sharma <sharma.mukesh439@gmail.com>
Mura Li <mura_li@castech.com.tw>
Mykhailo Lesyk <mikhail@lesyk.org>
Naman Aggarwal <aggarwal.nam@gmail.com>
Nan Deng <monnand@gmail.com>
Nao Yonashiro <owan.orisano@gmail.com>
Naoki Kanatani <k12naoki@gmail.com>
Natanael Copa <ncopa@mirantis.com>
Nate Wilkinson <nathanwilk7@gmail.com>
Nathan Cantelmo <n.cantelmo@gmail.com>
Nathan Caza <mastercactapus@gmail.com>
Nathan Dias <nathan.dias@orijtech.com>
Nathan Fiscaletti <nathan.fiscaletti@vrazo.com>
Nathan Humphreys <nkhumphreys@gmail.com>
Nathan John Youngman <nj@nathany.com>
Nathan Otterness <otternes@cs.unc.edu>
Nathan P Finch <nate.finch@gmail.com>
Nathan VanBenschoten <nvanbenschoten@gmail.com>
Nathan Youngman <git@nathany.com>
Nathan(yinian) Hu <nathanhu@google.com>
Nathaniel Cook <nvcook42@gmail.com>
Naveen Kumar Sangi <naveenkumarsangi@protonmail.com>
Neelilan Selvalingam <neelilan96@gmail.com>
Neelas Chandola <neelasch.98@gmail.com>
Nehal J Wani <nehaljw.kkd1@gmail.com>
Neil Lyons <nwjlyons@googlemail.com>
Neuman Vong <neuman.vong@gmail.com>
Neven Sajko <nsajko@gmail.com>
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>
Niall Sheridan <nsheridan@gmail.com>
Nic Day <nic.day@me.com>
Nicholas Katsaros <nick@nickkatsaros.com>
Nicholas Maniscalco <nicholas@maniscalco.com>
Nicholas Ng <nickng@nickng.io>
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>
Nicholas Sullivan <nicholas.sullivan@gmail.com>
Nicholas Waples <nwaples@gmail.com>
Nick Anthony <Liberatys@outlook.com>
Nick Cooper <nnvc@google.com>
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>
Nick Harper <nharper@google.com>
Nick Kubala <nkubala@gmail.com>
Nick Leli <nicholasleli@gmail.com>
Nick Miyake <nmiyake@users.noreply.github.com>
Nick Patavalis <nick.patavalis@gmail.com>
Nick Petroni <npetroni@cs.umd.edu>
Nick Robinson <nrobinson13@gmail.com>
Nick Smolin <nick27surgut@gmail.com>
Nicolas BRULEZ <n.brulez@gmail.com>
Nicolas Kaiser <nikai@nikai.net>
Nicolas Owens <mischief@offblast.org>
Osamu TONOMORI <osamingo@gmail.com>
zgr Kesim <oec-go@kesim.org>
Pablo Caderno <kaderno@gmail.com>
Pablo Lalloni <splalloni@gmail.com>
Pablo Rozas Larraondo <pablo.larraondo@anu.edu.au>
Pablo Santiago Blum de Aguiar <scorphus@gmail.com>
Padraig Kitterick <padraigkitterick@gmail.com>
Pallat Anchaleechamaikorn <yod.pallat@gmail.com>
Panos Georgiadis <pgeorgiadis@suse.de>
Pantelis Sampaziotis <psampaz@gmail.com>
Paolo Giarrusso <p.giarrusso@gmail.com>
Paolo Martini <mrtnpaolo@gmail.com>
Parker Moore <parkermoore@gmail.com>
Parminder Singh <parmsingh101@gmail.com>
Pascal Dierich <pascal@pascaldierich.com>
Pascal S. de Kloe <pascal@quies.net>
Paschalis Tsilias <paschalis.tsilias@gmail.com>
Pasi Thkp <pasi.tahkapaa@gmail.com>
Pat Moroney <pat@pat.email>
Patrick Barker <barkerp@vmware.com>
Patrick Crosby <patrick@stathat.com>
Patrick Gavlin <pgavlin@gmail.com>
Patrick Gundlach <gundlach@speedata.de>
Patrick Higgins <patrick.allen.higgins@gmail.com>
Patrick Jones <ithuriel@google.com>
Patrick Lee <pattyshack101@gmail.com>
Patrick Mzard <patrick@mezard.eu>
Patrick Mylund Nielsen <patrick@patrickmn.com>
Patrick Pelletier <pp.pelletier@gmail.com>
Patrick Riley <spfr@google.com>
Patrick Smith <pat42smith@gmail.com>
Patrik Lundin <patrik@sigterm.se>
Paul A Querna <paul.querna@gmail.com>
Paul Borman <borman@google.com>
Paul Boyd <boyd.paul2@gmail.com>
Paul Chang <paulchang@google.com>
Paul D. Weber <x0bdev@gmail.com>
Paul Davis <43160081+Pawls@users.noreply.github.com>
Paul E. Murphy <mrup@ibm.com>
Paul Forgey <paulf@tessier-ashpool.net>
Paul Hammond <paul@paulhammond.org>
Paul Hankin <paulhankin@google.com>
Paul Jolly <paul@myitcv.org.uk>
Paul Lalonde <paul.a.lalonde@gmail.com>
Paul M Furley <paul@paulfurley.com>
Paul Marks <pmarks@google.com>
Paul Meyer <paul.meyer@microsoft.com>
Paul Nasrat <pnaasrat@gmail.com>
Paul PISCUC <paul.piscuc@gmail.com>
Paul Querna <pquerna@apache.org>
Paul Rosania <paul.rosania@gmail.com>
Paul Ruest <pruest@gmail.com>
Paul Sbarra <Sbarra.Paul@gmail.com>
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>
Paul Tyng <paul@paultyng.net>
Paul van Brouwershaven <paul@vanbrouwershaven.com>
Paul Wankadia <junyer@oracle.com>
Paulo Casaretto <pcasaretto@gmail.com>
Paulo Flabiano Smorigo <pfsmorigo@linux.vnet.ibm.com>
Paulo Gomes <paulo.gomes.uk@gmail.com>
Pavel Paulau <pavel.paulau@gmail.com>
Pavel Zinovkin <pavel.zinovkin@gmail.com>
Pavlo Sumkin <ymkins@gmail.com>
Pawel Knap <pawlKnap88@gmail.com>
Pawel Szczur <filemon@oracle.com>
Pawe Szulik <pawl.szulik@intel.com>
Pei Xian Chee <luciolas1991@gmail.com>
Pei-Ming Wu <p408865@gmail.com>
Percy Wegmann <ox.to.a.cart@gmail.com>
Perry Abbott <perry.j.abbott@gmail.com>
Petar Dambovaliev <petar.atanassov.1987@gmail.com>
Petar Maymounkov <petarm@gmail.com>
Peter Armitage <peter.armitage@gmail.com>
Peter Bourgon <peter@bourgon.org>
Peter Collingbourne <pcc@gmail.com>
Peter Conerly <pconerly@gmail.com>
Peter Dotchev <dotchev@gmail.com>
Peter Froehlich <peter.hans.froehlich@gmail.com>
Peter Gonda <pgonda@gmail.com>
Peter Hoyes <pahoyes@gmail.com>
Peter Kleiweg <pkleiweg@xs4all.nl>
Peter McKenzie <petermck@gmail.com>
Peter Moody <pmoody@uber.com>
Peter Morjan <pmorjan@gmail.com>
Peter Mundy <go.peter.90@gmail.com>
Peter Nguyen <peter@mictis.com>
Peter Surnyi <speter.go1@gmail.com>
Peter Szab <pts@gmail.com>
Peter Szilgyi <peterke@gmail.com>
Peter Teichman <pteichman@fastly.com>
Peter Tseng <ptseng@squareup.com>
Peter Waldschmidt <peter@waldschmidt.com>
Peter Waller <peter.waller@gmail.com>
Peter Weinberger <pjw@golang.org>
Peter Williams <pwil3058@gmail.com>
Peter Wu <pwu@cloudflare.com>
Peter Zhang <i@ddatsh.com>
Petr Jedin <petr.jediny@gmail.com>
Petrica Voicu <pvoicu@paypal.com>
Phil Pearl <philip.j.r.pearl@gmail.com>
Phil Pennock <pdp@golang.org>
Philip Brgesen <philip.borgesen@gmail.com>
Philip Brown <phil@bolthole.com>
Philip Hofer <phofer@umich.edu>
Philip K. Warren <pkwarren@gmail.com>
Philip Nelson <me@pnelson.ca>
Philipp Stephani <phst@google.com>
Philip Campbell <15082+phille@users.noreply.github.com>
Pierre Carru <pierre.carru@esnard.com>
Pierre Durand <pierre.durand@gmail.com>
Pierre Prinetti <pierreprinetti@gmail.com>
Pierre Rouillon <pierre.rouillon@gmail.com>
Piers <google@hellopiers.pro>
Pieter Droogendijk <pieter@binky.org.uk>
Pietro Gagliardi <pietro10@mac.com>
Piyush Mishra <piyush@codeitout.com>
Plekhanov Maxim <kishtatix@gmail.com>
Poh Zi How <poh.zihow@gmail.com>
Polina Osadcha <polliosa@gmail.com>
Pontus Leitzler <leitzler@gmail.com>
Povilas Versockas <p.povilas@gmail.com>
Prasanna Swaminathan <prasanna@mediamath.com>
Prashant Agrawal <prashant.a.vjti@gmail.com>
Prashant Varanasi <prashant@prashantv.com>
Praveen Kumar <praveen+git@kumar.in>
Pravendra Singh <hackpravj@gmail.com>
Preetam Jinka <pj@pjebs.com.au>
Pure White <wu.purewhite@gmail.com>
Qais Patankar <qaisip@gmail.com>
Quixuan Zhu <slsh1022@gmail.com>
Quan Tran <qued.quan@gmail.com>
Quan Yong Zhai <qyzhai@gmail.com>
Quentin Perez <qperez@ocs.online.net>
Quentin Renard <contact@asticode.com>
Quentin Smith <quentin@golang.org>
Quey-Liang Kao <s101062801@m101.nthu.edu.tw>
Quin Muntal <quinnmuntal@gmail.com>
Quinn Slack <sqs@sourcegraph.com>
Quinten Yearsley <qyearsley@chromium.org>
Quoc-Viet Nguyen <afelion@gmail.com>
Radek Simko <radek.simko@gmail.com>
Radek Sohlich <sohlich@gmail.com>
Radu Berinde <radu@cockroachlabs.com>
Rob Pike <r@golang.org>
Robert Ayrapetyan <robert.ayrapetyan@gmail.com>
Robert Daniel Kortschak <dan.kortschak@adelaide.edu.au> <dan@kortschak.io>
Robert Dinu <r@varp.se>
Robert Figueiredo <robfig@gmail.com>
Robert Griesemer <gri@golang.org>
Robert Hencke <robert.hencke@gmail.com>
Robert Iannucci <iannucci@gmail.com>
Robert Kuska <kuska@gmail.com>
Robert Obryk <robryk@gmail.com>
Robert Sesek <rsesek@gmail.com>
Robert Snedegar <roberts@google.com>
Robert Stepanek <robert.stepanek@gmail.com>
Robert van Gent <rvangent@gmail.com>
Robert-Andr Mauchin <zebob.m@gmail.com>
Roberto Clapis <robclap8@gmail.com>
Roberto Selbach <roberto@selbach.ca>
Robin Eklind <r.eklind.87@gmail.com>
Robin Zhong <robin@robinzhong.ca>
Rodolfo Carvalho <rhcarvalho@gmail.com>
Rodolfo Rodriguez <rodolfobgibson@gmail.com>
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>
Roger Pau Monn <royger@gmail.com>
Roger Peppe < rogpeppe@gmail.com>
Rohan Challa < rohan@golang.org>
Rohan Verma < rohanverma2004@gmail.com>
Rohith Ravi < entombedvirus@gmail.com>
Roland Illig < roland.illig@gmx.de>
Roland Shoemaker < rolandshoemaker@gmail.com>
Romain Baugue < romain.baugue@elwinar.com>
Roman Budnikov < romanyx90@yandex.ru>
Roman Kollr < roman.kollar.0@gmail.com>
Roman Shchekin < mrqtros@gmail.com>
Ron Hashimoto < mail@h2so5.net>
Ron Minnich < rminnich@gmail.com>
Ronnie Ebrin < ebrin.ronnie@protonmail.com>
Ross Chater < rdchater@gmail.com>
Ross Kinsey < rosskinsey@gmail.com>
Ross Light < light@google.com> < rlightr2@gmail.com>
Ross Smith II < ross@smithii.com>
Rowan Marshall < rowanajmarshall@gmail.com>
Rowan Worth < sqweek@gmail.com>
Rudi Kramer < rudi.kramer@gmail.com>
Rui Ueyama < ruui@gmail.com>
Ruixin Bao < ruixin.bao@ibm.com>
Ruslan Nigmatullin < elessar@dropbox.com>
Russ Cox < rsc@golang.org>
Sasha Lionheart <lionhearts@google.com>
Sasha Sobol <sasha@scaledinference.com>
Scott Barron <scott.barron@github.com>
Scott Bell <scott@sctsm.com>
Scott Crunkleton <crunk1@gmail.com>
Scott Ferguson <scottwferg@gmail.com>
Scott Lawrence <bytbox@gmail.com>
Scott Mansfield <smansfield@netflix.com>
Scott Ragan <ragansa@fb.com>
Scott Schwartz <scotts@golang.org>
Scott Van Woudenberg <scottvw@google.com>
Sean Burford <sburford@google.com>
Sean Chen <oohcode@gmail.com>
Sean Chittenden <seane@joyent.com>
Sean Christopherson <sean.j Christopherson@intel.com>
Sean Dolphin <sean.Dolphin@kpcompass.com>
Sean Harger <sharger@google.com>
Sean Hildebrand <seanwildebrand@gmail.com>
Sean Liao <seankhliao@gmail.com>
Sean Rees <sean@erifax.org>
Sebastiaan van Stijn <github@gone.nl>
Sebastian Chlopecki <sebsebmc@gmail.com>
Sebastian Kinne <skinne@google.com>
Sebastian Schmidt <yath@google.com>
Sebastien Binet <seb.binet@gmail.com>
Sbastien Paolacci <sebastien.paolacci@gmail.com>
Sebastian Williams-Wynn <sebastien@cytora.com>
Segev Finer <segev208@gmail.com>
Seiji Takahashi <timaki.st@gmail.com>
Sergei Lemeshkin <sergeilem@gmail.com>
Sergei Skorobogatov <skorobo@rambler.ru>
Sergei Zagurskii <gvozdoder@gmail.com>
Sergey 'SnakE' Gromov <snake.scaly@gmail.com>
Sergey Arseev <sergey.arseev@intel.com>
Sergey Dobrodey <sergey.dobrodey@synesis.ru>
Sergey Frolov <sfrolov@google.com>
Sergey Glushchenko <g sergey@gmail.com>
Sergey Ivanov <ser1325@gmail.com>
Sergey Lukjanov <me@slukjanov.name>
Sergey Mishin <sergeymishine@gmail.com>
Sergey Mudrik <sergey.mudrik@gmail.com>
Sergey Semin <gray12511@gmail.com>
Sergey Yanykin <syanykin@ozon.ru>
Sergio Luis O. B. Correia <sergio@correia.cc>
Sergiusz Bazanski <bazanski@gmail.com>
Serhat Giydiren <serhat giydiren@gmail.com>
Serhii Aheienko <serhii.aheienko@gmail.com>
Seth Hoenig <seth.a.hoenig@gmail.com>
Sparrow Li <liyuancylx@gmail.com>
Spencer Kocot <spencerkocot@gmail.com>
Spencer Nelson <s@spenczar.com>
Spencer Tung <spencertung@google.com>
Spring Mc <heresy.mc@gmail.com>
Srdjan Petrovic <spetrovic@gmail.com>
Sridhar Venkatakrishnan <sridhar@laddoo.net>
Srinidhi Kaushik <shrinidhi.kaushik@gmail.com>
StalkR <stalkr@stalkr.net>
Stan Hu <stanhu@gmail.com>
Stan Schwerly <stan@schwerly.com>
Stanislav Afanasev <php.progger@gmail.com>
Steeve Morin <steeve.morin@gmail.com>
Stefan Baebler <sbaebler@outbrain.com>
Stefan Nilsson <snisson@nada.kth.se> <trolleriprofessorn@gmail.com>
Stepan Shabalin <neverliberty@gmail.com>
Stephan Klatt <stephan.klatt@gmail.com>
Stephan Renatus <srenatus@chef.io>
Stephan Zuercher <zuercher@gmail.com>
Stphane Travostino <stephane.travostino@gmail.com>
Stephen Lewis <stephen@sock.org.uk>
Stephen Lu <steuhs@users.noreply.github.com>
Stephen Ma <stephenm@golang.org>
Stephen McQuay <stephen@mcquay.me>
Stephen Searles <stephens2424@gmail.com>
Stephen Weinberg <stephen@q5comm.com>
Steve Francia <spf@golang.org>
Steve Gilbert <stevegilbert23@gmail.com>
Steve LoFurno <slofurno@gmail.com>
Steve McCoy <mccoyst@gmail.com>
Steve Mynott <steve.mynott@gmail.com>
Steve Newman <snewman@google.com>
Steve Phillips <elimisteve@gmail.com>
Steve Streeting <steve@stevestreeting.com>
Steve Traut <straut@google.com>
Steven Buss <sbuss@gmail.com>
Steven Elliot Harris <seharris@gmail.com>
Steven Erenst <stevenerenst@gmail.com>
Steven Hartland <steven.hartland@multiplay.co.uk>
Steven Littiebrant <imgroxx@gmail.com>
Steven Maude <git@stevenmaude.co.uk>
Steven Wilkin <stevenwilkin@gmail.com>
Stuart Jansen <sjansen@buscaluz.org>
Subham Sarkar <sarkar.subhams2@gmail.com>
Sue Spence <virtuallysue@gmail.com>
Sugu Sougoumarane <ssougou@gmail.com>
Suharsh Sivakumar <suharsh@google.com>
Sukrit Handa <sukrit.handa@utoronto.ca>
Sunny <me@darkowlzz.space>
Suriyaa Sundararuban <suriyaasundararuban@gmail.com>
Suyash <dextrous93@gmail.com>
Suzy Mueller <suzmue@golang.org>
Sven Almgren <sven@tras.se>
Sven Blumenstein <svbl@google.com>
Sven Taute <sven.taute@gmail.com>
Sylvain Zimmer <sylvain@sylvainzimmer.com>
Syohei YOSHIDA <syohex@gmail.com>
Szabolcs Nagy <nsz@port70.net>
Taavi Kivisik <taavi.kivisik@gmail.com>
Tad Fisher <tadfisher@gmail.com>
Tad Glines <tad.glines@gmail.com>
Tadas Valiukas <tadovas@gmail.com>
Tadeo Kondrak <me@tadeo.ca>
Taesu Pyo <pyotaesu@gmail.com>
Tai Le <letientai299@gmail.com>
Taj Khattra <taj.khattra@gmail.com>
Takashi Matsuo <tmatsuo@google.com>
Takashi Mima <tks.m1205@gmail.com>
Takayoshi Nishida <takayoshi.nishida@gmail.com>
Takeshi YAMANASHI <9.nashi@gmail.com>
Takuto Ikuta <tikuta@google.com>
Takuya Ueda <uedatakuya@gmail.com>
Tal Shprecher <tshprecher@gmail.com>
Tams Gulcsi <tgulacsi78@gmail.com>
Tamir Duberstein <tamird@gmail.com>
Tao Qingyun <qingyunha@gmail.com>
Tao Shen <shentaoskyking@gmail.com>
Tao Wang <twang2218@gmail.com>
Tarmigan Casebolt <tarmigan@gmail.com>
Taro Aoki <aizu.s1230022@gmail.com>
Taru Karttunen <taruti@taruti.net>
Tatsuhiro Tsujikawa <tatsuhiro.t@gmail.com>
Tatsuya Kaneko <m.ddotx.f@gmail.com>
Taufiq Rahman <taufiqrx8@gmail.com>
Teague Cole <tnc1443@gmail.com>
Ted Kornish <golang@tedkornish.com>
Tejasvi Nareddy <tejunareddy@gmail.com>
Terin Stock <terinjokes@gmail.com>
Terrel Shumway <gopher@shumway.us>
Tetsuo Kiso <tetsuokiso9@gmail.com>
Than McIntosh <thanm@google.com>
Thanabodee Charoenpiriyakij <wingyminus@gmail.com>
Thanatat Tamtan <acoshift@gmail.com>
The Hatsune Daishi <nao20010128@gmail.com>
Thiago Avelino <t@avelino.xxx>
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>
Thom Wiggers <thom@thomwiggers.nl>
Thomas Alan Copeland <talan.copeland@gmail.com>
Thomas Bonfort <thomas.bonfort@gmail.com>
Thomas Bouldin <inlined@google.com>
Thomas Bruyelle <thomas.bruyelle@gmail.com>
Thomas Bushnell, BSG <tbushnell@google.com>
Thomas de Zeeuw <thomasdezeeuw@gmail.com>
Thomas Desrosiers <thomasdesr@gmail.com>
Thomas Habets <habets@google.com>
Thomas Kappler <tkappler@gmail.com>
Thomas Meson <zllak@hycik.org>
Thomas Symborski <thomas.symborski@gmail.com>
Thomas Wanielista <tomwans@gmail.com>
Thorben Krueger <thorben.krueger@gmail.com>
Thordur Bjornsson <thorduri@secnorth.net>
Tiago Queiroz <contato@tiago.eti.br>
Tianji Wu <the729@gmail.com>
Tianon Gravi <admwiggin@gmail.com>
Tilman Dilo <tilman.dilo@gmail.com>
Tim Cooijmans <timcooijmans@gmail.com>
Tim Cooper <tim.cooper@layeh.com>
Tim Ebringer <tim.ebringer@gmail.com>
Tim Heckman <t@heckman.io>
Tim Henderson <tim.tadh@gmail.com>
Tim Hockin <thockin@google.com>
Tim King <taking@google.com>
Tim Mhlmann <muhlemmer@gmail.com>
Tim Swast <swast@google.com>
Tim Wright <tenortim@gmail.com>
Tim Xu <xiaoxubeii@gmail.com>
Timmy Douglas <timmyd983@gmail.com>
Timo Savola <timo.savola@gmail.com>
Timo Truyts <alkaloid.btx@gmail.com>
Timothy Gu <timothygu99@gmail.com>
Timothy Studd <tim@timstudd.com>
Tipp Moseley <tipp@google.com>
Tiwei Bie <tiwei btw @ antgroup.com>
Tobias Assarsson <tobias.assarsson@gmail.com>
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@gmail.com>
Tobias Klauser <tklauser@distanz.ch>
Toby Burress <kurin@gmail.com>
Todd Kulesza <kulesza@gmail.com>
Todd Neal <todd@meil.org>
Todd Wang <toddwang@gmail.com>
Tom Anthony <git@tomanthony.co.uk>
Tom Bergan <tombergan@gmail.com>
Tom Heng <zhm20070928@gmail.com>
Tom Lanyon <tomlanyon@gmail.com>
Tom Levy <tomlevy93@gmail.com>
Tom Limoncelli <tal@whatexit.org>
Tom Linford <tomlinford@gmail.com>
Tom Panton <tom@tomandtally.co.uk>
Tom Parkin <tom.parkin@gmail.com>
Tom Payne <twpayne@gmail.com>
Tom Szymanski <tgs@google.com>
Tom Thorogood <me+google@tom thorogood.co.uk>
Tom Wilkie <tom@weave.works>
Tom Zierbock <tomzierbock@gmail.com>
Tomas Dabasinskas <tomas@dabasinskas.net>
Tommy Schaefer <tommym schaefer@teecom.com>
Tomohiro Kusumoto <zabio1192@gmail.com>
Tomoya Ishizaki <zaq.tomo@gmail.com>
Tonis Tiigi <tonistiigi@gmail.com>
Tony Reix <tony.reix@bull.net>
Tony Walker <walkert.uk@gmail.com>
Tooru Takahashi <tooru.takahashi134@gmail.com>
Tor Andersson <tor.andersson@gmail.com>
Torben Schinke <storben.schinke@neots.de>
Tormod Erevik Lea <tormodlea@gmail.com>
Toshihiro Shiino <shiino.toshihiro@gmail.com>
Toshiki Shima <hayabusa1419@gmail.com>
Totoro W <tw19881113@gmail.com>
Travis Bischel <travis.bischel@gmail.com>
Travis Cline <travis.cline@gmail.com>
Trevor Strohman <trevor.strohman@gmail.com>
Trey Lawrence <lawrence.trey@gmail.com>
Trey Roessig <strey.roessig@gmail.com>
Trey Tacon <ttacon@gmail.com>
Tristan Amini <taminif01@ca.ibm.com>
Tristan Colgate <tcolgate@gmail.com>
Tristan Ooohry <ooohry@gmail.com>
Tristan Rice <rice@fn.ic>
Troels Thomsen <troels@thomsen.io>
Trong Bui <trong.buiquoc@gmail.com>
Trung Nguyen <trung.n.k@gmail.com>
Tsuji Daishiro <dram.dt.shonan@gmail.com>
Tudor Golubenco <tudor.g@gmail.com>
Tugdual Saunier <tugeual.sau nier@gmail.com>
Tuo Shan <sturbo89@gmail.com> <shantuuo@google.com>
Tyler Bui-Pulsulich <tpulsulich@google.com>
Tyler Bunnell <tylerbunnell@gmail.com>
Tyler Treat <ttreat31@gmail.com>
Tyson Andre <tysonandre775@gmail.com>
Tzach Shabtay <tzachshabtay@gmail.com>
Tzu-Chiao Yeh <su3g4284z06y7@gmail.com>
Tzu-Jung Lee <roylee17@currant.com>
Udalov Max <re.udalov@gmail.com>
Ugorji Nwoke <ugorji@gmail.com>
Ulf Holm Nielsen <doktor@dyregod.dk>
Ulrich Kunitz <uli.kunitz@gmail.com>
Umang Parmar <umangiparmar@gmail.com>
Uriel Mangado <uriel@berlinblue.org>
Urvil Patel <pateluvt38@gmail.com>
Utkarsh Dixit <53217283+utkarsh-extc@users.noreply.github.com>
Uttam C Pawar <uttam.c.pawar@intel.com>
Vadim Grek <vadimprog@gmail.com>
Vadim Vygonets <unixdj@gmail.com>
Val Polouchkine <vpolouch@justin.tv>
Valentin Vidic <vvidic@valentin-vidic.from.hr>
Vee Zhang <veezhang@126.com> <veezhang@gmail.com>
Vega Garcia Luis Alfonso <vegacom@gmail.com>
Venil Noronha <veninl@vmware.com>
Veselkov Konstantin <kostozyb@gmail.com>
Viacheslav Poturayev <vearutop@gmail.com>
Victor Chudnovsky <vchudnov@google.com>
Victor Michel <victor@optimyze.cloud>
Victor Vrantchan <vrancean+github@gmail.com>
Vignesh Ramachandra <vickyramachandra@gmail.com>
Vikas Kedia <vikask@google.com>
Ville Skytt <ville.skytta@iki.fi>
Vincent Ambo <tazjin@googlemail.com>
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>
Vincent Vanackere <vincent.vanackere@gmail.com>
Vinu Rajashekhar <vinutheraj@gmail.com>
Vish Subramanian <vish@google.com>
Vishvananda Ishaya <vishvananda@gmail.com>
Visweswara R <r.visweswara@gmail.com>
Vitaly Zdanevich <zdanevich.vitaly@ya.ru>
Vitor De Mario <vitordemario@gmail.com>
Vivek Sekhar <vsekhch@gmail.com>
Vivek V <iamvivekv96@gmail.com>
Vivian Liang <vliang88@gmail.com>
Vlad Krasnov <vlad@cloudflare.com>
Vladimir Evgrafov <evgrafof.vladimir@gmail.com>
Vladimir Kovpak <cn007b@gmail.com>
Vladimir Kuzmin <vkuzmin@uber.com>
Vladimir Mihaileno <vladimir.webdev@gmail.com>
Vladimir Nikishenko <vova616@gmail.com>
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>
Vladimir Varankin <nek.narqo@gmail.com>
Vojtech Bocek <vbocek@gmail.com>
Volker Dobler <dr.volker.dobler@gmail.com>
Volodymyr Papirotski <vpaprots@ca.ibm.com>
W. Trevor King <wking@tremily.us>
Yang Tian <linuxty@gmail.com>
Yann Hodique <yhodique@google.com>
Yann Kerherv <yann.kerherv@gmail.com>
Yann Salan <yannsalaun@gmail.com>
Yannic Bonenberger <contact@yannic-bonenberger.com>
Yao Zhang <lunaria21@gmail.com>
Yaron de Leeuw <jarondl@Google.com>
Yaroslav Vorobiov <yar.vorobiov@gmail.com>
Yasha Bubnov <girokompass@gmail.com>
Yasser Abdolmaleki <yasser@yasser.ca>
Yasuhiro Goto <mattn.jp@gmail.com>
Yasuhiro Matsumoto <mattn.jp@gmail.com>
Yasuyuki Oka <yasuyuk@gmail.com>
Yazhen Shunnar <yazhen.shunnar@gmail.com>
Yestin Sun <ylh@pdx.edu>
Yesudeep Mangalapilly <yesudeep@Google.com>
Yissakhar Z. Beck <yissakhar.beck@gmail.com>
Yo-An Lin <yoanlin93@gmail.com>
Yohei Takeda <yo.tak0812@gmail.com>
Yongjian Xu <si3dmaster@gmail.com>
Yorman Arias <cixtords@gmail.com>
Yoshiyuki Kanno <nekotaro9@gmail.com> <yoshiyuki.kanno@stoic.co.jp>
Yoshiyuki Mineo <yoshiyuki.mineo@gmail.com>
Yosuke Akatsuka <yosuke.akatsuka@gmail.com>
Yu Heng Zhang <annita.zhang@cn.ibm.com>
Yu Xuan Zhang <zyxsh@cn.ibm.com>
Yuichi Kishimoto <yk2220s@gmail.com>
Yuichi Nishiwaki <yuichi.nishiwaki@gmail.com>
Yuji Yaginuma <yuji.yaginuma@gmail.com>
Yuki OKUSHI <huyuumi.dev@gmail.com>
Yuki Yugui Sonoda <yugui@Google.com>
Yukihiro Nishinaka <helpinai@gmail.com>
Yury Smolsky <yury@smolsky.by>
Yusuke Kagiwada <block.rxckin.beats@gmail.com>
Yuusei Kuwana <kuwana@kumama.org>
Yuval Pavel Zholkover <paulzhol@gmail.com>
Yves Junqueira <yvesj@Google.com> <yves.junqueira@gmail.com>
Zac Bergquist <zbergquist99@gmail.com>
Zach Bintliff <zbintliff@gmail.com>
Zach Gershman <zachgersh@gmail.com>
Zach Jones <zachj1@gmail.com>
Zachary Amsden <zach@thundertoken.com>
Zachary Gershman <zgershman@pivotal.io>
Zak <zrjknill@gmail.com>
Zakatell Kanda <hi@zkanda.io>
Zellyn Hunter <zellyn@squareup.com> <zellyn@gmail.com>
Zev Goldstein <zev.goldstein@gmail.com>
Zhang Boyang <zhangboyang.id@gmail.com>
Zheng Dayu <davidzheng23@gmail.com>
Zheng Xu <zheng.xu@arm.com>
Zhengyu He <hzy@google.com>
Zhongpeng Lin <zplin@uber.com>
Zhongtao Chen <chenzhongtao@126.com>
Zhongwei Yao <zhongwei.yao@arm.com>
Zhou Peng <p@ctriple.cn>
Ziad Hatahet <hatahet@gmail.com>
Ziheng Liu <lzhfromustc@gmail.com>
Zorion Arrizabalaga <zorionk@gmail.com>
Zyad A. Ali <zyad.ali.me@gmail.com>
<a.maksadbek@gmail.com>
<max.faceless.frei@gmail.com>
<hagen1778@gmail.com>
<thunyk@gmail.com>
<faxriddinjon@gmail.com>
<zs349596@gmail.com>
<bronze1man@gmail.com>

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1.107 x-text v0.3.3

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1.109 pcre 8.39 12

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Alain Vongsouvanhalainv <alainv@google.com>
Andrew Gerrand <adg@golang.org>
Brad Fitzpatrick <bradfitz@golang.org>
Eric Koleda <ekoleda+devrel@googlers.com>
Francesc Campoy <campoy@golang.org>
Garrick Evans <garrick@google.com>
Glenn Lewis <gmlewis@google.com>
Ivan Krasin <krasin@golang.org>
Jason Hall <jasonhall@google.com>
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Matthew Dolan <dolan@lightstep.com>
Matthew Whisenhunt <matt.whisenhunt@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
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1.116 go-openapi-swag v0.19.5

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  jar/org/apache/commons/digester/Rules.java
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  jar/org/apache/commons/digester/plugins/PluginInvalidInputException.java
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  jar/org/apache/commons/digester/Substitutor.java
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  jar/org/apache/commons/digester/plugins/PluginContext.java
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/* $Id: DigesterLoadingException.java 155412 2005-02-26 12:58:36Z dirkv $ *

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jar/org/apache/commons/digester/plugins/InitializableRule.java
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jar/org/apache/commons/digester/ObjectParamRule.java
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jar/org/apache/commons/digester/RuleSet.java
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  jar/org/apache/commons/digester/xmlrules/DigesterRuleParser.java
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* /opt/cola/permits/1135953136_1613641205.61/0/commons-digester-1-7-sources-1-jar/org/apache/commons/digester/plugins/RulesFactory.java
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* /opt/cola/permits/1135953136_1613641205.61/0/commons-digester-1-7-sources-1-jar/org/apache/commons/digester/substitution/package.html
* /opt/cola/permits/1135953136_1613641205.61/0/commons-digester-1-7-sources-1-jar/org/apache/commons/digester/package.html
* /opt/cola/permits/1135953136_1613641205.61/0/commons-digester-1-7-sources-1-jar/org/apache/commons/digester/xmlrules/package.html
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  jar/org/apache/commons/digester/plugins:strategies/FinderFromResource.java

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  jar/org/apache/commons/digester/xmlrules/DigesterRulesSource.java

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  jar/org/apache/commons/digester/SetRootRule.java
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2015/06/29, jvanzyl, Jason van Zyl, jason@takari.io
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2015/09/18, worsht, Rajiv Subrahmanyam, rajiv.public@gmail.com
2015/09/24, HSorensen, Henrik Sorensen, henrik.b.sorensen@gmail.com
2015/10/06, brwnml, Bryan Wilhelm, bryan.wilhelm@microsoft.com
2015/10/08, fedotovalex, Alex Fedotov, me@alexfedotov.com
2015/10/12, KvanTTT, Ivan Kochurkin, ivan.kochurkin@gmail.com
2015/10/21, martin-probst, Martin Probst, martin-probst@web.de
2015/10/21, hkff, Walid Benghabrit, walid.benghabrit@mines-nantes.fr
2015/11/12, cooperra, Robbie Cooper, cooperra@users.noreply.github.com
2015/11/25, abego, Udo Borkowski, ub@abego.org
2015/12/17, sebadur, Sebastian Badur, sebadur@users.noreply.github.com
2015/12/23, pboyer, Peter Boyer, peter.b.boyer@gmail.com
2015/12/24, dtymon, David Tymon, david.tymon@gmail.com
2016/02/18, reitzig, Raphael Reitzig, reitzig[at]cs.uni-kl.de
2016/03/10, mike-lischke, Mike Lischke, mike@lischke-online.de
2016/03/27, beardlybread, Bradley Steinbacher, bradley.j.steinbacher@gmail.com
2016/03/29, msteiger, Martin Steiger, antlr@martin-steiger.de
2016/03/28, gagn, Martin von Gagern, gagnern@ma.tum.de
2016/07/10, twz123, Tom Wieczorek, tom.wieczorek@zalando.de
2016/07/20, chrisheller, Chris Heller, chris.heller.greyheller@gmail.com
2016/07/20, nburles, Nathan Burles, nburles@gmail.com
2016/07/20, kosI00, Li Liqiang, kos1990l@gmail.com
2016/07/27, timoc, Tim O'Callaghan, timo@linux.com
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2016/07/18, willfaught, Will Faught, will.faught@gmail.com
2016/08/08, wjkohnen, Wolfgang Johannes Kohnen, wjkohnen-go-antrl@ko-sys.com
2016/08/11, BurtHarris, Ralph "Burt" Harris, Burt_Harrisantlr4@azxs.33mail.com
2016/08/19, andjo403, Andreas Jonson, andjo403@hotmail.com
2016/09/27, harriman, Kurt Harriman, harriman@acm.org
2016/10/13, cgdrian, Christian Gudrian, christian.gudrian@gmx.de
2016/10/13, nielsbasjes, Niels Basjes, niels@basjes.nl
2016/10/21, FloorGoddijn, Floor Goddijn, floor.goddijn[at]aimms.com
2016/11/01, RYDB3RG, Kai Stammerjohann, RYDB3RG@users.noreply.github.com
2016/11/05, runner-mei, meifakun, runner.mei@gmail.com
2016/11/15, hanjoes, Hanzhou Shi, hanzhou87@gmail.com
2016/11/16, sridharxp, Sridharan S, aurosridhar@gmail.com
2016/11/06, NoodleOfDeath, Thom Morgan, github@bytemeapp.com
2016/11/01, sebkur, Sebastian Krten, sebastian@topabyte.de
2016/04/13, renatahodovan, Renata Hodovan, reni@inf.u-szeged.hu
2016/11/05, ewanmellor, Ewan Mellor, github@ewanmellor.org
2016/11/06, janyou, Janyou, janyouantlr@outlook.com
2016/11/20, marcohu, Marco Hunsicker, antlr@hunsicker.de
2016/09/02, lygav, Vladimir (Vladi) Lyga, lyvladi@gmail.com
2016/09/23, ghosothope, Dmitry Shakhtanov, sudstrike@gmail.com
2016/11/25, MrSampson, Oliver Sampson, olsam@quickaudio.com
2016/11/29, millergarym, Gary Miller, miller.garym@gmail.com
2016/11/29, wxio, Gary Miller, gm@wx.io
2016/11/29, NaioS, Denis Blank, naios@users.noreply.github.com
2016/12/01, samtatasurya, Samuel Tataturas, xemradian@gmail.com
2016/12/03, redxdev, Samuel Bloomberg, sam@redxdev.com
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This is a bundle of X.509 certificates of public Certificate Authorities  
(CA). These were automatically extracted from Mozilla's root certificates  
file (certdata.txt). This file can be found in the mozilla source tree:  
It contains the certificates in PEM format and therefore  
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Anthony Green <green@redhat.com>
GCC developers
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import static org.immutables.generator.Intrinsics.*;

@java.lang.SuppressWarnings("all")
public class Generator_Immutables extends org.immutables.value.processor.Immutables {
  public org.immutables.generator.Templates.Invokable generate() { return generate; }
  private final org.immutables.generator.Templates.Invokable generate = new FragmentDispatch(0, 0);
  void _t0__generate(org.immutables.generator.Templates.Invokation __) {
    _dl(); _ln();
    _out(" ");
    final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueType type : $in(values.values())) {
      _dl(); _ln();
      _out(" ");
      _dl();
      if ($if(type.constitution.hasTopLevelImmutable())) {
        _dl(); _ln();
        _dl(); _ln();
        $(__ , output.java, type.$$package(), type.typeImmutable().simple(), type.element, new org.immutables.generator.Templates.Fragment(0) {
          @Override public void run(org.immutables.generator.Templates.Invokation __) {
            _dl(); _ln();
            $(__, generateImmutable, type, $$true);
            _ln();
        });
      }
    }
  }
}

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if ($if(type.isGenerateWithInterface())) {
  __dl();__ln();
  $(__, output.java, type.$$package(), type.typeWith().simple(), type.element, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __dl();__ln();
      $(__, generateWithInterface, type, $$true);
      __ln();
      __dl();
    } });
  __ln();
  __out("  ");
}
__dl();__ln();
__out("  ");

if ($if(type.constitution.hasTopLevelBuilder())) {
  __dl();__ln();
  $(__, generateWithBuilder, type, $$true);
  __ln();
  __dl();
} });
  __ln();
  __out("  ");
}
__dl();__ln();
__out("  ");

if ($if(type.constitution.hasEnclosingNonvalue())) {
  __dl();__ln();
  $(__, output.java, type.$$package(), type.typeEnclosing().simple(), type.element, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __dl();__ln();
      $(__, generateEnclosingNonvalue, type, $$true);
      __ln();
      __dl();
    } });
  __ln();
  __out("  ");
}
__dl();__ln();
__out("  ");
__dl();
if ($if(type.constitution.hasEnclosingNonvalue())) {
  __dl();__ln();
  __dl();__ln();
  $(__, output.java, type.$$package(), type.typeEnclosing().simple(), type.element, new
@Override public void run(org.immutables.generator.Templates.Invokation __) {
    __.dl();___.ln();
    ___.ln();
    __.dl();
}

__.ln();
__.dl();___.ln();
__.out(" ");

__.dl();_.it1.index++;
_.it1.first = false;
}

__.dl();___.ln();
__.dl();
}

org.immutables.generator.Templates.Invokable annotationsWhenTopLevel() { return annotationsWhenTopLevel; }
private final org.immutables.generator.Templates.Invokable annotationsWhenTopLevel = new FragmentDispatch(2, 1);
void _i1__annotationsWhenTopLevel(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueType type = __.cast(__.param(0));
    final java.lang.Boolean is = __.if(__.param(1));
    __.ln();
    __.dl();___.ln();
    __.out(" ");
    __.dl();_.it1.index++;
    _it1.first = false;
}

if (__if(is)) {
    __.dl();___.ln();
    __.dl();
    if (__if(type.generatedSuppressWarnings())) {
        __.dl();___.ln();
        __.out("@SuppressWarnings({");
        final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        for (final java.lang.String k : __in(type.generatedSuppressWarnings())) {
            __.dl();___.dl();
            if (__if(!_it1.first)) {
                __.dl();___.out(",");
            }
            __.dl();___.out(" ");
        }
    }
    __.dl();___.out(" ");
    __.dl();___.out(" ");
}
//
//  package
//
//  import java.lang.Object;
//  import java.lang.String;
//  import java.lang.Float;
//  import java.lang.Double;

{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final java.lang.String starImport : $in(type.getRequiredSourceStarImports())) {
      __dl();__ln();
      __out("import ");
      $___.starImport();
      __out(";").ln();
      __out(" ");
      __dl();_it1.index++;
      _it1.first = false;
    }
}
__dl();__ln();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final java.lang.String routine : $in(type.getImmutableCopyOfRoutines())) {
      __dl();__ln();
      __out("import static ");
      $___.routine();
      __out(";immutableCopyOf;").ln();
      __out(" ");
      __dl();_it1.index++;
      _it1.first = false;
    }
}
__dl();__ln();

if ($if(type.getDebugLines())) {
  __dl();__ln();
  __out("/*--DEBUG---------------------------------------------------
  $___.eachLine, type.getDebugLines());
  __ln();
  __out("----------------------------------------------------------*/").ln();
}$(___.type.$$package());
if ($if(v.constitution.isOutsideBuilder())) {
  __.dl();__.ln();
  __.out(" ");
  $(__, generateBuilder, v, $false);
  __.ln();
  __.out(" ");
}
___.dl();__.ln();
___.out(" ");
___.dl();
if ($if(v.isGenerateWithInterface())) {
  __.dl();__.ln();
  __.out(" ");
  $(__, generateWithInterface, v, $false);
  __.ln();
  __.out(" ");
}
___.dl();__.ln();
___.out(" ");
$(__, forwardingEnclosingFactoryMethods, v);
___.ln();
___.dl();___.it1.index++;
___.it1.first = false;
}
___.dl();__.ln();
___.out(" ");
$(__, objectsUtility, type);
___.ln();
___.dl();
if ($if($if(type.isGenerateJdkOnly(), and, type.isUseCollectionUtility())) {
  __.dl();__.ln();
  __.out(" ");
  $(__, collectionUtility, type);
  __.ln();
}
___.dl();__.ln();
___.dl();
if ($if(type.detectAttributeBuilders())) {
  __.dl();__.ln();
  __.out(" ");
  $(__, attributeBuilderTransformUtilities, type);
  __.ln();
}
org.immutables.generator.Templates.Invokable generateImmutable() { return generateImmutable; }
private final org.immutables.generator.Templates.Invokable generateImmutable = new FragmentDispatch(2, 4);
void _t4__generateImmutable(org.immutables.generator.Templates.Invokation __) {
    __dl();
    __out("}").ln();
    __dl();
}
if (type.isUseConstructor()) {
  out(" * Use the static factory method to create immutable instances:").ln();
  out(" * @code ");
  type.factoryOf().relativeRaw().out("()").ln();
}

if (type.isUseSingleton()) {
  out(" * Use the static factory method to get the default singleton instance:").ln();
  out(" * @code ");
  type.factoryInstance().relativeRaw().out("()").ln();
}

if ($(type, allowsClasspathAnnotation, "javax.annotation.concurrent.Immutable")) {
  out("@javax.annotation.concurrent.Immutable").ln();
}

if ($($if(type, allowsClasspathAnnotation, "javax.annotation.CheckReturnValue"))) {
if (Slf($type, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    __dl(); __ln();
    __out(" @javax.annotation.CheckReturnValue").ln();
    __out(" ");
}
__dl(); __ln();
$___.eachLine, type.passedAnnotations();
__ln();
$___.eachLine, type.immutableTypeInjectedAnnotations();
__ln();
$___.type.typeImmutable().access();
__dl();
if ($if($not, topLevel)) {
    __dl(); __out("static ");
}
__dl(); __out("final ");
$___.output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __dl(); __out("class ");
        $(__, type.typeImmutable().simple());
        $(__, type.generics());
        __ln();
        __out(" ");
        $(__, extendsImplements, type);
        __dl();
    } });
__ln();
__dl();
if ($if(type.isAnnotationType())) {
    __dl(); __ln();
    __out(" ");
    $(__, defaultAnnotationValues, type);
    __ln();
}
__dl(); __ln();
__dl();
if ($if($not, type.constitution.isOutsideBuilder())) {
$(__, p.name());
__dl();__it3.index++;  
__it3.first = false;
}
__dl();__out(" ").ln();
__out("    return new ");
$(__, type.typeBuilderImpl().relativeRaw());
$(__, type.generics().diamond());
__out(" ");
{final org.immutables.generator.Templates.Iteration __it3 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute p : $in(parameters)) {
  if ($if($(not, __it3.first))) {
    __dl();__dl();
    if ($if($(not, __it3.first))) {
      __dl();__out(" ");
    }
  }
  __dl();$(__, p.name());
__dl();__it3.index++;  
__it3.first = false;
}
__dl();__out(" ").ln();
__out("  ");ln();
__out("  ");
__dl();
if ($if($(parameters, andnot, type.kind().isFactory()))) {
  __dl();__ln();
  __ln();
  __out(" static");
$(__, type.generics().def());
__out(" ");
$(__, type.typeBuilderImpl().relative());
__out(" ");
$(__, type.factoryBuilder().applied());
__out(" ");ln();
__out("    return new ");
$(__, type.typeBuilderImpl().relativeRaw());
$(__, type.generics().diamond());
__out(" ");ln();
__out("  ");ln();
__out("  ");
}
__dl();__ln();
__out("  ");
__dl();__it2.index++;  
__it2.first = false;
__dl();__ln();
__out(" ");

}
__dl();__ln();
__out(" ");
$___.generateBuilder, type, $false);
__ln();

}
__dl();__ln();
__dl();
if ($if($not, type.constitution.isOutsideBuilder())) {
__dl();__ln();
__out(" ");
$___.rr.staticMethods(), type.getImplementedAttributes());
__ln();

}
__dl();__ln();
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueType v : $in(type.nested)) {
__dl();__ln();
__out(" ");
$___.generateImmutable, v, $false);
__ln();
__out(" ");
__dl();
if ($if(v.isGenerateWithInterface()) {__dl();__ln();
__out(" ");
$___.generateWithInterface, v, $false);
__ln();
__out(" ");

}
__dl();__ln();
__dl();_it2.index++;
_it2.first = false;
}
__dl();__ln();
__dl();
if ($if(topLevel)) {
__dl();__ln();
__out(" ");
$___.objectsUtility, type);
__ln();


if ($if($(topLevel, and, $(type.isGenerateJdkOnly(), and, type.isUseCollectionUtility())))) {
    __.dl();___.ln();
    ___.out(" ");
    $(___.collectionUtility, type);
    ___.ln();
}
___.dl();___.ln();
___.dl();
if ($if(type.detectAttributeBuilders())) {
    __.dl();___.ln();
    ___.out(" ");
    $((___.attributeBuilderTransformUtilities, type));
    __.ln();
}
___.dl();___.ln();
___.out("\})
___.ln();
___.dl();_it1.index++;
_it1.first = false;
}
___.dl();___.ln();
___.dl();
if ($if(type.isImplementing())) {
    __.dl();___.ln();
    ___.out(" implements ");
    $((___.type.typeAbstract()));
    __.dl();
    if ($if(type.serial.shouldImplement())) {
        __.dl();___.out(" , java.io.Serializable");
    } else {
        __.dl();___.ln();
        ___.out(" extends ");
    }
}
org.immutables.generator.Templates.Invokable extendsImplements() { return extendsImplements; }
private final org.immutables.generator.Templates.Invokable extendsImplements = new FragmentDispatch(1, 5);
void _t5__extendsImplements(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    __.ln();
    __.dl();
    if ($if(type.isImplementing())) {
        __.dl();___.ln();
        ___.out(" implements ");
        $((___.type.typeAbstract()));
        __.dl();
        if ($if(type.serial.shouldImplement())) {
            __.dl();___.out(" , java.io.Serializable");
        } else {
            __.dl();___.ln();
            ___.out(" extends ");
        }
    } else {
        __.dl();___.ln();
        ___.out(" extends ");
    }
$(__, type.typeAbstract());
__dl();
if ($if($(not, type.serial.shouldImplement())))
  __dl();__out(" ");
} else {
  __dl();__ln();
  __out("implements java.io.Serializable ");
}
__dl();__ln();
__dl();
__ln();
org.immutables.generator.Templates.Invokable generateSerialization() { return generateSerialization; }
private final org.immutables.generator.Templates.Invokable generateSerialization = new FragmentDispatch(1, 6);
void _t6__generateSerialization(org.immutables.generator.Templates.Invocation __) {
  __dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __ln();
  $(__, serialVersionUID, type);
  __ln();
  __dl();
  if ($if(type.serial.isSimple()))
    __dl();__ln();
    __out(" ");
    __dl();
    if ($if(type.isUseSimpleReadResolve()))
      __dl();
      if ($if(type.isUseSingletonOnly()))
        __dl();__ln();
        __out(" return INSTANCE; ");
        __ln();
      else if ($if($(type.isUsePrehashed(), and, type.isUseCopyConstructor())))
        __dl();__ln();
        __out(" ");
        $(__, generateReturnCopyRaw, type, ", ",
        __ln();
      } else {
        __dl();__ln();
        __out(" return ");
        {final org.immutables.value.processor.meta.ValueType type_validated_1881291508 = $cast(type);
        final java.lang.Boolean qualified_validated_1881291508 = $cast($$false);
final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invocation __) {
    __.dl(); final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = this;
    __.out("this");
    __.dl();
  }
  __.dl();
  if ($if(type_validated_1881291508.isUseValidation())) {
    __.dl();
    if ($if(qualified_validated_1881291508)) {
      __.dl(); $(__, type_validated_1881291508.typeImmutable().relativeRaw());
      __.out(":");
      __.dl();
  __.out("validate(");
  $((__, expression_validated_1881291508));
  __.out(")");
    } else {
      __.dl(); $((__, expression_validated_1881291508));
    }
  }
  __.dl();
  __.out(";").ln();
  }
  __.dl();
  __.ln();
  __.out(" */");ln();
  __.out(" ");
  }
  __.dl();
  if ($if(type.serial.isStructural())) {
    __.dl();
    __.ln();
    __.out("/**");ln();
    __.out(" * The serialized form captures the structural content of the value object, ").ln();
    __.out(" * providing the ability to reconstruct values with the capability to migrate ").ln();
    __.out(" * data. Uses optional, nullable, and provides flexible handling of ").ln();
    __.out(" * collection attributes.").ln();
    __.out(" */").ln();
    $((__, atGenerated, type));
    __.ln();
  }
}
if ($if(type.generics())) {
    __.dl();__.ln();
    __.out("@SuppressWarnings("unchecked")").ln();
}

___.dl();__.ln();
__.out("private static class SerialForm");
$.(__, type.generics());
__.out(" implements java.io.Serializable ");.ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
 final java.lang.Long serialVersion = $cast(type.serialVersionUID());
 final java.lang.String arr = $cast("["]");
 final java.lang.String arri = $cast(["i"]);
___.dl();__.ln();
__.out("  private static final long serialVersionUID = ");
___.dl();
if ($if(serialVersion)) {
    ___.dl();$___.literal, serialVersion);
}
else {
    ___.dl();__.out("0L");
}

___.dl();__.out(";").ln();
__.out(" private final String");
$.(__, "["]");
__.out(" names="").ln();
__.out(" private final Object");
$.(__, "["]");
__.out(" values="").ln();
__.out(" SerialForm");
$.(__, type.typeImmutable());
__.out(" instance ")
___.dl();
if ($if(type.isUseSingletonOnly())) {
    ___.dl();__.ln();
    ___.out(" this.names = new String");
$.(__, "["]");
    ___.out(" ");.ln();
    ___.out(" this.values = new Object");
$.(__, "["]");
    ___.out(" ");.ln();
    ___.out(" Object readResolve() ");.ln();
    ___.out(" return INSTANCE;");.ln();
    ___.out(" ");.ln();
java.util.List<String> names = new java.util.ArrayList;
$___.asDiamond, "String";
$___.out("(");
$___.size, type.getSettableAttributes();
$___.out(".");$.ln();
$___.out(" java.util.List<Object> values = new java.util.ArrayList");
$___.asDiamond, "Object";
$___.out("(");
$___.size, type.getSettableAttributes();
$___.out(".");$.ln();
$___.out(";");$.ln();
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
  
  if ($if(v.isCollectionType())) {
    if ($if(v.isNullable())) {
      if (instance.
$(___.v.names.get)
().orElse(null) == null) {
        names.add("$
$(___.v.name());
        names.add("");$.ln();
        values.add(null);$.ln();
      } else {
        if (!instance.
$(___.v.names.get)
().isNotEmpty()) {
          names.add("$
$(___.v.name());
          values.add(instance.
$(___.v.names.get).toArray());$.ln();
        } else {
          if ($if(v.isMapType())) {
            
            if ($if(v.isNullable())) {
              if (instance.
$(___.v.names.get)
().isEmpty()) {
                names.add("$
$(___.v.name());
                values.add(null);$.ln();
              } else {
                if ($if(v.isMapType())) {
                  
                  } else if ($if(v.isMapType())) {
                    
                    } else {"} 
      }
    } else if ($if(v.isMapType())) {
      
    }
  } else if ($if(v.isMapType())) {
  
  }
} else {"} 
} else {"} 
} else {"} 
}
```java
__.dl();
if ($if(v.isNullable()) {___.dl();___.out("if (instance.");
  ___.$_names.get();
  ___.out("() == null ");.ln();
  ___.out(" names.add("");
  ___.out(v.name());
  ___.out(" ");.ln();
  ___.out(" values.add(null); ").ln();
  ___.out(" } else ");
}
___.dl();___.out(" if (!instance.");
___.$_names.get();
___.out("().isEmpty() ");.ln();
___.out(" names.add("");
___.out(v.name());
___.out(" ");.ln();
___.out(" values.add(toArray(instance.");
___.$_names.get();
___.out(" ");
___.dl();
if ($if(v.isMultimapType()) {___.dl();___.out("entries");
) else {
  ___.dl();___.out("entrySet");
}
___.dl();___.out("()");.ln();
___.out(" ");.ln();
___.out(" ");
) else if ($if(v.isOptionalType()) {
  ___.dl();___.ln();
  ___.out(" if (instance.";
  ___.$_names.get();
  ___.out(" ");
  {final org.immutables.value.processor.meta.ValueAttribute a_optionalPresent_767352996 = $cast(v);
    ___.dl();
    if ($if($(a_optionalPresent_767352996.isFugueOptional(), or,
      a_optionalPresent_767352996.isJavaslangOptional()))) {
      ___.dl();___.out("isDefined");
    } else {
      ___.dl();___.out("isPresent");
    }
  )
  ___.dl();___.out("()");
  } final org.immutables.value.processor.meta.ValueAttribute a_optionalPresent_767352996 = $cast(v);
  ___.dl();
  if ($if($a_optionalPresent_767352996.isFugueOptional(), or,
    a_optionalPresent_767352996.isJavaslangOptional())) {
    ___.dl();___.out("isDefined");
  } else {
    ___.dl();___.out("isPresent");
  }
  ___.dl();___.out("()");
```
if ($if(a_optionalGet_1683307643.isJdkSpecializedOptional())) {
    __dl(); __out("getAs");
    $(__, toUpper, a_optionalGet_1683307643.getElementType());
} else {
    __dl(); __out("get");
}

__dl(); __out("()");

} else if ($if(v.isNullable())) {
    __dl(); __ln();
    __out(" if (instance.");
    $__ out("() != null) {"); __ln();
    __out(" names.add("v");
    $__ out(" values.add(instance.");
    $__ out(";"); __ln();
    __out(")"); __ln();
    __out("1"); __ln();
    __out(" ");
}

} else {
    __dl(); __ln();
    __out(" names.add("v");
    $__ out(" values.add(instance.");
    $__ out(";"); __ln();
    __out(" ");
```java
Object readResolve() {
    if ($if(type.isUseBuilder())) {
      builder = $
      for (int i = 0; i < names.length; i++) {
        name = names
        if ($if(v.name()) {
          if (v.equals(name)) {
            
```
if ($if(v.isNullable())) {
    __.dl();___.ln();
    __.out("  if (values";
$(__, arri);
    __.out(" == null) { ").ln();
    __.out("    builder.");
$(__, v.names.init);
    __.out("(null);").ln();
    __.out("    continue;").ln();
    __.out(" }").ln();
    __.out(" ");
}
    __.dl();___.ln();
    __.out("  for (Object e : toArray(values");
$(__, arri);
    __.out(")) { ").ln();
    __.out("    builder.");
$(__, v.names.add());
    __.out(";");

    [final java.lang.String typename_castObject_2078309443 = $cast(v.getWrappedElementType());
    __.dl();
    if ($if($if((typename_castObject_2078309443, ne, "java.lang.Object"))) {
        __.dl();___.out("("");
        __.out("typename_castObject_2078309443 = ");
        __.out(""");
    } else if ($if(v.isMapType())) {
        __.dl();___.ln();
        __.out(" ");
    } else if ($if(v.isNullable())) {
        __.dl();___.ln();
        __.out(" if (values";
$(__, arri);
        __.out(" == null) { ").ln();
        __.out("    builder.");
$(__, v.names.init);
        __.out("(null);").ln();
        __.out("    continue;").ln();
        __.out(" }").ln();

```
if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
    __dl(); __out("@javax.annotation.Nullable ");
}

if (entries != null) {
    for (int j = 0; j < entries.length; j += 2) {
        final org.immutables.generator.Templates.Iteration _it3 = new
        org.immutables.generator.Templates.Iteration();
        final java.lang.String j = $cast("[j]");
        final java.lang.String j1 = $cast("[j + 1]");
        __dl(); __ln();
        __out("   builder.");
        $(__, v.names.put());
        __out("\n");
        final java.lang.String typename_castObject_2078309443 = $cast(v.getWrappedElementType());
        __dl();
        if ($if($(typename_castObject_2078309443, ne, "java.lang.Object"))) {
            __dl(); __out("(");
            $(__, typename_castObject_2078309443);
            __out("\n");
        }
    }
}

__out("entries");
$___.j);
__out("\n");
final java.lang.String typename_castObject_2078309443 = $cast(v.getWrappedSecondaryElementType());
__dl();
if ($if($(typename_castObject_2078309443, ne, "java.lang.Object"))) {
    __dl(); __out("\n");
    $(__, typename_castObject_2078309443);
    __out("\n");
}
__dl();__out("(");
$__(_. typename_castObject_2078309443);
__out(") ");
}
__dl();
}
__out("entries");
$__(_. j1);
__out(";").ln();
__out(" ");
__dl();_it3.index++;
_it3.first = false;
}
__dl();__ln();
__out(" ");.ln();
__out(" ");.ln();
__out(" ");
} else if ($if(v.isOptionalType()) {__dl();__ln();
__out(" if (values");
$__(_. arri);
__out(" != null) { ").ln();
__out(" builder.");
$__(_. v.names.init);
__out(" ");
{final java.lang.String typename_castObject_2078309443 = $cast(v.getWrappedElementType());__dl();
if ($if($(_. typename_castObject_2078309443, ne, "java.lang.Object")) {
__dl();__out("(");
$__(_. typename_castObject_2078309443);
__out(" ");
}
__dl();
__out("values");
$__(_. arri);
__out(";").ln();
__out(" ");.ln();
__out(" ");
} else if ($if(v.isNullable()) {__dl();__ln();
__out(" if (values");
$__(_. arri);
__out(" != null) { ").ln();
__out(" builder.");
$__(_. v.names.init);
}
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```java
    continue;
    } else {
      final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
      final java.util.List<org.immutables.value.processor.meta.ValueAttribute> constructables = $cast(type.getConstructableAttributes());
      for (final org.immutables.value.processor.meta.ValueAttribute v : $in(constructables)) {
        if ($if($(v.isCollectionType(), or, v.isMapType()))) {
          $<_, createBuilderForCollection, type, v, new org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
              __.dl();$<_, v.name());
              __.out("Builder");
              __.dl();
            }
          });
        }
      }
    }
```

__.ln();
__.out("    ");
} else if ($if(v.isOptionalType())) {
  __.dl();__.ln();
  __.out("    ");
  $(__, v.getType());
  __.out(" ");
  $(__, v.name());
  __.out("Value = ");
  (final org.immutables.value.processor.meta.ValueAttribute a_optionalEmpty_1867206284 = $cast(v);
   $(__, a_optionalEmpty_1867206284.getRawType());
   __.dl();
   if ($if(a_optionalEmpty_1867206284.isJdkOptional())) {
     __.dl();__.out("empty");
   } else if ($if($(a_optionalEmpty_1867206284.isFugueOptional(), or,
     a_optionalEmpty_1867206284.isJavaslangOptional())) {
     __.dl();__.out("none");
   } else {
     __.dl();__.out("absent");
   }  
   __.dl();__.out("()");
}
__.out(";").ln();
__.out("    ");
}

} else {
  __.dl();__.ln();
  __.out(" ");
  (final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
   __.dl();
   if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
     __.dl();__.out("@javax.annotation.Nullable ");
   } __.dl();
  }
  __.dl();
  $(__, v.getWrapperType());
  __.out(" ");
  $(__, v.name());
  __.out("Value = null;").ln();
  __.out("    ");
}
___.dl();__.ln();
```java
    for (int i = 0; i < names.length; i++) {
      String name = names[i];
      for (final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
        final org.immutables.value.processor.meta.ValueAttribute v : $in(constructables)) {
        if ("\"\".equals(name)) {
          if ($if(v.isCollectionType())) {
            for (Object e : toArray(values[i])) {
              __out("Builder.add(");
            }
          } else {
            continue;
          }
        }
      }
    }
```
$(__, typename_castObject_2078309443);
__out(" ");

__dl();
}
__out("e;").ln();
__out(" ");
__out(" ");
} else if ($(v.isMapType())) {
__dl();__ln();
__out(" ");
__dl();
if ($(v.isNullable())) {
__dl();__ln();
__out(" if (values");
$(__, arri);
__out(" == null ) {".ln();
__out(" ");
$(__, v.name());
__out("Builder = null;").ln();
__out(" continue;").ln();
__out(" }").ln();
__out(" ");
}
__dl();__ln();
__out(" Object");
$(__, arr);
__out(" entries = (Object");
$(__, arr);
__out(" ) values";
$(__, arri);
__out(";") .ln();
__out(" if (entries != null ) {".ln();
__out(" for (int j = 0; j < entries.length; j += 2) {".ln();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it4 = new
org.immutables.generator.Templates.Iteration();
final java.lang.String j = $cast("[j]");
final java.lang.String j1 = $cast("[j + 1]");
__dl();__ln();
__out(" ");
$(__, v.name());
__out("Builder.put(";
{final java.lang.String typename_castObject_2078309443 = $cast(v.getWrappedElementType());
__dl();
if ($(typename_castObject_2078309443, ne, "java.lang.Object")) {


__dl();
}
__out("values");
$___.arri);
__out(";").ln();
__out(" ");
}
else {
__dl();__ln();
__out(" ");
$___.v.name());
__out("Value = ");
(final java.lang.String typename_castObject_2078309443 = $cast(v.getWrapperType());
__dl();
if ($.is$(typename_castObject_2078309443, ne, "java.lang.Object")) {
__dl();__out("(");
$___.typename_castObject_2078309443);
__out(") ");
}
__dl();
}
__out("toList("");
$___.v.name());
__out("", values");
$___.arri);
__out(";").ln();
__out(" ");
}
__dl();__ln();
__out("  continue; ").ln();
__out(" } ").ln();
__out(" ");
__dl();_it3.index++; 
_it3.first = false;
}
__dl();__ln();
__out("  ");.ln();
__out(" ");
__dl();
if ($.is$(type.isUseConstructor())) {
__dl();__ln();
__out(" ");
$___.type.typeValue().relative());
__out(" instance = ");
$___.type.factoryOf().relative());
__out(" ");
$(__, output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
__.dl();{final org.immutables.generator.Templates.Iteration _it3 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
__.dl();__.dl();
if ($if($(not, _it3.first))) {
__.dl();__.out(",");
}
__.dl();__.ln();
__.out("
");
__.dl();
if ($if($(v.isCollectionType(), or, v.isMapType()))) {
__.dl();__.dl();
if ($if(v.isNullable())) {
__.dl();$(__, v.name());
__.out("Builder == null ? null : ");
}
__.dl();$(__, createBuiltCollection, type, v, new org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
__.dl();$(__, v.name());
__.out("Builder");
__.dl();
}});
} else {
__.dl();$(__, v.name());
__.out("Value");
}
__.dl();__.dl();_it3.index++;
_it3.first = false;
}}
__.dl();__.out(");");
__.dl();
}});
__.ln();
__.out(" ");
} else if ($if(type.isUseSingleton())) {
__.dl();__.ln();
__.out(" ");
$(__, type.typeValue().relative());
__.out(" instance = ");
$(__, type.factoryInstance().relative());
__.out("();").ln();
__.out(" ");

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} else {
    .dl(); .ln();
    $.(_.output.error, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            .dl(); .out("Cannot generate code when there are no builder, constructor or singleton available");
            .dl();
        });
    .ln();
    .out("  ");
}

    .dl(); .ln();
    .out("  ");
    {final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute o :
        $in(type.getWithSettableAfterConstruction())) {
        .dl(); .ln();
        .out("  ");
        .dl();
        if ($if($(o.isCollectionType(), or, o.isMapType()))) {
            .dl(); .ln();
            .out("    instance = instance.");
            $.(_.names.with);
            .out("(");
            .dl();
            if ($if(o.isNullable())) {
                .dl(); $(__, o.name());
                .out("Builder == null ? null : ");
            }
            createBuiltCollection, type, o, new org.immutables.generator.Templates.Fragment(0) {
                @Override public void run(org.immutables.generator.Templates.Invokation __) {
                    .dl(); $(_.name());
                    .out("Builder");
                    .dl();
                });
                .out(";").ln();
                .out("  ");
            } else {
                .dl(); .ln();
                .out(" if ");
                $(_.name());
                .out("Value != null ");
                .ln();
                .out("    instance = instance.");
            }
        } else {
            .dl(); .ln();
            .out("    ");
        }
    }
}
$(__, o.names.with);
    __.out("(");
$(__, o.name());
    __.out("Value").ln();
    __.out(" })").ln();
    __.out(" ");
}
__dl();__ln();
    __.out(" ");
__dl();__it3.index++;
__it3.first = false;
}))
__dl();__ln();
    __.out(" return instance;");ln();
    __.out(" ");
__dl();__it2.index++;
__it2.first = false;
}
__dl();__ln();
}
__dl();__ln();
    __.out(" ");ln();
__ln();
    __.out(" private static Object toSingle(String attribute, Object value) {").ln();
    __.out(" if (value instanceof Object");
$(__, arr);
    __.out(" ").ln();
    __.out(" Object");
$(__, arr);
    __.out(" elements = (Object");
$(__, arr);
    __.out(" value;");ln();
    __.out(" if (elements.length == 1) {").ln();
    __.out(" return elements");
$(__, ":[0]");
    __.out(";").ln();
    __.out(" ");ln();
    __.out(" ");ln();
    __.out(" throw new ");
$(__, type.getThrowForInvalidImmutableState());
    __.out("Cannot extract scalar value for attribute \
").ln();
    __.out(" + attribute + \
from array of length \" + elements.length");").ln();
    __.out(" ");ln();
    __.out(" return value;");ln();
    __.out(" ");ln();
    __.out(" ");
__dl();
if ($if(type.hasSettableCollection()) {  
  __dl(); __ln();  
  __out(" private static Object");  
$(__, arr);  
  __out(" toArray()");  
{final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(type);  
    __dl();  
  if ($if(S(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {  
    __dl(); __out("@javax.annotation.Nullable ");  
  }  
  __dl();  
  __out(" Object value ").ln();  
  __out(" if (value == null) ").ln();  
  __out(" return new Object");  
$(__, arr);  
  __out(" ]");.ln();  
  __out(" ]").ln();  
  __out(" if (value instanceof Object");  
$(__, arr);  
  __out(" ]").ln();  
  __out(" return (Object");  
$(__, arr);  
  __out(" value;").ln();  
  __out(" ]").ln();  
  __out(" return new Object");  
$(__, arr);  
  __out(" ] value ];").ln();  
  __out(" ]").ln();  
  __out(" ");  
}
__dl(); __ln();  
__out(" ");  
__dl();
if ($if(type.hasSettableMapping()) {  
  __dl(); __ln();  
  __out(" private static Object");  
$(__, "[]");  
  __out(" Object");  
$(__, "[]");  
  __out(" data = new Object");  
$(__, "]");  
  __out("entries.size() * 2");
```java
__out("int p = 0;").ln();
__out("for (java.util.Map.Entry<?, ?> e : entries) {").ln();
__out("data");
__out("p++");
__out("= e.getKey();").ln();
__out("data");
__out("p++");
__out("= e.getValue();").ln();
__out("}").ln();
__out("return data;").ln();
__out("}").ln();
__out(" ");
__dl();__ln();

__dl();__ln();
__dl();_it1.index++;
_it1.first = false;
__dl();__ln();
__out("} ").ln();
__ln();
__out("private Object writeReplace() { ").ln();
__out("return new SerialForm");
__ln();
$___.type.generics().args();
__out("(this);");ln();
__out("} ");ln();

__dl();__ln();
__dl();
```
```java
__.ln();
__.ln();
$(__, annotationsWhenTopLevel, type, topLevel);
__.ln();
$(__, type.typeWith().access());
__.out("interface ");
$(__, type.typeWith().simple());
$(__, type.generics());
__.out(" {");__.ln();
__.out(" ");
{ final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
  __.dl();__.ln();
  __.out(" ");
  __.dl();
  if ($if(v.isArrayType())) {
    __.dl();__.ln();
    __.ln();
    __.out(" /**");__.ln();
    __.out(" Copy the current immutable object with elements that replace the content of ");
  { final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    __.out(" .");__.ln();
    __.out(" The array is cloned before being saved as attribute values.");
    __.out(" @param elements The non-null elements for ");
    __.out(" */");__.ln();
    __.out(" */");__.ln();
    } final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __.out(" @return A modified copy of \{ @code this \} object\}.");__.ln();
    __.out(" */\}.");__.ln();
    __.out(" @ Deprecation\}";
    __.dl();
    if ($if(a_deprecation_286924011.deprecated)) {
      __.dl();__.out(" @Deprecation");
    }
  }
  __.dl();
}
__.ln();
__.out(" ");
$(__, type.typeAbstract().relative());
__.out(" ");
$(__, v.names.with);
__.out(" ");
$(__, v.getElementType());
__.out("... elements;");__.ln();
}
```
else if ($if(v.isCollectionType())) {
  __.dl();__.ln();
  __.ln();
  __.out("/**/").ln();
  __.out("  * Copy the current immutable object with elements that replace the content of ");
  {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    $(___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
    }
  __.out(".").ln();
  __.out("  * @param elements The elements to set").ln();
  __.out("  * @return A modified copy of [code this] object").ln();
  __.out("  */").ln();
  __.out("  */");
  }
  {
    final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __.dl();
    if ($if(a_deprecation_286924011.deprecated)) {
      __.dl();___.out("@Deprecated");
    }
  }
  {
    final org.immutables.value.processor.meta.ValueAttribute a_varargsSafetyAbstract_2026977502 = $cast(v);
    __.dl();
    if ($if($a_varargsSafetyAbstract_2026977502.isNonRawElementType(), or,
      a_varargsSafetyAbstract_2026977502.hasTypeVariables)) {
      __.dl();___.out("@SuppressWarnings("varargs")");
    }
  }
  __.dl();
  ___.ln();
  __.out(" ");
  $(__.type.typeAbstract().relative());
  __.out(" ");
  $(__.v.names.with);
  __.out(" ");
  $(__.v.getUnwrappedElementType());
  __.out("... elements;").ln();
  __.ln();
  __.out("/**/").ln();
  __.out("  * Copy the current immutable object with elements that replace the content of ");
  }
  {
    final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    $(__.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
  }
A shallow reference equality check is used to prevent copying of the same value by returning

```java
   * @param elements An iterable of 
   * @return A modified copy of this object
   */
```

```java
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
   if ($if(a_deprecation_286924011.deprecated)) {
      @Deprecated
   }
}

$(__, type.typeAbstract().relative());
__out(" ");
$(__, v.names.with);
__out("Iterable<");
$(__, v.getConsumedElementType());
__out(">");
}
else if ($if(v.isOptionalType())) {
   /**
   * Copy the current immutable object by setting a <i>present</i> value for the optional
   * @param value The value for 
   */
```

```java
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
   if ($if(a_sourceDocRef_1518656892.deprecated)) {
      @Deprecated
   }
}
```

```java
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
```

```java
}
__out(" ");
__out("attribute.");
__out(" ");
__out("* @param value The value for ");
$(__, v.name());
__dl();
if ($if(v.isOptionalAcceptNullable())) {
   __dl();__out(",[@code null] is accepted as [@code ");
```

```java
{final org.immutables.value.processor.meta.ValueAttribute a_optionalEmpty_1867206284 = $cast(v);
   if ($if(a_optionalEmpty_1867206284.isJdkOptional())) {
      __dl();__out("empty")
```
} else if ($if($a_optionalEmpty_1867206284.isFugueOptional(), or,
a_optionalEmpty_1867206284.isJavaslangOptional())) {
	__.dl();__.out("none");
}
} else {
	__.dl();__.out("absent");
}
	___.dl();__.out("()");
}
	__.out("}");

	__.dl();__.ln();
	__.out("   * @return A modified copy of {@code this} object").ln();
	__.out("   */").ln();
	__.out("  ");
	$(__, type.typeAbstract().relative());
	__.out(" ");
	$(__, v.names.with);
	__.out(";");
	{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_2869240111 = $cast(v);
	__.dl();
	if ($if(a_deprecation_2869240111.deprecated)) {
		__.dl();__.out("@Deprecated");
	}
	__.dl();
}
	__.ln();
	__.out(" ");
	$(__, a_unwrappedOptionalType_1615308684.getUnwrappedElementType());
	__.dl();
	if ($if($a_unwrappedOptionalType_1615308684.isOptionalType(), and,
a_unwrappedOptionalType_1615308684.isOptionalAcceptNullable())) {
		__.dl();$(__, atNullable, a_unwrappedOptionalType_1615308684);
		$(__, a_unwrappedOptionalType_1615308684.getWrappedElementType());
	}
	else {
		__.dl();$(__, a_unwrappedOptionalType_1615308684.getUnwrappedElementType());
	}
	__.dl();
	__.out(" value").ln();
	__.ln();
	__.out(" /*").ln();
* Copy the current immutable object by setting an optional value for the `a`.

```java
    final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);

    __.out(" * Copy the current immutable object by setting an optional value for the ");
    $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
    __.out(" * A shallow reference equality check on the optional value is used to prevent copying of the same
    value by returning [@code this]").ln();
    __.out(" * @param optional A value for ");
    $(__, v.name());
    __.ln();
    __.out(" * @return A modified copy of [@code this] object").ln();
    __.out(" */").ln();
    __.out(" ");
```

```java
    final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __.dl();
    if ($if(a_deprecation_286924011.deprecated)) {
        __.dl();___.out("@Deprecated");
    }
    __.dl();
    __.ln();
    __.out(" ");
    $(__, type.typeAbstract().relative());
    __.out(" ");
    $(__, v.names.with);
    __.out(" ");
    $(__, v.getRawType());
    __.dl();
    if (If(($if($not, v.isJdkSpecializedOptional())))) {
        __.dl();___.out("<");
        $(__, v.getConsumedElementType());
        __.out(">");
    }
    __.dl();___.out(" optional;").ln();
    __.out(" ");
    } else if ($if(v.isMapType())) {
        __.dl();___.ln();
        __.out(" ");
    }
```

```java
    final java.lang.String gE = $cast(v.getConsumedElementType());
    final java.lang.String uK = $cast(v.getUnwrappedElementType());
    final java.lang.String wK = $cast(v.getWrappedElementType());
    final java.lang.String uV = $cast(v.getUnwrappedSecondaryElementType());
    final java.lang.String wV = $cast(v.getWrappedSecondaryElementType());
    __.dl();___.ln();
```
__ln();
__out(" /**").ln();
__out(" * Copy the current immutable object by replacing the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" map with the specified map.").ln();
__out(" * Nulls are not permitted as keys or values.").ln();
__out(" * A shallow reference equality check is used to prevent copying of the same value by returning
{code this}").ln();
__out(" * @param entries The entries to be added to the ");
$___.v.name());
__out(" map").ln();
__out(" * @return A modified copy of {code this} object").ln();
__out(" */").ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
__dl();__out("@Deprecated")
}
__dl();
}
__ln();
__out(" ");
$___.type.typeAbstract().relative());
__out(" ");
$___.v.names.with);
__out("(");
__dl();
if ($if(v.isMultimapType())) {
__dl();$___.guava);
__out(".collect.Matimap");
} else {
__dl();__out("java.util.Map");
}
__dl();__out("<");
$___.gE);
__out(" , ? extends ");
$___.wV);
__out(" > entries");\).ln();
__out(" ");
__dl();__it2.index++;__it2.first = false;
if ($(v.isPrimitive(), andnot, v.isFloatType())) {
  __.dl();___.ln();
  __.out("   * A value equality check is used to prevent copying of the same value by returning {
  this}").ln();
  __.out("   ");
} else if ($(not, v.isPrimitive())) {
  __.dl();___.ln();
  __.out("   * A shallow reference equality check is used to prevent copying of the same value by returning
  {
  this}").ln();
  __.out("   ");
}

___.dl();___.ln();
___.out("   * @param value A new value for ");
$___.name());
___.dl();
if ($(v.isNullable())) {
  __.dl();___.out(" (can be {
  code null})");
}

___.dl();___.ln();
___.out("   * @return A modified copy of the {
  code this} object").ln();
___.out("   *");
___.out("   ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
___.dl();
if ($(a_deprecation_286924011.deprecated)) {
  __.dl();___.out("@Deprecated");
}
___.dl();}


org.immutables.generator.Templates.Invokable generateJsonWithUnsupported() { return generateJsonWithUnsupported; }
private final org.immutables.generator.Templates.Invokable generateJsonWithUnsupported = new FragmentDispatch(1, 8);
void _t8__generateJsonWithUnsupported(org.immutables.generator.Templates.Invocation __) {
   __dl();__ln();
   __out(" ");
   __dl();_it1.index++;
   _it1.first = false;
}
__dl();__ln();
__out("[");__ln();
__dl();

if ($if(type.isGenerateWithInterface())) {
   __dl();__ln();
   __dl();__ln();
   __out(" ");
   {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
   for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
      __dl();__ln();
      __out(" ");
      if ($if(v.isArrayType())) {
         __dl();__ln();
         __out("Override").ln();
         {final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
         __dl();
         if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or,
         a_varargsSafety_1368213209.hasTypeVariables))) {
            __dl();__out("@SafeVarargs @SuppressWarnings("varargs")");
         }
      }
   }
}
}
public final TypeAbstract relative();

$(__, v.names.with);
__out("("
$__ v.getElementType();
__out("... elements) { throw new UnsupportedOperationException(); }").ln();
__out(""
});
} else if ($if(v.isCollectionType())) {
__dl();__ln();
__out("@Override").ln();
{final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
__dl();
if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or,
a_varargsSafety_1368213209.hasTypeVariables))) {
__dl();__out("@SafeVarargs @SuppressWarnings("varargs")");
}
__dl();
}__ln();
__out("public final ");
$__ v.names.with;
__out(""
);__$ v.getUnwrappedElementType();
__out("... elements) { throw new UnsupportedOperationException(); }").ln();
__out("@Override").ln();
__out("public ");
$__ v.names.with;
__out(""
);__$ v.getUnwrappedElementType();
__out("(Iterable<"
$__ v.getConsumedElementType();
__out("> elements) { throw new UnsupportedOperationException(); }").ln();
__out(""
);}
} else if ($if(v.isOptionalType())) {
__dl();__ln();
__out("@Override").ln();
__out("public ");
$__ v.names.with;
__out(""
);__$ v.getUnwrappedElementType();
__out("("
$__ v.getUnwrappedElementType();
__out("... elements) { throw new UnsupportedOperationException(); }").ln();
__out(""
);}
if ($if($(a_unwrappedOptionalType_1615308684.isOptionalType(), and,
a_unwrappedOptionalType_1615308684.isOptionalAcceptNullable())) {   
  $(__, atNullable, a_unwrappedOptionalType_1615308684);
  $(__, a_unwrappedOptionalType_1615308684.getWrappedElementType());
} else {
  $(__, a_unwrappedOptionalType_1615308684.getUnwrappedElementType());
}

$__dil();
__out(" value) { throw new UnsupportedOperationException(); }").ln();
$__out("@Override").ln();
$__out(" public ");
$___.type.typeAbstract().relative();
$__out(" ");
$___.v.names.with();
$__out(" ");
$___.v.getRawType();
$__dil();
if ($if($not, v.isJdkSpecializedOptional())) {
  $__dil();$__out("<");
  $___.v.getConsumedElementType();
  $__out(">");
}
$__dil();$__out(" optional) { throw new UnsupportedOperationException(); }").ln();
$__out(" ");
} else if ($if(v.isMapType())) {
  $__dil();$__ln();
  $__out(" ");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
final java.lang.String gE = $cast(v.getConsumedElementType());
final java.lang.String uK = $cast(v.getUnwrappedElementType());
final java.lang.String wK = $cast(v.getWrappedElementType());
final java.lang.String uV = $cast(v.getUnwrappedSecondaryElementType());
final java.lang.String wV = $cast(v.getWrappedSecondaryElementType());
$__dil();$__ln();
$__out("@Override").ln();
$__out(" public ");
$___.type.typeAbstract().relative();
$__out(" ");
$___.v.names.with();
$__out(" ");
}
if ($if(v.isMultimapType())}) {
    __.dl();$___.guava;
    __.out(".collect.Multimap");
}

else {
    __.dl();___.out("java.util.Map");
}

___.dl();___.out("<");
$(___.gE);
___.out(",
? extends ");
$(___.wV);
___.out(">
entries) { throw new UnsupportedOperationException(); }").ln();

___.dl();___.it2.index++;
___.it2.first = false;
}

___.dl();___.ln();
___.out(" ");

} else {
    ___.dl();___.ln();
    ___.out("@Override").ln();
    ___.out("public ");
$(___.type.typeAbstract().relative());
    ___.out(" ");
$(___.v.names.with);
    ___.out("()");
$(___.v.isNullability());
$(___.v.getType());
    ___.out("value) { throw new UnsupportedOperationException(); }").ln();
    ___.out(" ");
}

___.dl();___.ln();
___.out(" ");
___.dl();___.it1.index++;
___.it1.first = false;
}

___.dl();___.ln();

generateInterning() {
    return generateInterning;
}

private final org.immutables.generator.Templates.Invokable generateInterning = new FragmentDispatch(1, 9);
void _t9__generateInterning(org.immutables.generator.Templates.Invokation __) {
  __dl(); final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __ln();
  __dl();
  if ($if($($($($get(type, isUseStrongInterned, or, type.isGenerateOrdinalValue())))) ) {
    __dl(); __ln();
    __out(" ");
    __dl();
    if ($if($($not, type.isUseSingletonOnly())) ) {
      __dl(); __ln();
      __ln();
      __out(" ");
      $(__, atGenerated, type);
      __ln();
      __out(" private static class InternProxy ").ln();
      __out(" final ");
      $(__, type.typeImmutable().relativeRaw());
      __out(" instance;").ln();
      __ln();
      __out(" InternProxy");
      $(__, type.typeImmutable().relativeRaw());
      __out(" instance ") ").ln();
      __out(" this.instance = instance; ").ln();
      __out(" ");).ln();
      __ln();
      __out(" @Override").ln();
      __out(" public boolean equals();
    }
  __dl();
  if ($if($($s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable")) ) {
    __dl(); __out("@javax.annotation.Nullable ");
    __dl();
    __out("Object another ").ln();
    __out(" return another != null && instance.equalTo(((InternProxy) another).instance); ").ln();
    __out(" ");).ln();
    __ln();
    __out(" @Override").ln();
    __out(" public int hashCode() ").ln();
    __out(" return instance.hashCode(); ").ln();
    __out(" ");).ln();
    __out(" ");
    __out(" ");
  }
  __dl(); __ln();
}
if ($if(type.isGenerateOrdinalValue())) {
  __dl();__ln();
  __ln();
  __out("/**").ln();
  __out(" * Copy constructor used for interning of objects implementing”).ln();
  __out(" * [@link org.immutables.ordinal.OrdinalValue]”).ln();
  __out("*/").ln();
  __out("private “);

$(__, type.typeImmutable().simple());
__out(";");

$(__, type.typeImmutable().relative());
__out("instance, int ordinal) { “).ln();
__out(" “);

{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getImplementedAttributes())) {
  __dl();__ln();
  __out(" this.");
  $(__, v.name());
  __out(" = instance.");
  $(__, v.name());
  __out(";").ln();
  __out(" “);
  __dl();_it1.index++; _it1.first = false;
}
__dl();__ln();
__out(" “);
__dl();

if ($if(type.isUsePrehashed())) {
  __dl();__ln();
  __out(" “ this.hashCode = instance.hashCode; “).ln();
  __out(" “);

}
private static final Domain INSTANCE = new Domain();

/** Construct the ordinal domain of */

protected *

@override

public String toString() {
  if (this == INSTANCE) return "
    return

    /**
     * Retrieves the static singleton instance of [@link OrdinalDomain].
     * All instances that were not built with the specified domain will be
     * bound to a static domain.
     * @return The ordinal domain of all instances"

  */

  public static Domain get() {
    return INSTANCE;
  }

  /**
   * Constructs the ordinal domain of
   */

  public Domain() {}

  protected *

  extractValue(InternProxy proxy, int ordinal) {
    return new *

  }
```java
  @Override
  public org.immutables.ordinal.OrdinalDomain<
$(__, type.typeAbstract());
> domain() {
    return domain;
  }

} else if ($if(type.isUseSingletonOnly())) {
  __dl();__dl();__ln();
} else if ($if(type.isUseInterned())) {
  __dl();__ln();
  __ln();
  __out(" ");
  __dl();

  if ($if(type.isGenerateJdkOnly())) {
    __dl();__ln();
    __out(" ");
    __dl();
  }

  if ($if(type.isUseWeakInterned())) {
    __dl();__ln();
    __out(" private static final java.util.Map<");
$(__, type.typeImmutable().simple());
    __out(" , java.lang.ref.WeakReference<");
$(__, type.typeImmutable().simple());
    __out(">> INTERNER =");__ln();
    __out(" new java.util.WeakHashMap<>();");__ln();
    __out(" ");
  }
}
}

} else {
  __dl();__ln();
  __out(" private static final java.util.concurrent.ConcurrentHashMap<InternProxy, ");
$(__, type.typeImmutable().relative());
  __out(">> INTERNER =");__ln();
  __out(" new java.util.concurrent.ConcurrentHashMap<InternProxy, ");
$(__, type.typeImmutable().relative());
  __out("();");__ln();
  __out(" ");
}
```

**:  private static final */
$__ (__.guava);
__.out(".collect.Interner<");
$__ (__.type.typeImmutable().relative());
__.out("> INTERNER = ");
$__ (__.guava);
__.out(".collect.Interners.newWeakInterner();").ln();
__.out("  ");

} else {
__.dl();__.ln();
__.out("  private static final ");
$__ (__.guava);
__.out(".collect.Interner<InternProxy> INTERNER = ");
$__ (__.guava);
__.out(".collect.Interners.newStrongInterner();").ln();
__.out("  ");

}
__.dl();__.ln();
__.out("  ");

}
__.dl();__.ln();
}
__.dl();
}

org.immutables.generator.Templates.Invokable generateConstruction() { return generateConstruction; }
private final org.immutables.generator.Templates.Invokable generateConstruction = new FragmentDispatch(1, 10);
void _t10__generateConstruction(org.immutables.generator.Templates.Invocation __) {
__.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
__.ln();
__.dl();
if ($if($if(type.isUseConstructor(), andnot, type.factoryOf().isNew()))) {
__.dl();__.ln();
__.out("  ");
__.dl();
if ($if(type.requiresAlternativeStrictConstructor())) {
__.dl();__.ln();
__.ln();
__.out(" /* */").ln();
__.out("  * Construct a new immutable { @code ");
$__ (__.type.name());
__.out(" } instance.");).ln();
$__ (__.javadocGenerics, type);
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {

  __.dl(); __.ln();
  __.out("   * @param ");
  ${(__, v.name());
  __.out(" The value for the { @code ");
  ${(__, v.name());
  __.out(" } attribute").ln();
  __.dl(); _it1.index++;
  _it1.first = false;
}
___.dl(); ___.ln();
___.out("   * @return An immutable ");
${(__, type.name());
___.out(" instance").ln();
___.out(" */").ln();
___.out(" public static ");
${(__, type.generics().spaceAfter());
${(__, type.typeValue());
___.out(" */");
${(__, type.names().of);
___.out("(");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {

  __.dl(); __.dl();
  if ($if($(not, _it1.first))) {
    __.dl(); __.out(" , ");
  }

  ___.dl(); ${(__, v.atNullability());
  ___.eachLine, v.constructorParameterInjectedAnnotations());
  ${(__, v.getType());
  ___.out(" ");
  ${(__, v.name());
  __.dl(); _it1.index++;
  _it1.first = false;
}
___.dl(); ___.out(" ");
  __.ln();
  __.out(" return ");
  ${(__, type.names().of);
  __.out("(");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {

  __.dl(); __.dl();
  if ($if($(not, _it1.first))) {
    __.dl(); __.out(" , ");
  }

  __.ln();
  __.out(" @param ");
  ${(__, v.name());
  __.out(" The value for the { @code ");
  ${(__, v.name());
  __.out(" } attribute").ln();
  __.dl(); _it1.index++;
  _it1.first = false;
}
__dl();
if ($if(v.requiresAlternativeStrictConstructor())) {
    __dl();
    __out("(");
    $(__, constructorAcceptType, v);
    __out(") ");
}
__dl();
$(__, v.name());
__dl();
_it1.index++;
_it1.first = false;
}
__dl();
__out(";").ln();
__out(" } ").ln();
__out(" ");

__dl();
__ln();
__ln();
__out(" /**").ln();
__out(" * Construct a new immutable [@code ");
$(__, type.name());
__out(" } instance.").ln();
$(__, javadocGenerics, type);
__ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
    __dl();
    __ln();
    __out(" * @param ");
    $(__, v.name());
    __out(" The value for the [@code ");
    $(__, v.name());
    __out(" ] attribute"),ln();
    __dl();
    _it1.index++;
    _it1.first = false;
}
__dl();
__ln();
__out(" * @return An immutable ");
$(__, type.name());
__out(" instance"),ln();
__out(" */",ln());
__out(" public static ");
$(__, type.generics().spaceAfter());
$(__, type.typeValue());
__out(" ");
$(__, type.names().of);
__out(" ");
} final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
   __dl();__dl();
   if ($if($not, _it1.first)) {
      __dl();__out(",");
   }
   __dl();$___.v.atanullability();
   $___.eachLine, v.constructorParameterInjectedAnnotations();
   $___.constructorAcceptType, v);
   __out(" ");
   $___.v.name();
   __dl();_it1.index++;
   _it1.first = false;
}
__dl();__out(""").ln();
__out(" return ");
{final org.immutables.value.processor.meta.ValueType type_validated_1881291508 = $cast(type);
 final java.lang.Boolean qualified_validated_1881291508 = $cast($false);
 final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = new org.immutables.generator.Templates.Fragment(0) {
   @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __dl();final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = this;
      __out("new ");
      $___.type.typeImmutable().relativeRaw();
      $___.type.generics().diamond();
      __out("(");
      {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
       for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
          __dl();__dl();
          if ($if($not, _it1.first)) {
             __dl();__out(",");
          }
          __dl();$___.v.name();
          __dl();_it1.index++;
          _it1.first = false;
       }
       __dl();__out(""");
       __dl();
    };
    __dl();__dl();
    if ($if(type_validated_1881291508.isUseValidation())) {
       __dl();__dl();
       if ($if(qualified_validated_1881291508)) {
          __dl();$___.type_validated_1881291508.typeImmutable().relativeRaw();
          __out(".");
       }
    }
    __dl();__out("validate(");
if ($if($not, _it1.first)) { 
    __dl();__out(" "); 
} 
__dl();$___.outNullability(); 
$___.eachLine, v.constructorParameterInjectedAnnotations(); 
__dl(); 
if ($if(v.isOptionalType())) { 
    __dl();{final org.immutables.value.processor.meta.ValueAttribute a_unwrappedOptionalType_1615308684 = $cast(v); 
        ___.dl(); 
        if ($if($a_unwrappedOptionalType_1615308684.isOptionalType(), and, 
            a_unwrappedOptionalType_1615308684.isOptionalAcceptNullable())) { 
            ___.dl();${_._.atNullable, a_unwrappedOptionalType_1615308684}; 
            ___.dl();a_unwrappedOptionalType_1615308684.getWrappedElementType(); 
        } else { 
            ___.dl();a_unwrappedOptionalType_1615308684.getUnwrappedElementType(); 
        } 
    } 
} else { 
    ___.dl();${_._.constructorAcceptType, v}; 
} 
___.dl();___.outNullability(); 
$___.outNullability(); 
$___.outNullability(); 
$___.atNullable, v.name()); 
$___.outNullability(); 
_it1.index++; 
_it1.first = false; 
} } 
___.dl();___.outNullability(); 
___.dl();___.outNullability(); 
___.dl();___.outNullability(); 
{final org.immutables.value.processor.meta.ValueType type_validated_1881291508 = $cast(type); 
    final java.lang.Boolean qualified_validated_1881291508 = $cast($$false); 
    final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = new 
    org.immutables.generator.Templates.Fragment(0) { 
        @Override public void run(org.immutables.generator.Templates.Invokation __) { 
            ___.dl();final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = this; 
            ___.dl();___.outNullability(); 
            ___.dl();___.outNullability(); 
            ___.dl();___.outNullability(); 
            ___.dl();___.outNullability(); 
            for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) { 
                ___.dl();___.dl(); 
            } 
        } 
    } 
}
if ($if($not, _it1.first)) {
    __.dl();__.out(" ");
}
___.dl();$(__, v.name());
___.dl();_it1.index++; _it1.first = false;
} }
___.dl();__.out(""");
___.dl();}
});___.dl();___.dl();
if ($if(type_validated_1881291508.isUseValidation())) {
    ___.dl();___.dl();
    if ($if(qualified_validated_1881291508)) {
        ___.dl();$(__, type_validated_1881291508.typeImmutable().relativeRaw());
        __.out(".");
    }
    ___.dl();__.out("validate(");
    __$.(__, expression_validated_1881291508);
    __.out(" )");
} else {
    ___.dl();$
    }
    ___.dl();
    __.out(":").ln();
    __.out(" ");.ln();
    __.out(" ");
} ___.dl();___.ln();
} ___.dl();___.ln();
___.dl();
if ($if(type.isUseValidation())) {
    ___.dl();___.ln();
    ___.dl();
    if ($if(type.isUseJavaValidationApi())) {
        ___.dl();___.ln();
        ___.ln();
        __.out(" private static final javax.validation.Validator ");
        __$.(__, disambiguateField, type, "validator");
        __.out(" = javax.validation.ValidatorFactory().getValidator();").ln();
    }
```java
private static validate(instance) {
  if (isUseJavaValidationApi()) {
    java.util.Set<javax.validation.ConstraintViolation<?>> constraintViolations = validator.validate(instance);
    if (!constraintViolations.isEmpty()) {
      throw new javax.validation.ConstraintViolationException(constraintViolations);
    }
  }

  for (final org.immutables.value.processor.meta.ValueType.ValidationMethod vm : validationMethods) {
    if (vm.normalize) {
      instance = () instance.
    } else {
      instance.
    }
  }
}
```
if ($if(type.isUseSingletonOnly())) {
    __.dl();___.ln();
    __.dl();
    __.out("return INSTANCE != null ? INSTANCE : instance;\n");
    __.dl();___.ln();
} else if ($if(type.isGenerateOrdinalValue())) {
    __.dl();___.ln();
    __.out("return \n");
    $(__, type.typeImmutable().relative());
    __.out("instance.domain.internOrdinal(new InternProxy(instance));\n");
} else if ($if(type.isUseInterned())) {
    __.dl();___.ln();
    __.out("\n");
    __.dl();
    if ($if(type.isGenerateJdkOnly())) {
        __.dl();___.ln();
        __.out("\n");
        __.dl();
        if ($if(type.isUseWeakInterned())) {
            synchronized (INTERNER) { \n
            final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(type);
            __.dl();
            if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
                __.dl();___.out("@javax.annotation.Nullable \n");
            }
            __.dl();___.out("java.lang.ref.WeakReference<\n");
            __.dl();
            $(__, type.typeImmutable().relative());
            __.out("> reference = INTERNER.get(instance);\n");
            __.out("\n");
            final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(type);
            __.dl();
            if ($if($s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable")) {
                __.dl();___.out("@javax.annotation.Nullable \n");
            }
            __.dl();
            __.out("java.lang.ref.WeakReference<\n");
            __.dl();
            $(__, type.typeImmutable().relative());
            __.out("interned = reference != null ? reference.get() : null;\n");
            __.out(" if (interned == null) \n");
            __.out("INTERNER.put(instance, new java.lang.ref.WeakReference<\n\n");
        }
    }
}
__out("    interned = instance; ").ln();
__out("  }").ln();
__out("    return interned;").ln();
__out("  }").ln();
__out("    ");

} else {
__dl();__ln();
__out("    ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(type);
__dl();
if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
__dl();__out("    @javax.annotation.Nullable ");

} __dl();
}
$(__, type.typeImmutable().relative());
__out("    interned = INTERNER.putIfAbsent(new InternProxy(instance), instance); ").ln();
__out("    return interned != null ? interned : instance; ").ln();
__out("    ");

} __dl();__ln();
__out("  ");

} else {
__dl();__ln();
__out("  ");
__dl();
if ($if(type.isUseWeakInterned())) {
__dl();__ln();
__out("    return INTERNER.intern(instance); ").ln();
__out("    ");

} else {
__dl();__ln();
__out("    return INTERNER.intern(new InternProxy(instance)).instance; ").ln();
__out("    ");

} __dl();__ln();
__out("  ");

} __dl();__ln();

} else if ($if(type.isUseSingleton())) {

} __dl();__ln();

}
```java
__.out("new ");
$(__, type.typeImmutable().relativeRaw());
__.out("()");
__.dl();
});__.dl();__.dl();
if ($if(type_validated_1881291508.isUseValidation())) {
  __.dl();__.dl();
  if ($if(qualified_validated_1881291508)) {
    __.dl();$(__, type_validated_1881291508.typeImmutable().relativeRaw());
    __.out(".");
  }
  __.dl();___.out("validate(");
$(__, expression_validated_1881291508);
___.out(")");
} else {
  __.dl();$(__, expression_validated_1881291508);
}
__.dl();
___.out(";").ln();
___.ln();
___.out("/**").ln();
___.out(" * Returns the default immutable singleton value of { @code ");
$(__, type.name());
___.out(" */").ln();
___.out(" * @return An immutable instance of ");
$(__, type.name());
___.ln();
___.out(" */").ln();
___.out(" public static ");
$(__, type.typeValue().relative());
___.out(" ");
$(__, type.names().instance);
___.out(" } ").ln();
___.out(" return INSTANCE; ").ln();
___.out(" ").ln();
}
__.dl();__.ln();
__.dl();
}
organ.immutables.generator.Templates.Invokable generateImmutableCopyOf() {
  return generateImmutableCopyOf; }
private final organ.immutables.generator.Templates.Invokable generateImmutableCopyOf = new FragmentDispatch(1, 12);
```
void _t12__generateImmutableCopyOf(org.immutables.generator.Templates.Invokation __) {
  __dl();final org.immutables.value.processor.meta.ValueType type = $cast(__param(0));
  __ln();
  __dl();
  if ($if($if($if(type.isUseCopyConstructor(), andnot, type.constitution.isImplementationHidden())))) {
    __dl();__ln();
    __ln();
    __out("/**").ln();
    __out("* Creates an immutable copy of a { @link }");
    __out(__, type.typeAbstract().relativeRaw());
    __out("] value.").ln();
    __out("* Uses accessors to get values to initialize the new immutable instance.").ln();
    __out("* If an instance is already immutable, it is returned as is.").ln();
    __javadocGenerics, type);
    __ln();
    __out("* @param instance The instance to copy").ln();
    __out("* @return A copied immutable ");
    __type.name();
    __out(" instance").ln();
    __out(" */").ln();
    __dl();
    if ($if($if(not, type.constitution.isImplementationPrimary()))) {
      __dl();__out("public ");
    }
    __dl();__out("static");
    __type.generics().def();
    __out(" ");
    __type.typeValue().relative();
    __out(" ");
    __type.factoryCopyOf().applied();
    __out("(");
    __type.typeAbstract().relative();
    __out(" instance) ").ln();
    __out(" if (instance instanceof ");
    __type.typeImmutable().relativeRaw();
    __type.generics().unknown;
    __out(" ").ln();
    __out(" return ");
    __type.typeImmutable().relative();
    __out(" instance;").ln();
    __out(" ").ln();
    __dl();
    if ($if(type.isUseBuilder())) {
      __dl();__ln();
      __out(" return ");
      @Override public void run(org.immutables.generator.Templates.Fragment(0) {
```java
__dl();$___.type.factoryBuilder().relative();
__out("()");
__dl();
}});
__ln();
__out(" ");
__dl();
if ($if(type.isGenerateBuilderFrom())) {
__dl();__ln();
__out(".");
$___.type.names().from);
__out("(instance)").ln();
__out(" ");
} else {
__dl();__ln();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
__dl();__ln();
__out(" ");
if ($if(v.isEncoding())) {
__dl();__ln();
$___.rr.builderCopyFrom().v);
__out("(instance.");
$___.v.names.get);
__out("())").ln();
__out(" ");
} else if ($if(v.isNullable())) {
__dl();__ln();
$___.v.names.init);
__out("(instance.");
$___.v.names.get);
__out("())").ln();
__out(" ");
} else if ($if(v.isCollectionType())) {
__dl();__ln();
$___.v.names.addAll();
__out("(instance.");
$___.v.names.get);
__out("())").ln();
__out(" ");
} else if ($if(v.isMapType())) {
__dl();
$___.v.names.addAlf());
__out("(instance.");
$___.v.names.get);
__out("())").ln();
__out(" ");
} else if ($if(v.isMapType())) {
__dl();__ln();
```
__out("      ."));
$___.v.names.putAll();
__out("(instance.");
$___.v.names.get();
__out("()")\.ln();
__out("    ");
}

} else {
__dl();__ln();
__out("      .");
$___.v.names.init();
__out("(instance.");
$___.v.names.get();
__out("()")\.ln();
__out("    ");
}

__dl();__ln();
__out("      ");
__dl();__it1.index++;__it1.first = false;
}

__dl();__ln();
__out("    ");

__dl();__ln();
__out("      ");
$___.type.names().build();
__out("();")\.ln();

} else {
__dl();__ln();
__out("      ");
$___.type.factoryOf().relative();
__out("(");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
  __dl();__dl();
  if ($if($(not, _it1.first))) {
    __dl();__out(" , ");
  }

  __dl();__out("instance.");
  $(_.v.names.get());
  __out("()" );
  __dl();__it1.index++;__it1.first = false;
}}

}
org.immutables.generator.Templates.Invokable generateLazyValues() {
    return generateLazyValues;
}

private final org.immutables.generator.Templates.Invokable generateLazyValues = new FragmentDispatch(1, 13);

void _t13__generateLazyValues(org.immutables.generator.Templates.Invokation __) {
    __dl(); final org.immutables.value.processor.meta.ValueType type = __cast(__.param(0));
    __ln();
    if ($if(lz)) {
        __dl(); final org.immutables.value.processor.meta.ValueAttribute> lz = __cast(type.getLazyAttributes());
        __dl(); __ln();
        __out(" ");
        __dl();
        if ($if(lz)) {
            __dl(); __ln();
            __ln();
            __out(" ");
            __dl();
            final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
            final org.immutables.value.processor.meta.LongBits.LongPositions positions = __cast($longsFor, lz));
            __dl(); __ln();
            __out(" ");
            __dl();
            final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
            for (final org.immutables.value.processor.meta.LongBits.LongSet l : $in(positions.longs())) {
                __dl(); __ln();
                __out(" ");
                final org.immutables.value.processor.meta.ValueType type_jsonIgnore_782971179 = __cast(type);
if ($if(type_jsonIgnore_782971179.isGenerateJacksonIngoreFields())) {
    __.dl();
    __.out("  ");
    $.(__, eachLine, type.syntheticFieldsInjectedAnnotations());
    __.ln();
    __.out("  ");
    final org.immutables.value.processor.meta.ValueType type_hiddenMutableState_1091893888 = $cast(type);
    __.dl();
    if ($if($(type_hiddenMutableState_1091893888, allowsClasspathAnnotation,"com.google.errorprone.annotations.Immutable"))) {
      __.dl();
      __.out("@SuppressWarnings("Immutable")");
    }
    __.dl();
    __.ln();
    __.out("  private transient volatile long lazyInitBitmap");
    $.(__, emptyIfZero, l.index);
    __.out(";").ln();
    __.out(" ");
    __.dl();
    __.it3.index++;
    __.ln();
}__

{final org.immutables.value.processor.meta.ValueAttribute l : $in(lz)) {
  final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute l : $in(lz)) {
    final org.immutables.generator.Templates.Invokable maskConstantName = new org.immutables.generator.Templates.Invokable("_LAZY_INIT_BIT");
    __.dl();
    __.ln();
    __.out(" ");
    final org.immutables.generator.Templates.Invokable bitmapFieldName = new org.immutables.generator.Templates.Invokable(" ");
    __.dl();
    __.ln();
  }
  @Override public void run(org.immutables.generator.Templates.Invocation __) {
    __.dl();
    __.toConstant, l.name();
    __.out("_LAZY_INIT_BIT");
    __.ln();
    __.out(" ");
    final org.immutables.generator.Templates.Invokable bitmapFieldName = new org.immutables.generator.Templates.Invokable(" ");
    __.dl();
    __.ln();
    __.out(" ");
    __.dl();
    __.ln();
    __.out(" ");
    final org.immutables.generator.Templates.Invokable bitmapFieldName = new org.immutables.generator.Templates.Invokable(" ");
    __.dl();
    __.ln();
    __.out(" ");
  }
```java
final org.immutables.generator.Templates.Invokable lazyVar = new
org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        final org.immutables generator.Templates.Invokable lazyVar = this;
        __.out("@com.fasterxml.jackson.annotation.JsonIgnore
        ");
    }
};

final org.immutables generator.Templates.Invokable bitmapFieldName = this;

final org.immutables generator.Templates.Invokable lazyVar = new
org.immutables generator.Templates.Fragment(0) {
    @Override public void run(org.immutables generator.Templates.Invokation __) {
        final org.immutables generator.Templates.Invokable lazyVar = this;
        __.out("@com.fasterxml.jackson.annotation.JsonIgnore
        ");
    }
};

private static final long

private transient
```

__out(" ");
$(__, lazyVar);
__out(";").ln();
__ln();
__out(" /** ");
__out(" * @inheritDoc ");.ln();
__out(" * <p> ");.ln();
__out(" * Returns a lazily initialized value of the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(l);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" attribute.").ln();
__out(" * Initialized once and only once and stored for subsequent access with proper 
  synchronization.").ln();
__out(" * In case of any exception or error thrown by the lazy value initializer,").ln();
__out(" * the result will not be memoised (i.e. remembered) and on next call computation'").ln();
__out(" * will be attempted again.").ln();
__out(" * @return A lazily initialized value of the { @code ");
$(__, l.name());
__out(" } attribute").ln();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it4 = new 
  org.immutables.generator.Templates.Iteration(); 
  for (final java.lang.String t : $in(l.getThrownCheckedExceptions())) { 
    __dl();__.ln();
    __out(" * @throws ");
    $(__, t);
    __out(" if undelying { @code ");
    $(__, l.names.get);
    __out("() will throw it.");.ln();
    __out(" ");
    __dl();_it4.index++;
    _it4.first = false;
  }
}
__dl();__.ln();
__out(" */").ln();
__out(" ");
$(__, eachLine, l.accessorInjectedAnnotations());
__.ln();
__out(" @Override").ln();
__out(" ");
__dl();
if ($if(l.getThrownCheckedExceptions())) {
  __dl();__.ln();
  __out(" ");
  $(__, l.getAccess());
  $(__, l.getType());
$(___. lazyVar);
  __out(" = ");
  final org.immutables.value.processor.meta.ValueAttribute v_maybeNonNullValue_1844859357 = $cast(l);
  final org.immutables.generator.Templates.Invokable expression_maybeNonNullValue_1844859357 = new
  org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invocation __) {
      __dl();
      final org.immutables.generator.Templates.Invokable expression_maybeNonNullValue_1844859357 = this;
      $(___. invokeSuper, l);
      __out(".");
      $(___. l.names.get);
      __out("(");
      __dl();
    } __dl();
    if ($if($(v_maybeNonNullValue_1844859357.isPrimitive(), or,
              v_maybeNonNullValue_1844859357.isNullable()))
            __dl();$(___. expression_maybeNonNullValue_1844859357);
        } else {
          __dl();$(___. requireNonNull, v_maybeNonNullValue_1844859357.containingType);
          __out(";");
          $(___. expression_maybeNonNullValue_1844859357);
          __out(";");
          $(___. v_maybeNonNullValue_1844859357.name());
          __out("\"\";");
        }
  } __dl();
  __dl();
  __out(";").ln();  
  __out(";");
  $(___. bitmapFieldName);
  __out(" |= ");
  $(___. maskConstantName);
  __out(";").ln();
  __out(" return ");
  $(___. lazyVar);
  __out(";").ln();
  __out(" ");
  __out(" ");
  __dl();
  __dl();
  --it3.index++;
  _it3.first = false;
} __dl();
  __ln();  
  __out(" ");
org.immutables.generator.Templates.Invokable castBuildStagedBuilder() { return castBuildStagedBuilder; }
private final org.immutables.generator.Templates.Invokable castBuildStagedBuilder = new FragmentDispatch(2, 14);
void _t14__castBuildStagedBuilder(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  final java.lang.String expression = __.param(1).toString();
  { final org.immutables.value.processor.meta.TelescopicBuild tb = $cast(type.getTelescopicBuild());
    __.dl();
    if ($if($tb, andnot, type.getInnerBuilder().isExtending)) {
      __.dl();
      __.out("(");
      __.out($(__, type.typeBuilderImpl().relative()));
      __.out(" ");
      __.out($(__, expression));
      __.out("\n");
    } else {
      __.dl();
    }
    __.dl();
    _it1.index++;
    _it1.first = false;
  }
  __.dl();
}

org.immutables.generator.Templates.Invokable factoryBuildStageBuilderType() { return factoryBuildStageBuilderType; }
private final org.immutables.generator.Templates.Invokable factoryBuildStageBuilderType = new FragmentDispatch(1, 15);
void _t15__factoryBuildStageBuilderType(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  { final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    _it1 = new org.immutables.generator.Templates.Iteration();
    final org.immutables.value.processor.meta.TelescopicBuild tb = $cast(type.getTelescopicBuild());
  }
  __.dl();
}
if ($if(tb)) {
  __.dl();$(__, toUpper, tb.firstStage().attribute.name());
  __.out("BuildStage");
  $__().type.generics().args();
}
else {
  __.dl();$__().type.typeBuilderImpl().relative();
}
___.dl();___.dl();___.dl();___.it1.index++;
___.it1.first = false;
___.dl();___.dl();
}

org.immutables.generator.Templates.Invokable telescopicBuilderImplementInterfaces() { return
telelescopicBuilderImplementInterfaces; }
private final org.immutables.generator.Templates.Invokable telescopicBuilderImplementInterfaces = new
FragmentDispatch(1, 16);
void _t16__telescopicBuilderImplementInterfaces(org.immutables.generator.Templates.Invokation __) {
  __.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  {final org.immutables.value.processor.meta.TelescopicBuild tb = $cast(type.getTelescopicBuild());
    __.dl();___.dl();
    if ($if(tb)) {
      __.dl();final org.immutables.generator.Templates.Iteration _it1 = new
org.immutables.generator.Templates.Iteration();
      for (final org.immutables.value.processor.meta.TelescopicBuild.TelescopicStage nt : $in(tb.stages)) {
        final org.immutables.value.processor.meta.ValueAttribute v = $cast(nt.attribute);
        __.dl();$(__, toUpper, v.name());
        __.out("BuildStage");
        ___.type.generics().args();
        __.out(",");
        ___.dl();___.it2.index++;
        ___.it2.first = false;
      }
    }
    ___.dl();___.out("BuildFinal");
    ___.type.generics().args();
  }
___.dl();___.dl();___.dl();
}

org.immutables.generator.Templates.Invokable generateTelescopicBuilderInterfaces() { return
generateTelescopicBuilderInterfaces; )
private final org.immutables.generator.Templates.Invokable generateTelescopicBuilderInterfaces = new FragmentDispatch(1, 17);

void _t17__generateTelescopicBuilderInterfaces(org.immutables.generator.Templates.Invokation __) {
    final org.immutables.value.processor.meta ValueType type = $cast(__.param(0));
    __.dl();
    __.ln();
    {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        final org.immutables.value.processor.meta TelescopicBuild tb = $cast(type.getTelescopicBuild());
    __.dl();
    __.ln();
    __.dl();
    __.ln();
    if ($if(tb)) {
        __.dl();
        __.ln();
        {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
            for (final org.immutables.value.processor.meta.TelescopicBuild.TelescopicStage nt : $in(tb.stages)) {
                final org.immutables.value.processor.meta.ValueAttribute v = $cast(nt.attribute);
            __.dl();
            __.ln();
            if ($if(nt.next)) {
                __.dl();
                $(__, toUpper, nt.next.attribute.name());
                __.out("BuildStage");
            __.dl();
            __.ln();
            $(__, type.generics().args());
            } else {
                __.dl();
                __.out("BuildFinal");
            __.dl();
        $(__, type.generics().args());
    
} __.dl();
} __.ln();
$__.__.dl();
$__.__.ln();
$__.__.ln();
$__.__.out("public interface ");
$__.__.out("BuildStage");
$__.__.out(" ");
$__.__.out("/");
$__.__.out(" *");
$__.__.ln();
$__.__.out(" * Initializes the value for the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$__.__.out("attribute.");
$__.__.out(" * @param ");
}
$(__, v.name());
__out(" The value for ");
$(__, v.name());
__out(" ");
__dl();
if ($if(v.isNullable()) {__dl();__out("(can be { @code null})");}
__dl();__ln();
__out(" * @return { @code this} builder for use in a chained invocation").ln();
__out(" */").ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);__dl();
if ($if(a_deprecation_286924011.deprecated)) {
__dl();__out("@Deprecated");
}
__dl();
__ln();
__out(" ");
$(__, builderReturn);
__out(" ");
$(__, v.names.init);
__out(" ()");
$(__, v.getType());
__out(" ");
$(__, v.name());
__out(":");ln();__out(" ");.ln();
__dl();_it2.index++;_it2.first = false;
}
__dl();__ln();
__ln();
$(__, atGenerated, type);
__ln();
__out("public interface BuildFinal");
$(__, type.generics());
__out(" ");ln();
__dl();__ln();
__dl();
if ($if(v.isEncoding())) {
__dl();__ln();
}
__out(" ");
__dl();__ln();
} else if ($if(v.isCollectionType())) {
__dl();__ln();
__out("/**").ln();
__out(" * Adds one element to ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
__$(_, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" ");
__$(_, toLower, v.getRawCollectionType());
__out(".").ln();
__out(" * @param element A ");
__$(_, v.name());
__out(" element").ln();
__out(" * @return {@code this} builder for use in a chained invocation”).ln();
__out(" */").ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
__dl();__out("@Deprecated");
}
__dl();
__ln();
__out(" BuildFinal");
__$(_, type.generics().args());
__out(" ");
__$(_, v.names.add());
__out(" ");
__$(_, v.getUnwrappedElementType());
__out(" element;").ln();
__ln();
__out(" /**").ln();
__out(" * Adds elements to ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
__$(_, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" ");
__$(_, toLower, v.getRawCollectionType());
__out(".").ln();
__out(" * @param elements An array of ");
__$(_, v.name());
__out(" elements").ln();
__out("    * @return {code this} builder for use in a chained invocation
").ln();
__out("    */").ln();
__out("  ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
    __dl();__out("@Deprecated");
}
__dl();
__ln();
__out(" BuildFinal");
$(_, type.generics().args());
__out(" ");
$(_, v.names.addv());
__out("(");
$(_, v.getUnwrappedElementType());
__out("... elements;").ln();
__ln();
__out(" /**").ln();
__out("    * Adds elements to ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(_, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" ");
$(_, toLower, v.getRawCollectionType());
__out(".").ln();
__out("    * @param elements An iterable of ");
$(_, v.name());
__out(" elements").ln();
__out("    * @return {code this} builder for use in a chained invocation
").ln();
__out("    */").ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
    __dl();__out("@Deprecated");
}
__dl();
__ln();
__out(" BuildFinal");
$(_, type.generics().args());
__out(" ");
if ($if(a_deprecation_286924011.deprecated)) {
    $.dl();$.out("@Deprecated");
}
$.dl();
$.ln();
$.out("  BuildFinal");
$.($,. type.generics().args());
$.out(" ");
$.($,. v.names.init);
$.out("\");
{final org.immutables.value.processor.meta.ValueAttribute a_unwrappedOptionalType_1615308684 = $cast(v);
    $.dl();
    if ($if($($a_unwrappedOptionalType_1615308684.isOptionalType(), and,
        a_unwrappedOptionalType_1615308684.isOptionalAcceptNullable()))) {
        $.dl();$.($,. atNullable, a_unwrappedOptionalType_1615308684);
        $.($,. a_unwrappedOptionalType_1615308684.getWrappedElementType());
    } else {
        $.dl();$.($,. a_unwrappedOptionalType_1615308684.getUnwrappedElementType());
    }
    $.dl();
    $.($,. v.name());
    $.out(" ");$.ln();
    $.ln();
    $.out(" */*").ln();
    $.out(" * Initializes the optional value ");
} final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$.($,. sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
$.($,. v.name());
$.out(" to ");
$.($,. v.name());
$.out(" @param ");
$.($,. v.name());
$.out(" The value for ");
$.($,. v.name());
$.ln();
$.out(" * @return { @code this } builder for use in a chained invocation"),ln();
$.($,. v.name());
$.ln();
$.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __.dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __.dl();___.out("@Deprecated");
  }
  __.dl();
  __.ln();
  __.out("  BuildFinal");
  $(___.type.generics().args());
  __.out(" ");
  $(___.v.names.init);
  __.out(" ");
  $(___.v.getRawType());
  __.dl();
  if ($if($(not, v.isJdkSpecializedOptional()))) {
    __.dl();___.out("<");
    $(___.v.getConsumedElementType());
    __.out(">");
  }
  __.dl();___.out(" ");
  $(___.v.name());
  __.out(";");ln();
} else if ($if(v.isMapType())) {
  __.dl();___.ln();
  ___.out("    ");
  if ($if(v.isMultimapType())) {
    __.dl();___.ln();
    ___.ln();
    __.out("/**").ln();
    __.out("  * Put all mappings from the specified key to values for ");
  }
  final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
  final java.lang.String gE = $cast(v.getConsumedElementType());
  final java.lang.String uK = $cast(v.getUnwrappedElementType());
  final java.lang.String wK = $cast(v.getWrappedElementType());
  final java.lang.String uV = $cast(v.getUnwrappedSecondaryElementType());
  final java.lang.String wV = $cast(v.getWrappedSecondaryElementType());
  __.dl();___.ln();
  __.out(" ");
  __.dl();
  if ($if(v.isMultimapType())) {
    __.dl();___.ln();
    __.ln();
    __.out("/**").ln();
    __.out("  * Put all mappings from the specified key to values for ");
  }
  final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
  $(___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
___.out(" ");
$(__, toLower, v.isMapType());
__out(". Nulls are not permitted").ln();
__out("  * @param key The key for ");
$___.v.name();
__ln();
__out("  * @param values The values for ");
$___.v.name();
__ln();
__out("  * @return {@code this} builder for use in a chained invocation").ln();
__out("  */").ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
__dl();__out("@Deprecated");
}
__dl();
}
__ln();
__out("  BuildFinal");
$___.type.generics().args();
__out(" ");
$___.v.names.putv();
__out("(");
$___.uK;
__out(" key, ");
$___.uV;
__out("... values;");ln();
__ln();
__out(" /**<").ln();
__out("  * Put all mappings from the specified key to values for ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw;
}
__out(" ");
$___.toLower, v.isMapType();
__out(". Nulls are not permitted").ln();
__out("  * @param key The key for ");
$___.v.name();
__ln();
__out("  * @param values The values for ");
$___.v.name();
__ln();
__out("  * @return {@code this} builder for use in a chained invocation").ln();
__out("  */").ln();
__out(" ");
```java
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __.dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __.dl(); __.out("@Deprecated");

  }
  __.dl();
} __.ln();
___.out(" BuildFinal");
$___.type.generics().args();
___.out(" ");
$___.v.names.putAll();
___.out("()");
$___.uK;
___.out(" key, Iterable<");
$___.wV;
___.out("> values").ln();
___.out(" ");
}
___.dl(); __.ln();
___.ln();
___.out(" /**").ln();
___.out(" * Put one entry to the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
  $(___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
___.out(" map.").ln();
___.out(" * @param key The key in the ");
$___.v.name();
___.out(" map").ln();
___.out(" * @param value The associated value in the ");
$___.v.name();
___.out(" map").ln();
___.out(" * @return [ @code this ] builder for use in a chained invocation").ln();
___.out(" */").ln();
___.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __.dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __.dl(); __.out("@Deprecated");

  }
  __.dl();
} __.ln();
```

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__.out(" BuildFinal");
$(__, type.generics().args());
__.out(" ");
$(__, v.names.put());
__.out("(");
$(__ uK);
__.out(" key, ");
$(__ uV);
__.out(" value);".ln();
__.ln();
__.out(" /**");.ln();
__.out(" * Put one entry to the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
 $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__.out(" map. Nulls are not permitted").ln();
__.out(" * @param entry The key and value entry").ln();
__.out(" * @return [code this] builder for use in a chained invocation").ln();
__.out(" */").ln();
__.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
 $(__, dl());
 if (Sif(a_deprecation_286924011.deprecated)) {
   __.dl();__.out("@Deprecated");
 }
$(__, dl());
__.ln();
$.ln();
__.out(" BuildFinal");
$(__, type.generics().args());
__.out(" ");
$(__, v.names.put());
__.out("(java.util.Map.Entry<");
$(__, gE);
__.out(" , ? extends ");
$(__, wV);
__.out("> entry);".ln();
__.ln();
__.out(" /**");.ln();
__.out(" * Put all mappings from the specified map as entries to ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
 $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__.out(" map. Nulls are not permitted").ln();
__.out(" * @param entries The entries that will be added to the ");
if (Sif(v.isGenerateDefault)) {
  _.dl();_.ln();
  _.out("  * <p><em>If not set, this attribute will have a default value as defined by ");
  {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
   $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
  }
  _.out("</em>").ln();
  _.out("  ");
}
_.dl();_.ln();
_.out("  * @param elements The elements for ");
$(__, v.name());
_.ln();
_.out("  * @return {@code this} builder for use in a chained invocation").ln();
_.out("  */").ln();
_.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  _.dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __.dl();__.out("@Deprecated");
  }
  _.dl();
}
_.ln();
_.out("  BuildFinal");
$(__, type.generics().args());
_.out(" ");
$(__, v.names.init);
_.out(" ");
$(__, v.getElementType());
_.out("... elements;");.ln();
} else {
  _.dl();_.ln();
  _.ln();
  _.out("  /**").ln();
  _.out("  * Initializes the value for the ");
  {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
   $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
  }
  _.out("  attribute.");.ln();
  _.out("  ");
if (Sif(v.isGenerateDefault)) {
  __dl();__ln();
  __out(" * <p><em> If not set, this attribute will have a default value as returned by the initializer of ").ln();
  {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
   $(___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
  }
  __out("</em>").ln();
  __out(" ");
}
__dl();__ln();
__out(" * @param ");
$(___.v.name());
__out(" The value for ");
$(___.v.name());
__out(" ");
__dl();
if (Sif(v.isNullable())) {
  __dl();__out("(can be {@code null})");
}
__dl();__ln();
__out(" * @return {@code this} builder for use in a chained invocation").ln();
__out(" */").ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __dl();__out("@Deprecated");
  }
  __dl();
}
__ln();
__out(" BuildFinal");
$(___.type.generics().args());
__out(" ");
$(___.v.names.init);
__out(" ");
$(___.v.atNullability());
$(___.v.getType());
__out(" ");
$(___.v.name());
__out(";").ln();
}
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final java.util.List<org.immutables.value.processor.meta.ValueAttribute> mandatories = $cast(type.getMandatoryAttributes());
final java.util.List<org.immutables.value.processor.meta.ValueAttribute> nondefaults = $cast(type.getRequiresTrackedIsSetNonMandatoryAttributes());
final org.immutables.value.processor.meta.LongBits.LongPositions positions = $cast($longsFor, mandatories);
final org.immutables.value.processor.meta.LongBits.LongPositions nondefaultsPositions = $cast($longsFor, nondefaults);

if ($if(type.kind().isFactory())) {
  $__.dl(); $.ln();
  $.out("/**").ln();
  $.dl();
  $.out(" * @code ");
  $__(__. type.typeBuilderImpl().simple());
  $.out("{ } collects parameters and invokes the static factory method:").ln();
  $.out(" * @code ");
  $__(__. type.factoryOf());
  $.out("(...) ").ln();
  $.out(" * Call the { @link #");
  $__(__. type.names().build);
  $.out("() } method to get a result of type { @code ");
  $__(__. type.typeValue());
  $.out(".").ln();
} else {
  $.dl(); $.ln();
  $.out(" * Builds instances of type { @link ");
  $__(__. type.typeValue().relativeRaw());
  $.out(" ");
  $__(__. type.typeValue().simple());
  $.out(".").ln();
  $.out(" * Initialize attributes and then invoke the { @link ");
  $__(__. type.names().build);
  $.out("() } method to create an").ln();
  $.out(" * immutable instance.").ln();
}

} else {
  $.dl(); $.ln();
  $.out(" * <p><em> { @code ");
  $__(__. type.typeBuilderImpl().simple());
  $.out("} is not thread-safe and generally should not be stored in a field or collection,"").ln();
  $.out(" * but instead used immediately to create instances.<em>"").ln();
  $.out(" */"").ln();
  $__(__. annotationsWhenTopLevel, type, topLevel);
  $.ln();
  $.dl();
}
} else {
    __dl();__ln();
    __out("    extends ");
    $(__, type.typeAbstract().relativeRaw());
    __out(".");
    $(__, type.getInnerBuilder().simpleName);
    $(__, type.getInnerBuilder().generics.args());
    __dl();
    if (!type.getTelescopicBuild()) {
        __dl();__ln();
        __out("    implements ");
        $(__, telescopicBuilderImplementInterfaces, type);
    }
    __dl();__out("  ");
    __out("  ");
    __dl();__ln();
    __out("  ");
} else if (!type.getTelescopicBuild()) {
    __dl();__ln();
    __out("  ");
    $(__, rr.staticFields(), setters);
    __ln();
    __out("  ");
    $(__, rr.staticMethods(), setters);
    __ln();
    __out("  ");
} else {
    __dl();__ln();
    __out("  ");
    __dl();
})
__ln();
__dl();
if (!type.constitution.isOutsideBuilder()) {
    __dl();__ln();
    __out("  ");
    $(__, rr.staticFields(), setters);
    __ln();
    __out("  ");
    $(__, rr.staticMethods(), setters);
    __ln();
    __out("  ");
}
final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute m : $in(mandatories)) {
    final org.immutables.value.processor.meta.LongBits.BitPosition pos = $cast($in(positions, m));
    __.dl();___.ln();
    __.out("  private static final long INIT_BIT_");
    __.out(toConstant, m.name());
    __.out(" = ");
    __.out(literal.hex, pos.mask);
    __.out(";");.ln();
    __.dl();_it2.index++;
    _it2.first = false;
}
___.dl();___.ln();
___.out(" ");

final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute p : $in(nondefaults)) {
    final org.immutables.value.processor.meta.LongBits.BitPosition pos = $cast($in(nondefaultsPositions, p));
    __.dl();___.ln();
    __.out("  private static final long OPT_BIT_");
    __.out(toConstant, p.name());
    __.out(" = ");
    __.out(literal.hex, pos.mask);
    __.out(";");.ln();
    __.dl();_it2.index++;
    _it2.first = false;
}
___.dl();___.ln();
___.out(" ");
$___. rr.builderStaticFields(), setters);
___.ln();
___.out(" ");

final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.LongBits.LongSet l : $in(positions.longs())) {
    __.dl();___.ln();
    __.out("  private long initBits");
    __.out(emptyIfZero, l.index);
    __.out(" = ");
    __.out(literal.hex, l.occupation);
    __.out(";");.ln();
    __.dl();_it2.index++;
    _it2.first = false;
$___.eachLine, type.syntheticFieldsInjectedAnnotations());
___.ln();
___.out("private Domain domain = Domain.get();").ln();
___.out(" ");
}
___.dl();___.ln();
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
final java.lang.Boolean useFactoryMethod = $cast($not, type.factoryBuilder().isNew());
___.dl();___.ln();
___.out(" ");
___.dl();
{final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
final java.util.List<org.immutables.value.processor.meta.ValueAttribute> parameters =
$cast(type.getBuilderParameters());
___.dl();___.ln();
___.ln();
___.out(" ");
___.dl();
if ($if($not, useFactoryMethod)) {
___.dl();___.ln();
___.out("/**\*/").ln();
___.dl();
if ($if(type.kind().isFactory())) {
___.dl();___.ln();
___.out(" * Creates a {code ");
$___.type.typeBuilderImpl().simple());
___.out("} factory builder.").ln();
}
else {
___.dl();___.ln();
___.out(" * Creates a builder for {link ");
$___.type.typeValue().relativeRaw());
___.out(" ");
$___.type.typeValue().simple());
___.out("} instances.").ln();
}
___.dl();___.ln();
___.out(" ");
$___.javadocBuilderExample, type);
___.ln();
{final org.immutables.generator.Templates.Iteration _it4 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute p : $in(parameters)) {
___.dl();___.ln();
___.out(" * @param ");
$___.p.name());
___.out("} @code ");
$(__, p.name());
__out("} parameter");
__dl();
if ($if(p.isNullable()) {__dl();__out("}, can be { @code null }");}
__dl();__ln();
__dl();_it4.index++;
_it4.first = false;
}
__dl();__ln();__out(" */").ln();
__out(" ");
__dl();__ln();
__out(" ");
__dl();
if ($if(useFactoryMethod)) {
__dl();__out("private ");
} else {
__dl();$(__, type.typeBuilderImpl().access());
}
__dl();$(__, type.typeBuilderImpl().simple());
__out("()");
{final org.immutables.generator.Templates.Iteration _it4 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute p : $in(parameters)) {
__dl();__dl();
if ($if($(not, _it4.first))) {__dl();__out("),
__dl();$__atNullability();
$__constructorAcceptType, p);
__out(" ");
$__name();
__dl();_it4.index++;
_it4.first = false;
}
__dl();__out(" ").ln();
__out(" ");
__dl();
if ($if(type.getInnerBuilder().isExtending)) {
__dl();__ln();
__out(" if ( !"(this instanceof ");
if ($if(v.isBuilderSwitcher()) { 
    ___dl();___ln(); 
    ___out(" "); 
    ___dl();
    } )
___dl();___ln();
___out(" ");

if ($$v$$isBuilderSwitcher()) {
    ___dl();___ln(); 
    ___out(" "); 
    ___dl();
    if ($if($v$.isDefault) { 
        ___dl();___ln(); 
        ___out(" "); 
        $(__, v$.names$init$); 
        ___out("(");
        $(__, v$.getRawType$); 
        ___out("."); 
        $(__, o$.constantName$); 
        ___out(");"$).ln(); 
        ___out(" "); 
        ___dl();_it5.index++; 
        _it5.first = false; 
    } )
    ___dl();___ln(); 
    ___out(" "); 
}
___dl();___ln(); 
___out(" "); 

if ($if($v$$isBuilderParameter) { 
    ___dl();___ln(); 
    ___out(" "); 
    ___dl();
}
if ($if(v.isCollectionType())) {
    __.dl();__.ln();
    __.out("    ");
    __.out("  ");
    __.out("    ");
    v.names.addAll();
    __.out("    ");
    v.name();
    __.out("  ");
    __.out("  ");
} else if ($if(v.isMapType())) {
    __.dl();__.ln();
    __.out("    ");
    __.out("    ");
    v.names.putAll();
    __.out("    ");
    v.name();
    __.out("  ");
    __.out("  ");
} else {
    __.dl();__.ln();
    __.out("    ");
    __.out("    ");
    v.names.init;
    __.out("    ");
    v.name();
    __.out("  ");
    __.out("  ");
}

__dl();__.ln();
__out("  ");
__dl();_it4.index++;
_it4.first = false;
}

if ($if($(parameters, andnot, type.kind().isFactory()))) {
    __.dl();__.ln();
    __.ln();
    __.out("    ");
    __.out("    ");
    __.out("}");
    __.ln();
    __.out("  ");
    __.ln();
    __.dl();
}

if ($if($parameters, andnot, type.kind().isFactory())) {
    __.dl();__.ln();
    __.ln();
    __.out("    ");
    __.dl();
}

if (Sif(useFactoryMethod)) {
    __.dl();__.out("private ");
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```java
__dl();$(__, type.typeBuilderImpl().simple());
__out("() {\n",ln();
__out("    ");
__dl();
if ($if(type.getInnerBuilder().isExtending)) {
__dl();ln();
__out("    if (!this instanceof ");
$__(__, type.typeBuilder().relativeRaw());
$__(__, type.generics().unknown);
__out("() ) {\n",ln();
__out("      throw new UnsupportedOperationException("Use: ");
$__(__, type.factoryBuilder().relative());
__out("(\v")\n",ln();
__out("   1")\n",ln();
__out("    ");
}
__dl();ln();
__out("  ").ln();
__out("  ");
}
__dl();ln();
__out("  ");
__dl();
if ($if(useFactoryMethod)) {
__dl();ln();
__dl();
if ($if($if(type.kind().isFactory(), or, type.constitution.isOutsideBuilder()))) {
  __dl();ln();
  __ln();
  __out("  /**");
  __dl();
  __if(type.kind().isFactory()) {
    __dl();ln();
    __out("   * Creates a { \@code ");
    $(__, type.typeBuilderImpl().simple());
    __out("} factory builder.");\n",ln();
  } else {
    __dl();\n    __out("   * Creates a builder for { \@link ");
    $(__, type.typeValue().relativeRaw());
    __out(" ");
    $(__, type.typeValue().simple());
    __out("} instances.");\n",ln();
```

\_
```
__dl();__.ln();
$out(" ");
$___.javadocGenerics, type);
__.ln();
__$out(" ");
{final org.immutables.generator.Templates.Iteration _it4 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute p : $in(parameters)) {
__dl();__.ln();
$out("  * @param ");
$___.p.name());
__.out(" {");
$___.p.name());
__.out(" } parameter");
__dl();
if ($if(p.isNullable())) {
___.dl();__.out(" can be { @code null}");
}
___.dl();__.ln();
___.out(" ");
___.dl();_it4.index++;  
_it4.first = false;
}
___.dl();__.ln();
___.out("  * @return A new builder").ln();
___.out(" */").ln();
___.out(" public static");
$___.type.generics().def());
___.out(" ");
$___.type.typeBuilderImpl().simple());
$___.type.generics().args());
___.out(" ");
$___.type.factoryBuilder().applied());
___.out("()");
{final org.immutables.generator.Templates.Iteration _it4 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute p : $in(parameters)) {
___.dl();__.dl();
if ($if($not(_it4.first))) {
___.dl();__.out(" ,");
}
___.dl();__$p.atNullability());
$___.constructorAcceptType, p);
___.out(" ");
$___.p.name());
```

if ($if(type.isGenerateOrdinalValue())) {
    __dl();__ln();
    __ln();
    __out("/**").ln();
    __out("  * Specify a non-default {link Domain} for ordinal values.").ln();
    __out("  * @return {code this} builder for use in a chained invocation").ln();
    __out("  */").ln();
    __out("  ");
    {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
        __dl();
        if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue"))) {
            __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
        }
        __dl();
    }
    __ln();
    __out("  public final ")
    {final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
        __dl();
        if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
            __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
        } else {
            __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
            $(__, type_builderReturnType_1031721330.generics().args());
        }
        __dl();
    }
    __out("  domain(Domain domain) { ").ln();
    __out("    this.domain = ");
    $(__, requireNonNull, type);
    __out("(domain, \"domain\")");.ln();
    __out("  return ");
}
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type):
  __.dl();
  if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
    __.dl(); __.out("(");
    $(__, type_builderReturnThis_1267082624.typeBuilder());
    __.out(" )");
  }
  __.dl(); __.out("this");
}
  __.out(";").ln();
  __.out(" }").ln();
}
  __.dl(); __.ln();
  __.dl();
  if ($if(type.kind().isValue())) {
    __.dl(); __.ln();
    __.out(" ");
    __.dl();
    if ($if(type.isGenerateBuilderFrom())) {
      __.dl(); __.ln();
      __.out(" ");
      __.dl();
      if ($if(type.kind().isModifiable())) {
        __.ln();
        __.out("/**").ln();
        __.out(" * Fill a builder with attribute values from the provided #{@code "}");
        $(__, type.typeModifiable().simple());
        __.out(" instance.").ln();
        __.out(" * @param instance The instance from which to copy values").ln();
        __.out(" * @return {@code this} builder for use in a chained invocation").ln();
        __.out(" */").ln();
        __.out(" ");
        {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type):
          __.dl();
          if ($if(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
            "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
            __.dl(); __.out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
          }
          __.dl();
          __.ln();
          __.out(" public final ");
        }}}}
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__.dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
__.dl();$(__, type_builderReturnType_1031721330.typeBuilder());
} else {
__.dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
$(__, type_builderReturnType_1031721330.generics().args());
}
__.dl();
}
__.out(" ");
$(__, type.names().from);
__.out("(");
$(__, type.typeModifiable());
__.out(" instance) {").ln();
__.out(" ");
$(__, requireNonNull, type);
__.out("(instance, \"instance\");").ln();
__.out(" ");
{final org.immutables.generator.Templates.Iteration _it2 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(setters)) {
__.dl();__.ln();
__.out(" ");
$(__, buildFromMandatoryAttribute, buildFromAttribute, v);
__.ln();
__.out(" ");
__.dl();_it2.index++;
_it2.first = false;
}}
__.dl();__.ln();
__.out(" return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
__.dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
__.dl();__.out("(");
$(__, type_builderReturnThis_1267082624.typeBuilder());
__.out(") ");
}
__.dl();__.out("this");
}
__.out(";").ln();
__.out(" }").ln();
__.out(" ");

Open Source Used In kASA v1.5 1991


if ($if($(type.getBuildFromTypes().hasManySupertypes()))) {
  final org.immutables.generator.Templates.Iteration _it2 = new
  org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.FromSupertypesModel.FromSupertype s :
    type.getBuildFromTypes().supertypes)) {
    final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 =
    $cast(type);
    if ($if($s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
      "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
      $out("  @com.google.errorprone.annotations.CanIgnoreReturnValue ");
    }
  }
}

public final {
  final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 =
  $cast(type);
  if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    $(__, type_builderReturnType_1031721330.typeBuilder());
  } else {
    $(__, type_builderReturnType_1031721330.typeBuilder().simple());
    $(__, type_builderReturnType_1031721330.generics().args());
  }

  final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 =
  $cast(type);
  if ($if($s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
    "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    $out("  @com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
}
$cast(type);
    __.dl();
    if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
        __.dl();$___.type_builderReturnType_1031721330.typeBuilder();
    }
    else {
        __.dl();$___.type_builderReturnType_1031721330.typeBuilder().simple();
        ___.type_builderReturnType_1031721330.generics().args();
    }
    __.dl();
    __.out(" ");
    ___.type.names().from;
    __.out("(");
    ___.type.typeAbstract().relative();
    __.out(" instance) {").ln();
    __.out(" ");
    ___.requireNonNull, type;
    __.out("(instance, \"instance\")\").ln();
    __.out(" from((Object) instance);\").ln();
    __.out(" return ");
    final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
    __.dl();
    if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
        __.dl();___.out("(");
        ___.type_builderReturnThis_1267082624.typeBuilder();
        __.out(" )");
    }
    __.dl();___.out("this");
    __.out(";\".ln();
    __.out(" }");.ln();
    __.out(" ");
    }
    else {
    __.dl();___.ln();
    __.ln();
    __.out(" /*@ */\").ln();
    __.out(" @ Fill a builder with attribute values from the provided { @code ");
    __.s.raw();
    __.out(" instance\").ln();
    __.out(" @param instance The instance from which to copy values\").ln();
    __.out(" @ return { @code this } builder for use in a chained invocation\").ln();
    __.out(" */\").ln();
    __.out(" ");
```java
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  __dl();
  if ($if(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
  __dl();
}__ln();
__out(" public final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
  __dl();
  if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __dl();$___.typeBuilder();
  } else {
    __dl();$___.typeBuilder().simple();
    $(___.type_builderReturnType_1031721330.generics().args());
  }
  __dl();
}__out(" ");
$___.requireNonNull, type;
__out("(");
$___.s.type;
__out(" instance ") {"}.ln();
__out(" ");
$___.instance, type;
__out(" from((Object) instance)");.ln();
__out(" return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
  __dl();
  if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
    __dl();__out("(");
    $___.typeBuilder();
    __out(" this");
  }
  __dl();__out("this");
}
__out(";").ln();
__out(" ").ln();
```
final org.immutables.value.processor.meta.FromSupertypesModel bs = $cast(type.getBuildFromTypes());
    final org.immutables.value.processor.meta.HasStyleInfo s_atVar_1287436599 = $cast(type);
    if ($if($(s_atVar_1287436599, allowsClasspathAnnotation, "com.google.errorprone.annotations.Var"))) {
        __out(" @com.google.errorprone.annotations.Var ");
    }
    __out(" long bits");
    __out(" = 0;");
    __out(" ");
    __dl(); __ln();
    }
}

Open Source Used In kASA v1.5 1996
for (final org.immutables.value.processor.meta.FromSupertypesModel.FromSupertype s : $in(bs.supertypes))
{
    if ($if(s.attributes)) {
        __.dl();__.ln();
        __.out("    if (object instanceof ");
        $(__, s.wildcard);
        __.out(" ").ln();
        __.out(" ");
        $(__, s.type);
        __.out(" instance = (");
        $(__, s.type);
        __.out(" object;").ln();
        __.out(" ");
    }
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(s.attributes)) {
        final org.immutables.value.processor.meta.LongBits.BitPosition pos = $cast($(bs.positions, v.name()));
        __.dl();__.ln();
        __.out(" ");
        __.dl();
        if ($if(pos)) {
            __.dl();__.ln();
            __.out("      if ((bits");
            $(__, emptyIfZero, pos.index);
            __.out(" & ");
            $(__, literal.hex, pos.mask);
            __.out(" == 0") [ ").ln();
            __.out(" ");
            __.dl();
            if ($if(v.isNullableInSupertype())) {
                __.dl();__.ln();
                __.out("      ");
                $(__, buildFromAttributeNullableSupertype, v);
                __.ln();
                __.out(" ");
            } else {
                __.dl();__.ln();
                __.out(" ");
                $(__, buildFromAttribute, v);
                __.ln();
                __.out(" ");
            }
        }
        __.dl();__.ln();
        __.out("    bits");
    }
}
$(__, emptyIfZero, pos.index);
   __out(" |= ");
$(__, literal.hex, pos.mask);
   __out(";").ln();
   __out("  ");ln();
   __out("  ");
}
else {
   __dl();__ln();
   __out("   ");
$(__, buildFromAttribute, v);
   __ln();
   __out("  ");
}

__dl();__ln();
   __out("   ");
__dl();__it4.index++;
   __it4.first = false;
} }
__dl();__ln();
   __out("  ");ln();
   __out("   ");
__dl();__it3.index++;
   __it3.first = false;
} }
__dl();__ln();
   __out("  ");ln();
   __out("  ");
__dl();__it2.index++;
   __it2.first = false;
} }
__dl();__ln();
   __out("  ");

} else {
   __dl();__ln();
   __ln();
   __out(" /**<").ln();
   __out(" * Fill a builder with attribute values from the provided [@code ");
   __dl();
   if ($if(type.constitution.isImplementationPrimary()) { }
   __dl();$___.typeImmutable().simple();
   } else {
   __dl();__$_.typeAbstract().simple();
   } }
   __dl();__out("} instance.").ln();
__out("   * Regular attribute values will be replaced with those from the given instance.").ln();  
__out("   * Absent optional values will not replace present values.").ln();  
__out(" ");  
__dl();  
if (Sif(type.hasSettableCollection(), or, type.hasSettableMapping())) {  
  __dl();__ln();  
  __out("   * Collection elements and entries will be added, not replaced.").ln();  
  __out(" ");  
  __dl();  
  __ln();  
  __out("   * @param instance The instance from which to copy values").ln();  
  __out("   * @return {@code this} builder for use in a chained invocation").ln();  
  __out(" */").ln();  
  __out(" ");  
  __dl();  
}

if (Sif(type.constitution.isImplementationPrimary())) {

  __dl();__ln();  
  __out("   * Collection elements and entries will be added, not replaced.").ln();  
  __out(" ");  
  __dl();  
  __ln();  
  __out("   * @param instance The instance from which to copy values").ln();  
  __out("   * @return {@code this} builder for use in a chained invocation").ln();  
  __out(" */").ln();  
  __out(" ");  
  __dl();  
}

if (Sif(type.constitution.isImplementationPrimary())) {

  __dl();__ln();  
  __out("   * Collection elements and entries will be added, not replaced.").ln();  
  __out(" ");  
  __dl();  
  __ln();  
  __out("   * @param instance The instance from which to copy values").ln();  
  __out("   * @return {@code this} builder for use in a chained invocation").ln();  
  __out(" */").ln();  
  __out(" ");  
  __dl();  
}

if (Sif(type.constitution.isImplementationPrimary())) {

  __dl();__ln();  
  __out("   * Collection elements and entries will be added, not replaced.").ln();  
  __out(" ");  
  __dl();  
  __ln();  
  __out("   * @param instance The instance from which to copy values").ln();  
  __out("   * @return {@code this} builder for use in a chained invocation").ln();  
  __out(" */").ln();  
  __out(" ");  
  __dl();  
}

if (Sif(type.constitution.isImplementationPrimary())) {

  __dl();__ln();  
  __out("   * Collection elements and entries will be added, not replaced.").ln();  
  __out(" ");  
  __dl();  
  __ln();  
  __out("   * @param instance The instance from which to copy values").ln();  
  __out("   * @return {@code this} builder for use in a chained invocation").ln();  
  __out(" */").ln();  
  __out(" ");  
  __dl();  
}

if (Sif(type.constitution.isImplementationPrimary())) {

  __dl();__ln();  
  __out("   * Collection elements and entries will be added, not replaced.").ln();  
  __out(" ");  
  __dl();  
  __ln();  
  __out("   * @param instance The instance from which to copy values").ln();  
  __out("   * @return {@code this} builder for use in a chained invocation").ln();  
  __out(" */").ln();  
  __out(" ");  
  __dl();  
}

if (Sif(type.constitution.isImplementationPrimary())) {

  __dl();__ln();  
  __out("   * Collection elements and entries will be added, not replaced.").ln();  
  __out(" ");  
  __dl();  
  __ln();  
  __out("   * @param instance The instance from which to copy values").ln();  
  __out("   * @return {@code this} builder for use in a chained invocation").ln();  
  __out(" */").ln();  
  __out(" ");  
  __dl();  
}
```java
__out("   * @return \{\code this\} builder for use in a chained invocation\}).ln();
__out("   */").ln();

final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
__dl();
if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
   __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
}
__dl();
__ln();
__out(" ");
$(__, type.typeAbstract().access());
__out("final ");

final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
   __dl();$__._ctor(type_builderReturnType_1031721330.typeBuilder());
} else {
   __dl();$__._ctor(type_builderReturnType_1031721330.typeBuilder().simple());
   $(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__out(" ");
$__._ctor(type.names().from);
__out("(");
$__._ctor(type.typeAbstract().relative());
__out(" instance \} \{\"instance\}\}).ln();
__out(" ");
$__._ctor(requireNonNull, type);
__out("(instance, \"instance\\")\}).ln();
__out(" ");
$__._ctor(dynamicFromModifiableCheck, type, "instance", "");
__ln();
__out(" ");

final org.immutables.generator.Templates.Iteration _it2 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(setters)) {
   __dl();__ln();
   __out(" ");
   $(__, buildFromAttribute, v);
   __ln();
```

.__out("    ");__dl();__it2.index++;__it2.first = false;}}
__dl();__ln();__out("    return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);__dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
    __dl();__out("(");$(__, type_builderReturnThis_1267082624.typeBuilder());
    __out(" ");
}
__dl();__out("this");

__out(";").ln();__out(" ").ln();__out(" ");
} else {
    __dl();__ln();
    __out(" ");
    {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
        __dl();
        if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
            "com.google.errorprone.annotations.CanIgnoreReturnValue"))) {
            __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
        }
    }
    __dl();
    __ln();
    __out(" public final ");
} final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
} else {
    __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());$(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__.out(" ");
$___.type.names().from);
__.out("(");
$___.type.typeAbstract().relative());
__.out(" instance) {").ln();
__.out(" ");
$___.requireNonNull, type);
__.out("(instance, "instance");").ln();
__.out(" ");
$___.dynamicFromModifiableCheck, type, "instance", ");
__.ln();
__.out(" ");
{final org.immutables.generator.Templates.Iteration _it2 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(setters)) {
  __.dl();__.ln();
  __.ln();
  __.out(" ");
  __.out(" ");
  __.dl():_it2.index++; _it2.first = false;
}
  __.dl();__.ln();
  __.out(" return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
  __.dl();
  if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
    __.dl();__.out("(");
    __.out(" ");
    __.out(" ");
  }
  __.dl();__.out("this");
  __.out(";").ln();
  __.out(" ").ln();
  __.out(" ");
}
  __.dl();__.ln();
  __.out(" ");
}
  __.dl();__.ln();
  __.out(" ");
}
  __.dl();__.ln();
  __.out(" ");
final org.immutables.generator.Templates.Invokable checkNotIsSet = new org.immutables.generator.Templates.Fragment(1) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __dl();
        final org.immutables.generator.Templates.Invokable checkNotIsSet = this;
        final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
        __ln();
        if ($if(v.containingType.isUseStrictBuilder())) {
            __dl();
            __out("checkNotIsSet(");
            __out($(__, v.names.isSet()));
            __out("(), ");
            __out($(__, v.names.raw));
            __out(");").[ln();
        }
        __dl();
        __dl();
    }];__dl();__ln();
    __dl();__ln();
}];__dl();__ln();
final org.immutables.generator.Templates.Invokable nondefaultSetInBuilder = new org.immutables.generator.Templates.Fragment(1) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __dl();
        final org.immutables.generator.Templates.Invokable nondefaultSetInBuilder = this;
        final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
        __ln();
        __dl();
        if ($if(v.requiresTrackIsSet())) {
            __dl();
            final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
            final org.immutables.value.processor.meta.LongBits.BitPosition pos = $cast($nondefaultsPositions, v));
            __dl();__ln();
            $(__, disambiguateField, type, "optBits");
            $(__, emptyIfZero, pos.index);
            __out(" |= OPT_BIT_"[); _it2.index++;
            __out(";").[ln();
            _it2.first = false;
        }
        __dl();
    }
    __dl();
}
final org.immutables.generator.Templates.Invokable mandatorySetInBuilder = new org.immutables.generator.Templates.Fragment(1) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        final org.immutables.generator.Templates.Invokable mandatorySetInBuilder = this;
        final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
        __.ln();
        final org.immutables.value.processor.meta.LongBits.BitPosition pos = $cast($positions, v);
        __.ln();
        $(__, disambugateField, type, "initBits");
        $(__, emptyIfZero, pos.index);
        __.out(" &~ INIT_BIT_");
        $(__, toConstant, v.name());
        __.out(";").ln();
        __.dl(); _it2.index++; _it2.first = false;
    }
    __.dl();
}
__dl(); __ln();
__dl();
}
__dl(); __ln();
__dl();
}
__dl(); __ln();
__dl();
}
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(setters)) {
    __.dl(); __ln();
    __.out(" ");
    __.dl();
    if ($if(v.isBuilderSwitcher())) {
        __.dl(); __ln();
        __.out(" ");
    }
}
__dl(); __ln();
__dl();
__out(" ");
__out(" /*");
__out(" */".ln());
__out(" * Switches { @code ");
$(__, v.name());
__out(" } to { @code ");
$(__, o.constantName);
__.out("}.").ln();
__.out("  * @return \{@code this\} builder for use in a chained invocation\}.").ln();
__.out("  */").ln();

{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  
  if ($if(a_deprecation_286924011.deprecated)) {
    __.dl();__.out("@Deprecated");
  }
  
  if ($if(o.isDefault)) {
    __.dl();__.out("private");
  } else {
    __.dl();__.out("public");
  }

  __.dl();__.out(" final ");

  if ($if(o.isDefault)) {
    __.dl();$(__, o.switcherName);
  }

  if ($if(o.getInit()) {
    __.out("() { return ");
    __.out(v.names.init);
    __.out(" ");
    $(__, o.constantName);
    __.out("}.").ln();
    __.out("  return ");
    $(__, v.names.init);
    __.out("} ");
    $(__, v.getRawType());
    __.out(";");
    $(__, o.constantName);
    __.out(";").ln();
    __.out("  ");
    __.dl();__it3.index++;
final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
  __dl();__out("@Deprecated");
}
__dl();
__ln();
__out(" ");
final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
__dl();
if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
  a_builderInitAccess_991723715.isBuilderSwitcher()))) {
  __dl();
  if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
    __dl();__out("private ");
  } else {
    __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
  }
}
__dl();
} else {
  __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
}
__out("final ");
final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
  __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
} else {
  __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
  $(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__out(" ");
$(__, v.names.add());
__out(" ");
if ($if($(not, a_atElementNullable_1621680092.nullElements.ban()))) {
  __.dl();$(__, atNullable, a_atElementNullable_1621680092);
}
___.dl();
}$(__, v.getUnwrappedElementType());
___.out(" element) {").ln();
___.out(" ");
___.dl();
if ($if(v.isNullableCollector())) {
  __.dl();___.ln();
  ___.out("  if (this.");
}$(__, v.name());
___.out(" == null) {").ln();
___.out(" ");
}$(__, defineOrResetBuildingFieldAlt, v, $$false, $$false);
___.ln();
___.out(" ");
___.ln();
___.dl();
if ($if($(v.isGenerateJdkOnly(), andnot, v.isPrimitiveElement()))) {
  __.dl();__.ln();
  ___.out("      if (element != null) ");
  ___.ln();
  ___.out(" ");
  ___.out(" ");
}
___.dl();___.ln();
___.out(" ");
___.dl();
if ($if($v.isGenerateJdkOnly(), andnot, v.isPrimitiveElement())()) {
  __.dl();___.ln();
  ___.out(" ");
  ___.dl();
if ($if(v.hasAttributeValue())) {
  __.dl();__.ln();
  ___.out("    ");
  ___.dl();
if ($if($(not, v.nullElements.ban()))) {
  __.dl();___.out("if (element != null) ");
}
___.dl();___.out("element = ");
}final org.immutables.value.processor.meta.ValueAttribute v_deepCopyOf_1878776147 = $cast(v);
final org.immutables.generator.Templates.Invokable expression_deepCopyOf_1878776147 = new
org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.generator.Templates.Invokable expression_deepCopyOf_1878776147 = this;
    __.out("element");
    __.dl();
  }).__.dl();___.dl();
if ($if(v_deepCopyOf_1878776147.isAttributeBuilder())()) {
  __.dl();$(__, convertToValueType, v_deepCopyOf_1878776147.getAttributeBuilderDescriptor());
if ($if(v.nullElements.allow())) {
    __.dl();___.ln();
    ___.out("   this.");
    $(___, v.name());
    ___.out(".add(");
    [final org.immutables.value.processor.meta.ValueAttribute v_maybeToBuilder_53814988 = $cast(v);
     final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new 
     org.immutables.generator.Templates.Fragment(0) {
         @Override public void run(org.immutables.generator.Templates.Invokation __) { 
            __.dl();final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = 
            this;
            __.out("element");
            ___.dl();
        } };___.dl();___.dl();
        if ($if(v_maybeToBuilder_53814988.isAttributeBuilder())) {
            __.dl();$(___, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new 
            org.immutables.generator.Templates.Fragment(0) {
                @Override public void run(org.immutables.generator.Templates.Invokation __) {
                    __.dl();$(___, expression_maybeToBuilder_53814988);
                    ___.dl();
                } });
        } else {
            __.dl();$(___, expression_maybeToBuilder_53814988);
            ___.dl();
        }
    } else if ($if(v.nullElements.allow())) {
    __.dl();___.ln();
    ___.out("   this.");
    $(___, v.name());
    ___.out(".add(");
    [final org.immutables.value.processor.meta.ValueAttribute v_maybeToBuilder_53814988 = $cast(v);
     final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new 
     org.immutables.generator.Templates.Fragment(0) {
         @Override public void run(org.immutables.generator.Templates.Invokation __) { 
            __.dl();final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = 
            this;
            $(___, requireNonNull, type);
            __.out("(element, \\
            $(___, v.name());
            __.out("  element")


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if ($if(v_maybeToBuilder_53814988.isAttributeBuilder()) {
    __dl();$(__, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __dl();$(__, expression_maybeToBuilder_53814988);
            __dl();
        }
    });
} else {
    __dl();$(__, expression_maybeToBuilder_53814988);
}
__dl();
__out(";").ln();
__out("  ");

__dl();__ln();
__out("  ");

} else {
    __dl();__ln();
    __out("  ");
    __dl();
    if ($if(v.hasAttributeValue()) {
        __dl();__ln();
        __out("  ");
        __dl();
        if ($if(v.deepCopyOf_1878776147.isAttributeBuilder()) {
            __dl();final org.immutables.generated.Templates.Invokable expression_deepCopyOf_1878776147 = $cast(v);
            final org.immutables.generated.Templates.Invokable expression_deepCopyOf_1878776147 = new org.immutables.generated.Templates.Fragment(0) {
                @Override public void run(org.immutables.generated.Templates.Invokation __) {
                    __dl();final org.immutables.generated.Templates.Invokable expression_deepCopyOf_1878776147 = this;
                    __out("element");
                    __dl();
                }
            });
            __dl();__dl();
            if ($if(v.deepCopyOf_1878776147.isAttributeBuilder()) {
                __dl();$(__, convertToValueType, v.deepCopyOf_1878776147.getAttributeBuilderDescriptor());
                __out("(");
                $(___ expression_deepCopyOf_1878776147);
                __out(")");
            } else {
                __dl();$(__, v.deepCopyOf_1878776147.attributeValueType.factoryCopyOf());
                __out("(");
                $(___ expression_deepCopyOf_1878776147);
            }
        } else {
            __dl();$(__, v.deepCopyOf_1878776147.attributeValueType.factoryCopyOf());
            __out("(");
            $(___ expression_deepCopyOf_1878776147);
        }
    } else {
        __dl();$(__, v.deepCopyOf_1878776147.attributeValueType.factoryCopyOf());
        __out("(");
        $(___ expression_deepCopyOf_1878776147);
    }
```java
    __.out(")");

    __.dl();
    __.out(";").ln();
    __.out("  ");

    __.dl();___.ln();
    __.out("  this.");
    $(__, v.name());
    __.out(".add(");

    if ($if(v_maybeToBuilder_53814988.isAttributeBuilder())) {
        $(__, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new
        org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
                __.dl();final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new
                org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 =
                this;
                __.out("element");
                __.dl();
            };
        });___.dl();
        if ($if(v_maybeToBuilder_53814988.isAttributeBuilder())) {
            __.dl();$(___.valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new
            org.immutables.generator.Templates.Fragment(0) {
                @Override public void run(org.immutables.generator.Templates.Invokation __) {
                    __.dl();$(___.expression_maybeToBuilder_53814988);
                    __.dl();
                }
            });
        } else {
            __.dl();$(___.expression_maybeToBuilder_53814988);
        }
    }
        __.dl();
    __.out(";").ln();
    __.out("  ");

    __.dl();___.ln();
    __.out("  ");
    $(___.nondefaultSetInBuilder, v);
    __.ln();
    __.out("  return ");

    if ($if(type_builderReturnThis_1267082624.isExtending)) {
```

$(__, eachLine, v.elementInitializerInjectedAnnotations());
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
__dl();__out("@Deprecated");
}
__dl();
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
__dl();
if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {
__dl();__dl();
if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
__dl();__out("private ");
}
__dl();
} else {
__dl();$(__, a_builderInitAccess_991723715.getInitializerAccess());
}
__dl();
__out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
__dl();$(__, type_builderReturnType_1031721330.typeBuilder());
} else {
__dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
$(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__out(" ");
$(__, v.names.add());
__out(" ");
{final org.immutables.generator.Templates.Iteration _it3 = new
org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute c : $in(v.getConstructorParameters())) {
    __.dl();___.dl();
    if ($if($not, _it3.first)) {
        __.dl();___.out(",");
    }
    __.dl();$_.c.atNullability();
    $(_. c.getType());
    __.out(" ");
    $(_. c.name());
    __.dl();_it3.index++;
    _it3.first = false;
}
___.dl();___.out("} ").ln();
___.out("    return ");
$(__, v.names.add());
___.out(";");
$(__, v.attributeValueType.factoryOf());
___.out(";");
{final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute c : $in(v.getConstructorParameters())) {
        __.dl();___.dl();
        if ($if($not, _it3.first)) {
            __.dl();___.out(",");
        }
        __.dl();$_.c.name();
        __.dl();_it3.index++;
        _it3.first = false;
    }
    __.dl();___.out(";").ln();
    ___.out(" }").ln();
    ___.out(" ");
}
___.dl();___.ln();
___.ln();
___.out("/***/").ln();
___.out(" * Adds elements to ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    $(_. sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
___.out(" ");
$(_. toLower, v.getRawCollectionType());
___.out(".").ln();
```java
__dl();__out("private ");

}
__dl();
} else {
  __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
}
__dl();
__out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
  __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
} else {
  __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
$(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__out(" ");
$___.v.names.addv();
__out(""");
$___.v.getUnwrappedElementType();
__out("... elements ")\n);
__out(" ");
__dl();
if (Sif(v.isNullCollector())) {
  __dl();__ln();
  __out(" if (this.");
$(___.v.name());
__out(" == null ")\n);
__out(" ");
$(___.defineOrResetBuildingFieldAlt, v, $$false, $$false);
__ln();
__out(" ")\n);
__out(" ");
}
__dl();__ln();
__out(" ");
__dl();
if (Sif($v.isGenerateJdkOnly(), or, v.hasAttributeValue())) {
  __dl();__ln();
  __out(" for ");
````
if ($if(v.hasAttributeValue())) {
  __.dl();__.ln();
  __.out("  ");
  __.dl();
  if ($if($(not, v.nullElements.ban()))) {
    __.dl();__.ln();
    __.out("if (element != null) ");
  }
  __.dl();__.out("element = ");
  [final org.immutables.value.processor.meta.ValueAttribute v_deepCopyOf_1878776147 = $cast(v);
   final org.immutables.generator.Templates.Invokable expression_deepCopyOf_1878776147 = new
   org.immutables.generator.Templates.Fragment(0) {
     @Override public void run(org.immutables.generator.Templates.Invokation __) {
       __.dl();final org.immutables.generator.Templates.Invokable expression_deepCopyOf_1878776147 = this;
       __.out("element");
       __.dl();
     }});__.dl();__.dl();
  if ($if(v_deepCopyOf_1878776147.isAttributeBuilder())) {
    __.dl();$___.convertToValueType, v_deepCopyOf_1878776147.getAttributeBuilderDescriptor();
    __.out("(");
    $(___.expression_deepCopyOf_1878776147);
    __.out(")");
  } else {
    __.dl();$(__, v_deepCopyOf_1878776147.attributeValueType.factoryCopyOf());
    __.out("(");
    $(___.expression_deepCopyOf_1878776147);
    __.out(")");
  }
}
___.dl();
___.out(";").ln();
___.out("  ");
}
___.dl();__.ln();
___.out("  ");
___.dl();
if ($if($v.isPrimitiveElement(), or, v.nullElements.allow())) {
  __.dl();__.ln();
  __.out("  this.");
  $(__, v.name());
  __.out(".add(");
final org.immutables.value.processor.meta.ValueAttribute v_maybeToBuilder_53814988 = $cast(v);
final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __dl(); final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new
        org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
                __dl(); final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 =
                this;
                __out("element");
                __dl();
            };
            if ($if(v_maybeToBuilder_53814988.isAttributeBuilder()) {
                __dl();$(__, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new
                org.immutables.generator.Templates.Fragment(0) {
                    @Override public void run(org.immutables.generator.Templates.Invokation __) {
                        __dl();$(__, expression_maybeToBuilder_53814988);
                        __dl();
                    }));
                } else {
                    __dl();$(__, expression_maybeToBuilder_53814988);
                    __dl();
                }
            }
            __out(";"); __ln();
            __out("   ");
        } else if ($if(v.nullElements.skip()) {
            __dl(); __ln();
            __out("   if (element != null) this.");
            $(__, v.name());
            __out(".add()");
        } finally {
            __dl();
            final org.immutables.value.processor.meta.ValueAttribute v_maybeToBuilder_53814988 = $cast(v);
            final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new
            org.immutables.generator.Templates.Fragment(0) {
                @Override public void run(org.immutables.generator.Templates.Invokation __) {
                    __dl(); final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 =
                    this;
                    __out("element");
                    __dl();
                };
                if ($if(v_maybeToBuilder_53814988.isAttributeBuilder()) {
                    __dl();$(__, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new
                    org.immutables.generator.Templates.Fragment(0) {
                        @Override public void run(org.immutables.generator.Templates.Invokation __) {
                            __dl();$(__, expression_maybeToBuilder_53814988);
                            __dl();
                        }));
                    } else {
                        __dl();
                        __out(";"); __ln();
                        __out("   ");
                    } else if ($if(v.nullElements.skip()) {
                        __dl(); __ln();
                        __out("   if (element != null) this.");
                        $(__, v.name());
                        __out(".add()");
                    } finally {
                        __dl();
                    }
                }
            } else {
                __dl();
                final org.immutables.value.processor.meta.ValueAttribute v_maybeToBuilder_53814988 = $cast(v);
                final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new
                org.immutables.generator.Templates.Fragment(0) {
                    @Override public void run(org.immutables.generator.Templates.Invokation __) {
                        __dl(); final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 =
                        this;
                        __out("element");
                        __dl();
                    };
                    if ($if(v_maybeToBuilder_53814988.isAttributeBuilder()) {
                        __dl();$(__, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new
                        org.immutables.generator.Templates.Fragment(0) {
                            @Override public void run(org.immutables.generator.Templates.Invokation __) {
                                __dl();$(__, expression_maybeToBuilder_53814988);
                                __dl();
                            }));
                        } else {
                            __dl();
                            __out(";"); __ln();
                            __out("   ");
                        } else if ($if(v.nullElements.skip()) {
                            __dl(); __ln();
                            __out("   if (element != null) this.");
                            $(__, v.name());
                            __out(".add()");
                        } finally {
                            __dl();
                        }
                    }
                }
            }
        }
    }
}

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if ($if(v.wrapArrayToIterable())) {
    __dl();__ln();
    __out("    this.");
    $(___.v.name());
    __out(".addAll(");
    __dl();
    if ($if(v.isAttributeBuilder())) {
        __dl();{final org.immutables.value.processor.meta.AttributeBuilderDescriptor
            n_convertToBuilderType_187063380 = $cast(v.getAttributeBuilderDescriptor());
        __out("convertToBuilderType");
        $(__, n_convertToBuilderType_187063380.getQualifiedValueTypeWithUnderscores());
    }
    __out("(elements)");
}
else {
    __dl();$(__, arrayAsList, v, "elements");
}

} else {
    __dl();__out(".");ln();
    __out("   ");
}

} else {
    __dl();__ln();
    __out("    this.");
    $(__, v.name());
    __out(".");
    __dl();
    if ($if(v.isAttributeBuilder())) {
        __dl();__out("addAll(");
        {final org.immutables.value.processor.meta.AttributeBuilderDescriptor
            n_convertToBuilderType_187063380 = $cast(v.getAttributeBuilderDescriptor());
        __out("convertToBuilderType");
        $(__, n_convertToBuilderType_187063380.getQualifiedValueTypeWithUnderscores());
    }
    __out("(elements)");
}
else {
    __dl();__out("add(elements)");
}

__dl();__out(";");ln();
__out("   ");

__dl();
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
__dl();__out("@Deprecated");
}
__dl();
}
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
__dl();
if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or,
a_varargsSafety_1368213209.hasTypeVariables))) {
__dl();__out("@SafeVarargs @SuppressWarnings("varargs")");
}
__dl();
}
__ln();
__out(" public final ");
{final org.immutables.value.processor.meta.AttributeBuilderDescriptor
n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
$(__, n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
}
__out(" ");
$(__, v.names.addBuilder());
__out("() {".ln();
__out(" ");
__dl();
if ($if(v.isNullableCollector())) {
__dl();__ln();
__out(" if (this.");
$(__, v.name());
__out(" == null {".ln();
__out(" ");
$(__, defineOrResetBuildingFieldAlt, v, $$false, $$false);__ln();
__out(" ");.ln();
__out(" ");
}
__dl();__ln();
   {final org.immutables.value.processor.meta.AttributeBuilderDescriptor
n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
$(__, n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
}
   __out(" builder = ");
   {final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_createAttributeBuilder_175285279
    = $cast(v.getAttributeBuilderDescriptor());
$(__, n_createAttributeBuilder_175285279.getQualifiedBuilderConstructorMethod());
   __out("()");
}
   __out(";").ln();
   __out(" this.");
$(__, v.name());
   __out(".add(builder;").ln();
   __out(" return builder;").ln();
   __out(" }").ln();
   __ln();
   __out(" /**").ln();
   __out(" * Adds elements to ");
   {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
   __out(" ");
$(__, toLower, v.getRawCollectionType());
   __out(".").ln();
   __out(" * @param elements An array of ");
$(__, v.name());
   __out(" builder elements").ln();
   __out(" * @return [ @code this ] builder for use in a chained invocation").ln();
   __out(" */").ln();
   __out(" ");
   {final org.immutables.value.processor.meta.HasValueInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
   __dl();
   if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
   "com.google.errorprone.annotations.CanIgnoreReturnValue"))) {
   __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
   }
   __dl();
}
   __ln();
   __out(" ");
   {final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
if ($if(a_deprecation_286924011.deprecated)) {
    __.dl();__.out("@Deprecated");
}
___.dl();
}
___.ln();
__.out("  ");
{final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
___.dl();
if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or,
a_varargsSafety_1368213209.hasTypeVariables))) {
    __.dl();__.out("@SafeVarargs @SuppressWarnings("varargs")");
}
___.dl();
}
___.ln();
__.out("  ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
___.dl();
if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {
    __.dl();___.dl();
    if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
        __.dl();__.out("private ");
    }
}
___.dl();
} else {
    __.dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
}
___.dl();
}
___.out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
___.dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __.dl();$___.dl();
    if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
        __.dl();$(__, type_builderReturnType_1031721330.typeBuilder());
    } else {
        __.dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
    }
}
___.dl();
if ($if(v.isNullableCollector())) {
    __dl();__ln();
    __out("    if (this.");
    $(__, v.name());
    __out(" == null) {").ln();
    __out("      ");
    $(__, defineOrResetBuildingFieldAlt, v, $$false, $$false);
    __ln();
    __out("    }").ln();
    __out("    ");
}
__dl();__ln();
__out("  ");
__dl();
if ($if($v.isGenerateJdkOnly(), or, v.hasAttributeValue())) {
    __dl();__ln();
    __out("      for (");
    [final org.immutables.value.processor.meta.AttributeBuilderDescriptor
     n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
     $(__, n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
    ]
    __out("    .add(element);".ln());
    __out("      ");
    if ($if($v.isPrimitiveElement(), or, v.nullElements.allow())) {
        __dl();__ln();
        __out("        this.");
        $(__, v.name());
        __out(".add(element);".ln());
        __out("      ");
    } else if ($if(v.nullElements.skip())) {
        __dl();__ln();
        __out("      if (element != null) this.");
        $(__, v.name());
    }
} else if ($if(v.nullElements.skip())) {
    __dl();__ln();
    __out("      if (element != null) this.");
    $(__, v.name());
}
```java
    __.out(".add(element);").ln();
    __.out("  ");

    } else {
        __.dl();___.ln();
        __.out("    this.");
        $(___. v.name());
        __.out(".add(");
        $(___. requireNonNull, type);
        __.out("(element, ")");
        $(___. v.name());
        __.out(" element");").ln();
        __.out("  ");

        __.dl();___.ln();
        __.out("  ");
        ___.ln();
    }

    __.dl();___.ln();
    __.out("  ").ln();
    __.out("  ");

    } else {
        __.dl();___.ln();
        __.out("  ");
        __.dl();
        if ($if(v.wrapArrayToIterable())) {
            __.dl();___.ln();
            __.out("    this.");
            $(___. v.name());
            __.out(".addAll(");
            $(___. arrayAsList, v, "elements");
            __.out(");").ln();
            __.out("  ");

            __.dl();___.ln();
            __.out("  ");
            __.dl();
        } else {
            __.dl();___.ln();
            __.out("    this.");
            $(___. v.name());
            __.out(".add(elements);").ln();
            __.out("  ");

            __.dl();___.ln();
            __.out("  ");
        }

        __.dl();___.ln();
        __.out("  ");
    }

    __.dl();___.ln();
    __.out("  ");
```
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```java
__.out("    return ");

final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
__.dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
    __.dl();__.out("(");
    $(__, type_builderReturnThis_1267082624.typeBuilder());
    __.out(""));
}
__.dl();__.out("this");

__.out(",;").ln();
__.out(" ").ln();
__.ln();
__.out(" /**").ln();
__.out(" * Gets the builder elements to *");

final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__.out(" ");
$(__, toLower, v.getRawCollectionType());
__.out(";").ln();
__.out(" * @return { @code this } unmodifiable list of modifiable builders."").ln();
__.out(" */").ln();
__.out(" ");

final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__.dl();
if ($if(a_deprecation_286924011.deprecated)) {
    __.dl();__.out("@Deprecated");
}
__.dl();

final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
__.dl();
if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or,
a_varargsSafety_1368213209.hasTypeVariables))) {
    __.dl();__.out("@SafeVarargs @SuppressWarnings("varargs")");
}
__.dl();

__.ln();
__.out(" ");

final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
__.dl();
if ($if($a_varargsSafety_1368213209.isNonRawElementType(), or,
a_varargsSafety_1368213209.hasTypeVariables)) {
    __.dl();__.out("@SafeVarargs @SuppressWarnings("varargs")");
}
__.dl();

__.ln();
__.out(" public final java.util.List<");
n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
$(__, n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());

if ($if(v.isGenerateJdkOnly())) {
  __.out("return createUnmodifiableList(false, this.");
  $(__, v.name()).out(".");
  __.out(";").ln();
  __.out(";");
} else {
  __.ln();
  __.out("return this.");
  $(__, v.name()).out(".");
  __.out(";");
}

if ($if(!type.isUseStrictBuilder())) {
  __.ln();
  __.out("/**");
  __.out("* Sets or replaces all elements for ");
  __.ln();
  __.out(" */**");
  __.out("*");
  __.ln();
  __.out("@param elements An iterable of ");
  $(__, v.name()).out(".");
  __.out("elements");
}
  $(__, eachLine, v.initializerInjectedAnnotations());
  __ln();
  __out(" ");
  {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 =
  $cast(type);
  __dl();
  if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
  "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
  __dl();
  __ln();
  __out(" ");
  {$(__, eachLine, v.getBuilderAttributeAnnotation());
  __ln();
  __out(" ");
  {final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __dl();__out("@Deprecated");
  }
  __dl();
  __ln();
  __out(" ");
  {final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  __dl();
  if ($if($(a_builderInitAccess_991723715, or,
  a_builderInitAccess_991723715.isBuilderParameter, or,
  a_builderInitAccess_991723715.isBuilderSwitcher()))} {
    __dl();__dl();
    if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory()) {
      __dl();__out("private ");
    }
    __dl();
  } else {
    __dl();$(__, a_builderInitAccess_991723715.getInitializerAccess());
  }
  __dl();
  } else {
```java
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
  __.dl();
  if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __.dl();$(__, type_builderReturnType_1031721330.typeBuilder());
  } else {
    __.dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
    $(__, type_builderReturnType_1031721330.generics().args());
  }
  __.dl();
  __.out(" ");
  $(__, v.names.init);
  __.out("(");
  $(__, v.atNullability());
  __.out("Iterable<");
  $(__, v.getConsumedElementType());
  __.out("> elements) {".ln();
  __.out(" ");
  __.dl();
  if ($if(v.isNullable())) {
    __.dl();__ln();
    __.out(" if (elements == null) {").ln();
    __.out(" ");
    $(__, defineOrResetBuildingFieldAlt, v, $$false, $$true);
    __.ln();
    __.out(" ");
    $(__, nondefaultSetInBuilder, v);
    __.ln();
    __.out(" return ");
  }
  __.dl();
  if ($if(type_builderReturnType_1267082624.getInnerBuilder().isExtending)) {
    __.dl();__out("(");
    $(__, type_builderReturnType_1267082624.typeBuilder());
    __.out(" ");
  }
  __.dl();__out("this");
  __.out(";").ln();
  __.out(" ");.ln();
  __.out(" ");.ln();
  __.dl();__ln();
```

final org.immutables.value.processor.meta.ValueAttribute v_defineOrResetBuildingField_1809684382 = $cast(v);
final java.lang.Boolean declare_defineOrResetBuildingField_1809684382 = $cast($false);
S__(defineOrResetBuildingFieldAlt, v_defineOrResetBuildingField_1809684382,
declare_defineOrResetBuildingFieldField_1809684382, $false);

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($__);
if ($if(v.isNullableCollector())
    __.dl();__.ln();
    __.out("   ");
    __.dl();
    $($.requireNonNull, type);
    __.out("(elements, \"\")
    $($.v.name());
    __.out(" element\")
    __.out(" if (this.");
    $($.v.name());
    __.out(" == null \")
    __.out(" ");
    $($.defineOrResetBuildingFieldAlt, v, $false, $false);
    __.ln();
    __.out(" ");
    __.out(" ");
}

___.dl();__.ln();
__.out("   ");
___.dl();
if ($if($(v.isGenerateJdkOnly(), or, v.hasAttributeValue()))
    __.dl();__.ln();
    __.out("   ");
    __.dl();
    $(_.v.getUnwrappedElementType());
    __.out(" element : elements \")
    __.out(" ");
    __.dl();
    if ($if(v.hasAttributeValue())
        __.dl();__.ln();
        __.out("   ");
        __.dl();
        if ($if(v.nullElements.ban())
            __.dl();__.out("if (element != null )
            {
final org.immutables.value.processor.meta.ValueAttribute v_deepCopyOf_1878776147 = $cast(v);
final org.immutables.generator.Templates.Invokable expression_deepCopyOf_1878776147 = new org.immutables.generator.Templates.Fragment(0) {
   @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __.dl();final org.immutables.generator.Templates.Invokable expression_deepCopyOf_1878776147 = this;
      __.out("element");
      __.dl();
    }
    __.dl();__.dl();
    if ($if(v.deepCopyOf_1878776147.isAttributeBuilder())
        __.dl();$_.convertToValueType, v.deepCopyOf_1878776147.getAttributeBuilderDescriptor());
__.out("(");
$(__, expression_deepCopyOf_1878776147);
__.out(")");

} else {
  __.dl();$(__, v_deepCopyOf_1878776147.attributeValueType.factoryCopyOf());
  __.out("(");
  $(__, expression_deepCopyOf_1878776147);
  __.out(")");
}
___.dl();
}
__.out(";").ln();
__.out(" ");

} ___.dl();___.ln();
__.out(" ");
___.dl();
if ($if(v.nullElements.allow())) {
  ___.dl();___.ln();
  ___.out(" this.");
  $(__, v.name());
  ___.out(" add(");
  {final org.immutables.value.processor.meta.ValueAttribute v_maybeToBuilder_53814988 = $cast(v);
    final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new
    org.immutables.generator.Templates.Fragment(0) {
      @Override public void run(org.immutables.generator.Templates.Invokation __) {
        ___.dl();final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 =
        this;
        ___.out("element");
        ___.dl();
      }};___.dl();___.dl();
    if ($if(v_maybeToBuilder_53814988.isAttributeBuilder())) {
      ___.dl();$(__, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(),
      new
      org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invocation __) {
          ___.dl();$(__, expression_maybeToBuilder_53814988);
          ___.dl();
        }));
    } else {
      ___.dl();$(__, expression_maybeToBuilder_53814988);
    }
  ___.dl();
}
if ($if(v.nullElements.skip())) {
    __.dl();___.ln();
    ___.out(" if (element != null) this.");
    $(___. v.name());
    ___.out(".add()");
} else if ($if(v.nullElements.skip())) {
    __.dl();___.ln();
    ___.out("      if (element != null) this.");
    $(___. v.name());
    ___.out(".add()");
} else {
    __.dl();___.ln();
    __.out("      this.");
    $(___. v.name());
    ___.out(".add()");
} if ($if(v_maybeToBuilder_53814988.isAttributeBuilder())) {
    __.dl();final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new
    org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 =
            this;
            __.out("element");
            ___.dl();
        } __.dl();___.dl();
    } __.dl();___.dl();
    if ($if(v_maybeToBuilder_53814988.isAttributeBuilder())) {
        __.dl();$(___. valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new
        org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
                __.dl();final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 =
                this;
                __.out("element");
                ___.dl();
            } __.dl();___.dl();
        } __.dl();___.dl();
    } else {
        __.dl();___.ln();
        __.out("      this.");
        $(___. v.name());
        __.out(".add()");
    } else {
        __.dl();___.ln();
        __.out("      this.");
        $(___. v.name());
        __.out(".add()");
    } else {
        __.dl();___.ln();
        __.out("      this.");
        $(___. v.name());
        __.out(".add()");
    } else {
        __.dl();___.ln();
        __.out("      this.");
        $(___. v.name());
        __.out(".add()");
    }
}
if ($if(v_maybeToBuilder_53814988.isAttributeBuilder())) {
    $.dl();$(__, valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            $.dl();$(__, expression_maybeToBuilder_53814988);
            $.dl();
        }
    });
} else {
    $.dl();$(__, expression_maybeToBuilder_53814988);
}

$.dl();
$.out(");
$.ln();
$.out("      ");
$.ln();
$.out("    } ").ln();
$.out("    ");
$.ln();
$.out("    this.");
$.out(" this.");
$.dl();
$.out(" .addAll(");
$.dl();
if ($if(v.isAttributeBuilder())) {
    $.dl();{final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_convertToBuilderType_187063380 = $cast(v.getAttributeBuilderDescriptor());
        $.dl();$(__, n_convertToBuilderType_187063380.getQualifiedValueTypeNameWithUnderscores());
    }
        $.out("(elements)");
} else {
    $.dl();$.out("(elements)");
}
$.dl();$.out("(elements)");
$.dl();$.out("(elements)").
$.ln();
$.out(" ");
$.ln();
```java
__.out("    ");
$___.nondefaultSetInBuilder, v);
__.ln();
__.out("    return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
__.dl();
if (!$if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
  ___.dl();__.out("(");
  $(___.type_builderReturnThis_1267082624.typeBuilder());
  ___.out(" )");
}
__.dl();__.out("this");
}
__.out(";").ln();
__.out("  ").ln();
__.out(" ");
__.dl();
if (!$if(v.isAttributeBuilder())) {
  ___.dl();__.ln();
  ___.ln();
  ___.out(" /**");
  ___.out(" * Adds elements to ");
  {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    $(___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
  }
  ___.out(" ");
  $(___.toLowerCase, v.getRawCollectionType());
  ___.out(".").ln();
  ___.out(" * @param elements An iterable of ");
  $(___.v.getName());
  ___.out(" builder elements").ln();
  ___.out(" * @return [ @code this ] builder for use in a chained invocation"");
  ___.out(" */");
  ___.out(" ");
  {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 =
    $cast(type);
    ___.dl();
    if (!$if($($s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
        "com.google.errorprone.annotations.CanIgnoreReturnValue")) }
      ___.dl();__.out(" @com.google.errorprone.annotations.CanIgnoreReturnValue ");
    }
    ___.dl();
  }
  ___.ln();
````
```java
__.out(" ");
(final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__.dl();
if ($if(a_deprecation_286924011.deprecated)) {
  __.dl();__.out("@Deprecated");
}
__.dl();
__.ln();
__.out(" ");
(final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
__.dl();
if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {
  __.dl();___.dl();
  if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
    __.dl();__.out("private ");
  } else {
    __.dl();$___.a_builderInitAccess_991723715.getIntializerAccess();
  }
} else {
  __.dl();$(___.a_builderInitAccess_991723715.getInicializerAccess());
}
__.dl();
___.out("final ");
(final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__.dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
  ___.dl();$___.type_builderReturnType_1031721330.typeBuilder();
} else {
  ___.dl();$___.type_builderReturnType_1031721330.typeBuilder().simple();
  $(___.type_builderReturnType_1031721330.generics().args());
}
__.dl();
___.out(" ");
$___.v.names.addAllBuilder();
__.out("Iterable<");
(final org.immutables.value.processor.meta.AttributeBuilderDescriptor
n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
$___.n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
```
if ($if(v.isNullableCollector())) {
    $(__, requireNonNull, type);
    $(__, v.name());
    $(__, defineOrResetBuildingFieldAlt, v, $$false, $$false);
    $(__, v.name());
    $(__, v.name());
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    $(__, v.name());
} else if ($if(v.nullElements.skip())) {
    $(__, v.name());
    $(__, v.name());
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    $(__, v.name());
    $(__, v.name());
} else {
    $(__, v.name());
    $(__, v.name());
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    $(__, v.name());
    $(__, v.name());
}
__dl();__ln();
__out("      this.");
$___.v.name());
__out(".add(");
$___.requireNonNull, type);
__out("(element, \"\")
$___.v.name());
__out(" element\")
).ln();
__out("    ");
}
__dl();__ln();
__out("    }
).ln();
__out("    ");
} else {
__dl();__ln();
__out("    this.");
$___.v.name());
__out(".addAll(elements);
).ln();
__out("    ");
}
__dl();__ln();
__out("    ");
$___.nondefaultSetInBuilder, v);
__ln();
__out("    return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
__dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
__dl();__out("(");
$___.type_builderReturnThis_1267082624.typeBuilder());
__out(") ");
}
__dl();__out("this");
}
__out(";").ln();
__out("    ");
__out("    ");
} else if ($if(v.isOptionalType())) {
__dl();__ln();
} else if ($if(v.isOptionalType())) {
__dl();__ln();
} else if ($if(v.isOptionalType())) {
__dl();__ln();
}
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```java
__out("    ");
__dl();
if ($if($not, v.isBuilderParameter)) {
  __dl();__ln();
  __ln();
  __out("/**").ln();
  __out(" * Initializes the optional value ");
  {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    ___, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
  }
  __out(" to ");
  $(__, v.name());
  __out(".").ln();
  __out(" * @param ");
  $(__, v.name());
  __out(" The value for ");
  $(__, v.name());
  __dl();
  if ($if(v.isOptionalAcceptNullable()) {
    __dl();__out("{ code null} is accepted as { @code ");
    {final org.immutables.value.processor.meta.ValueAttribute a_optionalEmpty_1867206284 = $cast(v);
      ___, a_optionalEmpty_1867206284.getRawType());
    __out(".");
    __dl();
    if ($if(a_optionalEmpty_1867206284.isJdkOptional()) {
      __dl();__out("empty");
    } else if ($if($(a_optionalEmpty_1867206284.isFugueOptional(), or,
      a_optionalEmpty_1867206284.isJavaslangOptional()))) {
      __dl();__out("none");
    } else {
      __dl();__out("absent");
    }
  }
  __dl();__out("()")
  }
  __out("}");
}
__dl();__ln();
__out(" * @return { @code this} builder for chained invocation").ln();
__out(" */").ln();
__out(" ");
$(__, eachLine, v.elementInitializerInjectedAnnotations());
__ln();
__out(" ");
```
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  __dl();
  if ($if($s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
      "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
  __dl();
  __ln();
  __out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __dl();__.out("@Deprecated");
  }
  __dl();
  __ln();
  __out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  __dl();
  if ($if($a_builderInitAccess_991723715.isBuilderParameter, or,
      a_builderInitAccess_991723715.isBuilderSwitcher())) {
    __dl();
    if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
      __dl();__.out("private ");
    }
    __dl();
  } else {
    __dl();$(__, a_builderInitAccess_991723715.getInitializerAccess());
  }
  __dl();
  }
  __out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
  __dl();
  if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
  } else {
    __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
    $(__, type_builderReturnType_1031721330.generics().args());
}
if ($if($(a_unwrappedOptionalType_1615308684.isOptionalType(), and, a_unwrappedOptionalType_1615308684.isOptionalAcceptNullable()))) {
  $.dl();$.out(atNullable, a_unwrappedOptionalType_1615308684);
  $.out(a_unwrappedOptionalType_1615308684.getWrappedElementType());
} else {
  $.dl();$.out(a_unwrappedOptionalType_1615308684.getUnwrappedElementType());
}
$.dl();
$.out(" ");
$.out("\n");
$.out(" ");
$.out("\n");
$.out(" ");
$.dl();
if ($if($(v.isJdkOptional(), and, type.kind().isFactory()))) {
  $.dl();$.ln();
  $.out(" this.");
  $.out("\n");
  $.out(" = ");
}
$.out(" ");
$.out("\n");
$.out(" ");
$.out("\n");
$.dl();
if ($if($(not, a_optionalOf_332927268.isOptionalAcceptNullable()))) {
  $.dl();$.dl();
  if ($if(a_optionalOf_332927268.isFugueOptional(), or,
a_optionalOf_332927268.isJavaslangOptional())) {
    $.dl();$.dl();
    $.out("some");
  } else {
    $.dl();$.out("of");
  }
} else if ($if(a_optionalOf_332927268.isJdkOptional())) {
  $.dl();

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```java
__dl();__out("ofNullable");
} else if ($if(a_optionalOf_332927268.isFugueOptional())) {
    __dl();__out("option");
} else if ($if(a_optionalOf_332927268.isJavaslangOptional())) {
    __dl();__out("of");
}

}}
__out("(");
{final org.immutables.value.processor.meta.ValueAttribute v_maybeCopyOf_1779456614 = $cast(v);
final org.immutables.generator.Templates.Invokable expression_maybeCopyOf_1779456614 = new org.immutables generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __dl();final org.immutables.generator.Templates.Invokable expression_maybeCopyOf_1779456614 =
        this;
        ${_, v.name()};
        __dl();
    }};__dl();__dl();
if (Sif(v_maybeCopyOf_1779456614.isGenerateImmutableCopyOf)) {
    __dl();__out("immutableCopyOf(");
    ${_, expression_maybeCopyOf_1779456614};
    __out("))");
}
} else if ($(v.isJdkOptional(), and, $($(v.isJdkSpecializedOptional(), or, v.isOptionalAcceptNullable()),
or, v.isPrimitiveElement())))) {
    __dl();__ln();
    __out(" this."");
    ${_, v.name()};
    __out(" = ");
    {final org.immutables.value.processor.meta.ValueAttribute v_maybeCopyOf_1779456614 = $cast(v);
    final org.immutables generator.Templates.Invokable expression_maybeCopyOf_1779456614 = new org.immutables generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __dl();final org.immutables generator.Templates.Invokable expression_maybeCopyOf_1779456614 =
            this;
            ${_, v.name()};
```
if ($if(v_maybeCopyOf_1779456614.isGenerateImmutableCopyOf)) {
    __dl();__out("immutableCopyOf(");
    $(__, expression_maybeCopyOf_1779456614);
    __out(")");
} else {
    __dl();$(__, expression_maybeCopyOf_1779456614);
}

    __out(";").ln();
    __out(" ");
} else if ($if(v.isJdkOptional())) {
    __dl();__ln();
    __out(" this.");
    $__ v.name();
    __out(" = ");
    __dl();
    if ($if(v.isAttributeBuilder())) {
        final org.immutables.value.processor.meta.AttributeBuilderDescriptor
            n_valueToBuilder_1442539515 = $cast(v.getAttributeBuilderDescriptor());
        final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 = new
            org.immutables.generator.Templates.Fragment(0) {
                @Override public void run(org.immutables.generator.Templates.Invokation __) {
                    final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 =
                        this;
                    __dl();final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 =
                        this;
                    __dl();
                    __out("(");
                    $__ v.name();
                    __out("", "+");
                    $__ v.name();
                    __out("\n");
                    __dl();
                }
            };__dl();__dl();
    }
    if ($if(n_valueToBuilder_1442539515.isCopyMethodOnValueInstance())) {
        __dl();$(__, expression_valueToBuilder_1442539515);
        __out(":");
        $(__, n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod());
        __out("()");
    } else {
        __dl();$(__, n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod());
        __out("(");
        $(__, expression_valueToBuilder_1442539515);
        __out(")");
```java
if ($if(v_maybeCopyOf_1779456614.isGenerateImmutableCopyOf)) {
  __dl();__out("immutableCopyOf(");
  $__d());__out(""");
  $__d();
} else {__dl();__ln();
  __out(" this.");
  $__d();__ln();
  __out(" = ");
  {final org.immutables.value.processor.meta.ValueAttribute a_optionalOf_332927268 = $cast(v);
    $(__, a_optionalOf_332927268.getRawType());
    __out(".");
    __dl();
  }
}
```

if ($if($(not, a_optionalOf_332927268.isOptionalAcceptNullable()))) {
  __dl();__dl();
  if ($if($(a_optionalOf_332927268.isFugueOptional(), or,
a_optionalOf_332927268.isJavaslangOptional()))) {
    __dl();__out("some");
  } else {
    __dl();__out("of");
  }
}
__dl();} else if ($if(a_optionalOf_332927268.isJdkOptional())) {
  __dl();__out("ofNullable");
} else if ($if(a_optionalOf_332927268.isFugueOptional())) {
  __dl();__out("option");
} else if ($if(a_optionalOf_332927268.isJavaslangOptional())) {
  __dl();__out("of");
} else {
  __dl();__out("fromNullable");
}
__dl();}
__out("(");
{final org.immutables.value.processor.meta.ValueAttribute v_maybeCopyOf_1779456614 = $cast(v);
final org.immutables.generator.Templates.Invokable expression_maybeCopyOf_1779456614 = new
org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __dl();final org.immutables.generator.Templates.Invokable expression_maybeCopyOf_1779456614 =
this;
    $(__, v.name());
    __dl();
  });__dl();__dl();
if ($if(v_maybeCopyOf_1779456614.isGenerateImmutableCopyOf)) {
  __dl();__out("immutableCopyOf(");
  $(__, expression_maybeCopyOf_1779456614);
  __out(")");
}
} else {
  __dl();$(__, expression_maybeCopyOf_1779456614);
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
   __.dl();
   if ($if(a_builderInitAccess_991723715.isBuilderParameter, or,
      a_builderInitAccess_991723715.isBuilderSwitcher())) {
      __.dl();___.dl();
      if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
         __.dl();___.out("private ");
      }
      __.dl();
   } else {
      __.dl();$(___. a_builderInitAccess_991723715.getInitializerAccess());
   }
   __.dl();
   __.out("final ");
   final org.immutables.value.processor.meta.AttributeBuilderDescriptor
   n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
   $(__. n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
}
___.out(" ");
$(__. v.names.getBuilder());
___.out("() { ");
___.out(" if (this.");
$(__. v.name());
___.out(" == null) { ");
___.out(" this.");
$(__. v.name());
___.out(" = ");
{final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_createAttributeBuilder_175285279 =
   $cast(v.getAttributeBuilderDescriptor());
   $(__. n_createAttributeBuilder_175285279.getQualifiedBuilderConstructorMethod());
   ___.out("() ");
}
___.out("; ");
___.out(" ");
$(__. nondefaultSetInBuilder, v);
___.ln();
___.out(" ");
$(__. mandatorySetInBuilder, v);
___.ln();
___.ln();
___.out(" return this.");
$(__. v.name());}


```java
.__out("; ").ln();
.__out("  ").ln();
.__ln();
.__out("/** ").ln();
.__out("  * Sets ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
  $(___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
.__out(" to the provided builder.").ln();
.__out("  */");
.__out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 =
  $cast(type);
  __.dl();
  if ($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
    "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    __.dl(); __.out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
  __.dl();
  __.ln();
  __.out(" ");
$(___.eachLine, v.getBuilderAttributeAnnotation());
.__ln();
.__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __.dl();
  if ($(a_deprecation_286924011.deprecated)) {
    __.dl(); __.out("@Deprecated");
  }
  __.dl();
  __.ln();
  __.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  __.dl();
  if ($(a_builderInitAccess_991723715.deprecated)) {
    __.dl(); __.out("@Deprecated");
  }
  __.dl();
  __.ln();
  __.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  __.dl();
  if ($(a_builderInitAccess_991723715.deprecated)) {
    __.dl(); __.out("@Deprecated");
  }
  __.dl();
  __.ln();
  __.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  __.dl();
  if ($(a_builderInitAccess_991723715.isBuilderParameter, or,
    a_builderInitAccess_991723715.isBuilderSwitcher())) {
    __.dl(); __.dl();
    if ($(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
      __.dl(); __.out("private ");
    }
    __.dl();
  } else {
```
___.dl();$

$___.dl();
}
$___.out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
 ___.dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {

___.dl();$

$___.type_builderReturnType_1031721330.typeBuilder();
}
else {

___.dl();$

$___.type_builderReturnType_1031721330.typeBuilder().simple();

$(___.type_builderReturnType_1031721330.generics().args());

}
___.dl();
___.out(" ");
$(___.v.names.setBuilder());
___.out("(");
$(___.v.atNullability());
$(___.v.getAttributeBuilderDescriptor().getQualifiedBuilderTypeName());
___.out(" ");
$(___.v.name());
___.out(" ");
$(___.checkNotIsSet, v);
___.ln();
___.out("      this.");
$(___.v.name());
___.out(" = ");
$(___.v.name());
___.out(";");
___.ln();
___.out(" ");
$(___.nondefaultSetInBuilder, v);
___.ln();
___.out("      ");
$(___.mandatorySetInBuilder, v);
___.ln();
___.out("      return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
 ___.dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {

___.dl();

$___.type_builderReturnThis_1267082624.typeBuilder();

}
if ($if(v.getConstructorParameters())) {

    /**
     * Constructs and initializes the optional value for the 
     * attribute.
     * @param {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
     * $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
     */

    for (final org.immutables.value.processor.meta.ValueAttribute c : $in(v.getConstructorParameters())) {
        __.dl();___.ln();
        ___.out("  * @param ");
        $(__, c.name());
        __.out(" The value for {code }");
        $(__, v.name());
        __.out(".");
        $(__, c.name());
        __.out(" } ");
        __.dl();
        if ($if(c.isNullable())) {
            __.dl();___.out("(can be {code null})");
        }
    }

    __.dl();___.ln();
    __.out("  */");
}

}
$(___. eachLine, v.elementInitializerInjectedAnnotations());
  __.ln();
  __.out(" ");
  { final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  __.dl();
    if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) { 
      __.dl();___.out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
    }
  __.dl();
  }
  __.ln();
  __.out(" ");
  { final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __.dl();
    if ($if(a_deprecation_286924011.deprecated)) {
      __.dl();___.out("@Deprecated");
    }
  __.dl();
  }
  __.ln();
  __.out(" ");
  { final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  __.dl();
    if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
        a_builderInitAccess_991723715.isBuilderSwitcher())))) {
      __.dl();___.dl();
        if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
          __.dl();___.out("private ");
        } else {
          ___.dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
        }
    } else {
      ___.dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
    }
  __.dl();
  }
  __.out("final ");
  { final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
  __.dl();
    if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) { 
      __.dl();$(__., type_builderReturnType_1031721330.typeBuilder());
    } else {
/**
 * Initializes the optional value
 * @param The value for
 * @return this builder for use in a chained invocation
 */

if (type.kind().isFactory() || !v.isJdkOptional()) {
  __(, suppressCovariantCastForOptional, v);
}

__(, eachLine, v.initializerInjectedAnnotations());

{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  __dl();__out(" @com.google.errorprone.annotations.CanIgnoreReturnValue ");
}

__(, ln());
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
  __(, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}

__(, v.name());
__out(" to ");

__(, v.name());
__out(" * @return [ @code this] builder for use in a chained invocation"");

__(, ln());
__out(" */");
__out(" ");

dl();
if (Sif$(type.kind().isFactory(), ornot, v.isJdkOptional())) {
  __dl();__ln();
  __out(" ");
  __(, suppressCovariantCastForOptional, v);
  __ln();
  __out(" ");
}

__dl();__ln();
__out(" ");
__(, eachLine, v.initializerInjectedAnnotations());
__ln();
__out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  __dl();
  if (Sif$(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
      "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
}
__dl();
__ln();
__out(" ");
$(__, eachLine, v.getBuilderAttributeAnnotation());
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
  __dl();__out("@Deprecated");
}
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
__dl();
if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {
  __dl();__dl();
  if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
    __dl();__out("private ");
  } else {
    __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
  }
} else {
  __dl();
} else {
  __dl();$(__, a_builderInitAccess_991723715.getInitializerAccess());
}
__dl();
__out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
  __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
} else {
  __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
$(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__out(" ");
$__ v.names.init;
__out(" ");
$(__, v.getRawType());
__dl();
if ($if($not, v.isJdkSpecializedOptional())) {
if ($if($(v.isJdkOptional(), and, type.kind().isFactory()))) {
    __.dl();__.ln();
    __.out("    this.");
    $(__, v.name());
    __.out(" = (");
    $(__, v.getType());
    __.out(" )");
    $(__, requireNonNull, type);
    __.out("\n");
    $(__, v.name());
    __.out(";");
    __.out("\n");
} else if ($if(v.isAttributeBuilder())) {
    __.dl();__.ln();
    __.out("    this.");
    $(__, v.name());
    __.out(" = ");
    [final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_convertToBuilderType_187063380 = $cast(v.getAttributeBuilderDescriptor());]
    __.out("convertToBuilderType");
    $(__, n_convertToBuilderType_187063380.getQualifiedValueTypeNameWithUnderscores());

    __.out("\n");
    $(__, valueFromValue, v, v.name());
    __.out(";\n");
    __.out("\n");
} else {
    __.dl();__.ln();
    __.out("    this.");
    $(__, v.name());
    __.out(" = ");
}
$(__, valueFromValue, v, v.name());
___out(";").ln();
___out("  ");

__dl();__ln();
___out("  ");
$(__, nondefaultSetInBuilder, v);
__ln();
___out(" return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
__dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
__dl();__out("(");
$(__, type_builderReturnThis_1267082624.typeBuilder());
__out(" )");
}
__dl();__out("this");
}
__out(";").ln();
__out("  ");
__out(" )");
} else if ($if(v.isMapType())) {
__dl();__ln();
___out("  ");
{final org.immutables.generator.Templates.Iteration __it3 = new org.immutables.generator.Templates.Iteration();
final java.lang.String gE = $cast(v.getConsumedElementType());
final java.lang.String uK = $cast(v.getUnwrappedElementType());
final java.lang.String wK = $cast(v.getWrappedElementType());
final java.lang.String uV = $cast(v.getUnwrappedSecondaryElementType());
final java.lang.String wV = $cast(v.getWrappedSecondaryElementType());
__dl();__ln();
__out("  ");
__dl();
if ($if(v.isMultimapType())) {
__dl();__ln();
__out("  ");
__dl();
if ($if($if($not, v.isBuilderParameter))) {
__dl();__ln();
__ln();
__out(" /* */");
__out("  * Put all mappings from the specified key to values for ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
__out(" ");
$___.out(toLower, v.isMapType());
___.out(" . Nulls are not permitted").ln();
___.out(" * @param key The key for ");
$___.v.name());
___.ln();
___.out(" * @param values The values for ");
$___.v.name());
___.ln();
___.out(" * @return {code this} builder for use in a chained invocation").ln();
___.out(" */").ln();
___.out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  ___.dl();
  if ($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    ___.dl();___.out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
  ___.dl();
}
___.ln();
___.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
  ___.dl();
  if ($(a_varargsSafety_1368213209.isNonRawElementType(), or, a_varargsSafety_1368213209.hasTypeVariables)) {
    ___.dl();___.out("@SafeVarargs @SuppressWarnings("varargs")");
  }
  ___.dl();
}
___.ln();
___.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  ___.dl();
  if ($(a_deprecation_286924011.isNonRawElementType(), or, a_deprecation_286924011.deprecated)) {
    ___.dl();___.out("@Deprecated");
  }
  ___.dl();
}
___.ln();
```java
    this.
    .putAll(key, ");
    this.
    nondefaultSetInBuilder, v);
    return {
            final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
            if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
                    
                    this
            }
    }.

    /**
     * Put all mappings from the specified key to values for 
     * @param key The key for 
     * @param values The values for 
     * @return {@code this} builder for use in a chained invocation
     */
    
```
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```java
__out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  __dl();
  if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
  "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
    __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
  __dl();
}
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __dl();__out("@Deprecated");
  }
  __dl();
}
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  __dl();
  if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
  a_builderInitAccess_991723715.isBuilderSwitcher()))) {
    __dl();__dl();
    if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
      __dl();__out("private ");
    }
    __dl();
  } else {
    __dl();$_(a_builderInitAccess_991723715.getIntializerAccess());
  }
  __dl();
}
__out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
  __dl();
  if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __dl();$_(type_builderReturnType_1031721330.typeBuilder());
  } else {
    __dl();$_(type_builderReturnType_1031721330.typeBuilder().simple());
  }
}
```
if ($if(!v.isBuilderParameter)) {
    __out(" **\n   * Put one entry to the ");
    {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
      __, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);

    __out(" map.").ln();
    __out(" * @param key The key in the ");
    $__, v.name();
    __out(" map").ln();
    __out(" * @param value The associated value in the ");
    $__, v.name();
    __out(" map").ln();
    __out(" * @return [ @code this] builder for use in a chained invocation").ln();
    __out(" */").ln();
    __out(" ");
    $__, eachLine, v.elementInitializerInjectedAnnotations();
    __ln();
    __out(" ");
    {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
      __,
      if ($if(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
        __ln();
      __out(" @com.google.errorprone.annotations.CanIgnoreReturnValue ");
    }
    __,
    if ($if(a_deprecation_286924011.deprecated)) {
      __, __out(" @Deprecated");
    }
if (v.jacksonAnyGetter) {
    __dl();__out("@com.fasterxml.jackson.annotation.JsonAnySetter");
}

{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
    __dl();
    if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {
        __dl();__dl();
        if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
            __dl();__out("private ");
        }
    } else {$(__, a_builderInitAccess_991723715.getInitializerAccess());
    }

{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
    __dl();
    if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
        __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
    } else {$(__, type_builderReturnType_1031721330.typeBuilder().simple());
        $(__, type_builderReturnType_1031721330.generics().args());
    }

    __dl();
}

if (not, a_atElementNullable_1621680092.nullElements.ban())} {
    __dl();$(__, atNullable, a_atElementNullable_1621680092);
final org.immutables.value.processor.meta.ValueAttribute a_atElementNullable_1621680092 = $cast(v);
__dl();
if ($if($(not, a_atElementNullable_1621680092.nullElements.ban()))) {
  __dl():$___.atNullable, a_atElementNullable_1621680092);
}
__dl();
$___.uV;
__out(" value) {").ln();
__out(" ");
__dl();
if ($if(v.isNullableCollector())) {
  __dl():___.ln();
  __out(" if (this.");
  $___.v.name();
  __out(" == null) ");.ln();
  __out(" ");
  $___.defineOrResetBuildingFieldAlt, v, $$false, $$false);.ln();
  __out(" ]").ln();
  __out(" ");
}
__dl();___.ln();
__out(" ");
__dl();
if ($if(v.isGenerateJdkOnly())) {
  __dl();___.ln();
  __out(" ");
  __dl();
  if ($if(v.nullElements.allow())) {
    ___.ln();
    __out(" this.");
    $___.v.name();
    __out(" .put(key, value);");.ln();
    __out(" ");
  } else if ($if(v.nullElements.skip())) {
    ___.ln();
    __out(" if (value != null");
    ___.ln();
  if ($if($not, v.isPrimitiveElement())) {
**/**

* Put one entry to the *

{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" map. Nulls are not permitted".ln();
__out(" * param entry The key and value entry".ln();
__out(" * @return [ @code this ] builder for use in a chained invocation".ln();
__out(" */").ln();
__out(" ");
$(__, eachLine, v.elementInitializerInjectedAnnotations());
__ln();
__out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 =
$cast(type);
__dl();
if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
"com.google.errorprone.annotations.CanIgnoreReturnValue")) {
__dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
}
__dl();
}
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
__dl();__out("@Deprecated");
}
__dl();
}
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
__dl();
if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {

}
if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory()) {
    __dl();__out("private ");
}
__dl();
} else {
    __dl();$(__, a_builderInitAccess_991723715.getInitializerAccess());
}

__.out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
  __, dl();
  if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __, dl();$(__, type_builderReturnType_1031721330.typeBuilder());
  } else {
    __, dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
    $(__, type_builderReturnType_1031721330.generics().args());
  }
  __, dl();
} __, out(" ");
$(__, v.names.put());
__out("(java.util.Map.Entry<");
$(__, gE);
__out("", ? extends ");
$(__, wV);
__out("> entry) ").ln();
__out(" ");
__dl();
if ($if(v.isNullCollector())) {
  __, dl();__ln();
  __out(" if (this.");
  $(__, v.name());
  __out(" == null) ").ln();
  __out(" ");
  $(__, defineOrResetBuildingFieldAlt, v, $$false, $$false);
  __ln();
  __out(" ").ln();
  __out(" ");
}
__dl();__ln();
__out(" ");
if ($if(v.isGenerateJdkOnly())) {
  $.dl(); $.ln();
  $.out("    ");
  $(_, wK);
  $.out("    k = entry.getKey();").ln();
  $.out("    ");
  $(_, wV);
  $.out("    v = entry.getValue();").ln();
  $.out("    ");
  $.dl();
} else if ($if(v.nullElements.allow())) {
  $.dl(); $.ln();
  $.out("    this.");
  $(_, v.name());
  $.out("    .put(k, v);").ln();
  $.out("    ");
  if ($if(v.nullElements.skip())) {
    $.dl(); $.ln();
    $.out("    if (k != null && v != null) this.");
    $(_, v.name());
    $.out("    .put(k, v);").ln();
    $.out("    ");
  } else {
    $.dl(); $.ln();
    $.out("    this.");
    $(_, v.name());
    $.out("    .put(").ln();
    $(_, requireNonNull, type);
    $.out("(k, "");
    $(_, v.name());
    $.out("(v, "");
    $(_, requireNonNull, type);
    $.out("(v, "");
    $(_, v.name());
    $.out("value")");
  }
  $.dl(); $.ln();
  $.out("    ");
} else {
  $.dl(); $.ln();
  $.out("    this.");
  $(_);
___out("put(entry);").ln();
___out(" ");
}
___dl();___ln();
___out(" ");
$(___, nondefaultSetInBuilder, v);
___ln();
___out(" return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
___dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
  ___dl();___out("(");
  $(___, type_builderReturnThis_1267082624.typeBuilder());
  ___out(" )");
}
___dl();___out("this");
}
___out(";").ln();
___out(" })").ln();
___out(" ");
___dl();
if ($if(!$(not, type.isUseStrictBuilder()))) {
  ___dl();___ln();
  ___ln();
  ___out("/***/").ln();
  ___out(" * Sets or replaces all mappings from the specified map as entries for the ");
  {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    $(___, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
  }
  ___out(" map. Nulls are not permitted");
  ___dl();
  if ($if(v.isNull()) {
    ___dl();___out(" as keys or values, but parameter itself can be null");
  }
  ___dl();___ln();
  ___out(" * @param entries The entries that will be added to the ");
  $(___, v.name());
  ___out(" map").ln();
  ___out(" * @return [ @code this ] builder for use in a chained invocation").ln();
  ___out(" */").ln();
  ___out(" ");
  $(___, eachLine, v.initializerInjectedAnnotations());
[final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
  __.dl();
  if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue"))) {
    __.dl();___.out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
  }
  __.dl();
  ___.ln();
  ___.out(" ");
  $(__, eachLine, v.getBuilderAttributeAnnotation());
  ___.ln();
  ___.out(" ");
  [final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
   __.dl();
   if ($if(a_deprecation_286924011.deprecated)) {
     __.dl();___.out("@Deprecated");
   }
   __.dl();
   ___.ln();
   ___.out(" ");
   [final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
    __.dl();
    if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or, a_builderInitAccess_991723715.isBuilderSwitcher()))) {
      __.dl();___.dl();
      if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
        __.dl();___.out("private ");
      }
      __.dl();
    } else {
      __.dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
    }
    __.dl();
  } else {
    __.dl();
  }
  ___.out("final ");
  [final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
   __.dl();
   if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {

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```java
  __dl();$(__.type_builderReturnType_1031721330.typeBuilder());
}
}

  __out(" ");
$(__.v.names.init);
  __out("(");
$(__.v.atNullability());
  __dl();
if ($if(v.isMultimapType())) {
  __dl();$(__.guava);
  __out(" collect.Multimap");
} else {
  __dl();__out("java.util.Map");
}

  __dl();__out("<");
$(__.gE);
  __out(" , ? extends ");
$(__.wV);
  __out(" > entries ) ").ln();
  __out(" ");
  __dl();
if ($if(v.isNullable())) {
  __dl();__ln();
  __out(" if (entries == null ) ").ln();
  __out(" ");
$(__.defineOrResetBuildingFieldAlt, v, $$false, $$true);
  __ln();
  __out(" ");
$(__.nondefaultSetInBuilder, v);
  __ln();
  __out(" return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 =
  $cast(type);
  __dl();
  if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
    __dl();__out("(");
    $(__.type_builderReturnType_1267082624.typeBuilder());
    __out(" ");
  }
```
__dl();__out("this");

}
__out(";").ln();
__out("  ");ln();
__out("  ");

}
__dl();__ln();
__out("  ");

{final org.immutables.value.processor.meta.ValueAttribute v_defineOrResetBuildingField_1809684382 = $cast(v);
final java.lang.Boolean declare_defineOrResetBuildingField_1809684382 = $cast($false);
$(__, defineOrResetBuildingFieldAlt, v_defineOrResetBuildingField_1809684382, declare_defineOrResetBuildingField_1809684382, $$false);

}
__ln();
__out("  ");
$__ nondefaultSetInBuilder, v);
__ln();
__out("  return ");
$__ v.names.putAll());
__out("(entries);").ln();
__out("  ").ln();
__out("  ");

}
__dl();__ln();
__out("  ");

}
__dl();__ln();
__ln();
__out("  /**
** Put all mappings from the specified map as entries to ");

{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$__ sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);

}
__out("  map. Nulls are not permitted").ln();
__out("  * @param entries The entries that will be added to the ");
__out("  * @return [@code this] builder for use in a chained invocation").ln();
__out("  */").ln();
__out("  ");
$(__, eachLine, v.initializerInjectedAnnotations());
(final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
    __dl();
    if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue"))
        __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
    }
    __dl();
} __ln();
__out("  ");
(final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __dl();
    if ($if(a_deprecation_286924011.deprecated))
        __dl();__out("@Deprecated");
    }
    __dl();
} __ln();
__out("  ");
(final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
    __dl();
    if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or, a_builderInitAccess_991723715.isBuilderSwitcher())))
        __dl();__dl();
        if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory()))
            __dl();__out("private ");
        }
    __dl();
} else {
    __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
    }
    __dl();
} __out("final ");
(final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
    __dl();
    if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending))
        __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
    } else {
        __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
    }
$(_. type_builderReturnType_1031721330.generics().args());

}
__dl();
}
__out(" ");
$(_, v.names.putAll());
__out("(");
__dl();
if ($if(v.isMultimapType())) {
  __dl();$(__, guava);
  __out(".collect.Multimap");
} else {
  __dl();__out("java.util.Map");
}
__dl();__out("<");
$__ gE);
__out(",
? extends ");
$__ wV);
__out(" => entries) ").ln();
__out(" ");
__dl();
if ($if(v.isNullableCollector())) {
  __dl();__ln();
  __out(" if (this.")
  $(__, v.name());
  __out(" == null) ").ln();
  __out(" ");
  $(__, defineOrResetBuildingFieldAlt, v, $$false, $$false);
  __ln();
  __out(" })").ln();
  __out(" ");
}
__dl();__ln();
__out(" ");
__dl();
if ($if(v.isGenerateJdkOnly())) {
  __dl();__ln();
  __out(" for (java.util.Map.Entry<");
  $__ gE);
  __out(",
? extends ");
  $__ wV);
  __out(" e : entries.entrySet()) ").ln();
  __out(" ");
  $(__, wK);
__out(" k = e.getKey();").ln();
__out("  ");
$___.wV;
__out("  v = e.getValue();").ln();
__out("  ");
__dl();
if ($if(v.nullElements.allow())) {
__dl();__ln();
__out("    this.");
$___.v.name();
__out(".put(k, v);").ln();
__out("    ");
} else if ($if(v.nullElements.skip())) {
__dl();__ln();
__out("      if (k != null && v != null) this.");
$___.v.name();
__out(".put(k, v);").ln();
__out("      ");
} else {
__dl();__ln();
__out("      this.");
$___.v.name();
__out(".put()").ln();
__out("    ");
$___.requireNonNull, type;
__out("(k, "");
$___.v.name();
__out(" key\")").ln();
__out("    ");
$___.requireNonNull, type;
__out("(v, "");
$___.v.name();
__out(" value\")").ln();
__out("    ");
}
__dl();__ln();
__out(""").ln();
__out(" ");
} else {
__dl();__ln();
__out("    this.");
$___.v.name();
__out(".putAll(entries);").ln();
__out("    ");
}
__dil();__ln();
__out(" ");
$___.nondefaultSetInBuilder, v);
__ln();
__out(" return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
__dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
__dl();__out("(");
$___.type_builderReturnThis_1267082624.typeBuilder();
__out(" )");
}
__dl();__out("this");
}
__out(".").ln();
__out(" } ").ln();
__out(" ");
__dl();_it3.index++;  
_it3.first = false;
}
__dl();__ln();
__out(" ");
} else if ($if(v.isArrayType())) {
__dl();__ln();
__ln();
__out(" /**").ln();
__out(" * Initializes the value for the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" attribute.").ln();
__out(" ");
__dl();
if ($if(v.isGenerateDefault)) {
__dl();__ln();
__out(" * <p><em>If not set, this attribute will have a default value as defined by ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(". </em>").ln();
__out(" ");
}
__dl();__ln();
__out("   * @param ");
$___.v.name());
__out(" The elements for ");
$___.v.name());
__ln();
__out("   * @return @code this builder for use in a chained invocation").ln();
__out(" */").ln();
__out(" ");
$___.eachLine, v.initializerInjectedAnnotations());
__ln();
__out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
__dl();
if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
"com.google.errorprone.annotations.CanIgnoreReturnValue")) {
   __dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
}
__dl();
}
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
__dl();
if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or,
a_varargsSafety_1368213209.hasTypeVariables))) {
   __dl();__out("@SafeVarargs @SuppressWarnings("varargs")");
}
__dl();
}
__ln();
__out(" ");
$___.eachLine, v.getBuilderAttributeAnnotation());
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
   __dl();__out("@Deprecated");
}
__dl();
}
__ln();
__out(" ");
$___.eachLine, v.getBuilderAttributeAnnotation());
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
   __dl();__out("@Deprecated");
}
__dl();
}
__ln();
__out(" ");
final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
__dl();
if (Sif$(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {
    __dl();__dl();
    if (Sif(a_builderInitAccess_991723715.containingType.kind().isFactory()) {
        __dl();__out("private ");
    }
    __dl();
} else {
    __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
}

__dl();
__out("final ");

final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if (Sif(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
} else {
    __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
$(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__out(" ");
$(__, v.names.init);
__out("(");
$(__, v.getElementType());
__out("...");
$(__, v.name());
__out(" ");
__out(" ");
$__;
$__;
$__;
$__;
$(__, checkNotIsSet, v);
__ln();
__out(" this.");
$(__, v.name());
__out(" = ");
$(__, valueFromValue, v, v.name());
__out(";");
__out(" ");
$(__, mandatorySetInBuilder, v);
__ln();
__out(" ");
$_($$.nondefaultSetInBuilder, v);
__$.ln();
__$.out("    return ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
__$.dl();
if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
  __$.dl();__$.out("(");
$(__, type_builderReturnThis_1267082624.typeBuilder());
__$.out(") ");
}
__$.dl();__$.out("this");
}
__$.out(";").ln();
__$.out(" }").ln();
__$.out(" ");
} else {
  __$.dl();__$.ln();
  __$.out(" ");
  __$.dl();
if ($if(v.getConstructorParameters())) {
    __$.dl();__$.ln();
    __$.ln();
    __$.out("/**");
    __$.out(" */ Constructs and initializes the value for the ");
    {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
      $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
    }
    __$.out(" attribute.").ln();
    __$.out(" ");
    {final org.immutables.generator.Templates.Iteration _it3 = new
      org.immutables.generator.Templates.Iteration();
      for (final org.immutables.value.processor.meta.ValueAttribute c : $in(v.getConstructorParameters())) {
        __$.dl();__$.ln();
        __$.ln();
        __$.out(" * @param ");
        $(__, c.name());
        __$.out(" The value for { @code }");
        $(__, v.name());
        __$.out(".");
        $(__, c.name());
        __$.out(" ");
        __$.dl();
        if ($if(c.isNullable())) {
          __$.dl();__$.out("(can be { @code null})");
        }
      }
    }
  }
}
    __out("  ");
    ___dl(); _it3.index++;
    _it3.first = false;
  }

  __dl(); __ln();
  __out("  * @return {@code this} builder for use in a chained invocation"");
  __out("  *");
  __out(" ");
 (___ eachLine, v.elementInitializerInjectedAnnotations());
__ln();
__out(" ");

  {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
    __dl();
    if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
            "com.google.errorprone.annotations.CanIgnoreReturnValue")) { $if( __, eachLine, v.elementInitializerInjectedAnnotations());
      __dl(); __out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
    }
    __dl();
  }

  __ln();
  __out(" ");

  {final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __dl();
    if ($if(a_deprecation_286924011.deprecated) { $if( __, eachLine, v.elementInitializerInjectedAnnotations());
      __dl(); __out("@Deprecated"};
    }
    __dl();
  }

  __ln();
  __out(" ");

  {final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
    __dl();
    if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
            a_builderInitAccess_991723715.isBuilderSwitcher())) { $if( __, eachLine, v.elementInitializerInjectedAnnotations());
      __dl();
      if ($if(a_builderInitAccess_991723715.isBuilderParameter, or,
              a_builderInitAccess_991723715.isBuilderSwitcher()) { $if( __, eachLine, v.elementInitializerInjectedAnnotations());
        __dl();
        if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory()) { $if( __, eachLine, v.elementInitializerInjectedAnnotations());
          __dl(); __out("private ");
        }
        __dl();
      } else {
        __dl();$
    }else {
        __dl();$
    }$(__, a_builderInitAccess_991723715.getInitializerAccess());
final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);

if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
    $(__, type_builderReturnType_1031721330.typeBuilder());
} else {
    $(__, type_builderReturnType_1031721330.typeBuilder().simple());
    $(__, type_builderReturnType_1031721330.generics().args());
}

for (final org.immutables.value.processor.meta.ValueAttribute c : $in(v.getConstructorParameters())) {
    $(__, c.atNullability());
    $(__, c.getType());
    $(__, c.name());
    _it3.index++;
    _it3.first = false;
}

for (final org.immutables.value.processor.meta.ValueAttribute c : $in(v.getAttributeValueTypes())) {
    $(__, c.getAttributeValueType().factoryOf());
}

for (final org.immutables.value.processor.meta.ValueAttribute c : $in(v.getAttributeValueTypes())) {
    $(__, c.getAttributeValueType().factoryOf());
}
__dl__:(__, c.name());
__dl__:__it3.index++;
__it3.first = false;
}
__dl__:__out(";").ln();
__out("  ");.ln();
__out("  ");

}
__dl__:__ln();
__ln();
__out(" */**").ln();
__out(" * Initializes the value for the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$__ sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out("  ");.ln();
__out("  ");
__dl();
if ($if(v.isGenerateDefault)) {
__dl__:__ln();
__out("  * <p>&lt;em&gt;If not set, this attribute will have a default value as returned by the initializer of ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$__ sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out("&lt;/em&gt;").ln();
__out("  ");

}
__dl__:__ln();
__out("  * @param ");
$__ v.name());
__out("  * The value for ");
$__ v.name());
__out("  ");
__dl();
if ($if(v.isNullable)) {
__dl__:__out("(can be { @code null})");
}
__dl__:__ln();
__out("  * @return { @code this} builder for use in a chained invocation").ln();
__out("  * ").ln();
__out("  ");
$__ eachLine, v.initializerInjectedAnnotations());
__ln();
final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 = $cast(type);
    __dl();
    if ($if(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
        __dl(); __out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
    }
    __dl();
    __ln();
    __out(" ");
    $___.eachLine, v.getBuilderAttributeAnnotation();
    __ln();
    __out(" ");
    final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __dl();
    if ($if(a_deprecation_286924011.deprecated)) {
        __dl(); __out("@Deprecated");
    }
    __dl();
    __ln();
    __out(" ");
    final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
    __dl();
    if ($if(a_builderInitAccess_991723715.isBuilderParameter, or, a_builderInitAccess_991723715.isBuilderSwitcher())) {
        __dl();
        if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
            __dl(); __out("private ");
        } else {
            __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
        }
    }
    __dl();
    if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
        __dl(); __out("private ");
    } else {
        __dl();$(__, a_builderInitAccess_991723715.getIntializerAccess());
    }
    __dl();
    __out("final ");
    final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
    __dl();
    if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
        __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
```java
} else {
    __.dl();
    $__().$type_builderReturnType_1031721330.typeBuilder().simple();
    $__().$type_builderReturnType_1031721330.generics().args();
}

___.dl();

__.out(" ");
$___.v.names.init;
__.out(" ");
$___.v.atNullability();
$___.v.getType();
__.out(" ");
$___.v.name();
__.out(" ");
___.ln();
__.out(" ");
__.dl();

if ($if($(v.isBuilderSwitcher(), and, type.kind().isFactory()))) {
    __.dl();
    __.dl();
    ___.ln();
    __.out(" this.");
    __.v.name();
    __.out(" = ");
    __.v.name();
    __.out(";");
    ___.ln();
    __.out(" ");
} else {
    __.dl();
    __.ln();
    __.out(" this.");
    __.v.name();
    __.out(" = ");
}

[final org.immutables.value.processor.meta.ValueAttribute v_maybeToBuilder_53814988 = $cast(v);
final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = new
org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();
        final org.immutables.generator.Templates.Invokable expression_maybeToBuilder_53814988 = this;
        $(_._.valueFromValue, v, v.name());
        __.dl();
    } });

if ($if(v_maybeToBuilder_53814988.isAttributeBuilder()) {
    __.dl();
    $(_._.valueToBuilder, v_maybeToBuilder_53814988.getAttributeBuilderDescriptor(), new
org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invocation __) {
            __.dl();
            $(_._.expression_maybeToBuilder_53814988);___.dl();
        } });
```
null

if ($if(v.isAttributeBuilder())) {
  __dl();__ln();
  __out("/**").ln();
  __out(" * Returns a builder for ").ln();
  __out(" * Once called, the attribute builder field is set to a new instance of the builder.").ln();
  __out(" * If called more than once, returns the same builder instance.").ln();
}

{|{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v); $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);}}

|}

if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
  __dl();
  __out("(");
  __out(type_builderReturnThis_1267082624.typeBuilder());
  __out(" )");
  __out(" this");
}

|}

$(__, nondefaultSetInBuilder, v);
__ln();
__out(" ");
$(__, mandatorySetInBuilder, v);
__ln();
__out(" return ");

{|{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);}}

|}

if ($if(v.isAttributeBuilder())) {
  __dl();
  __ln();
  __out("/**").ln();
  __out(" * Returns a builder for ");
  __out(" * Once called, the attribute builder field is set to a new instance of the builder.").ln();
  __out(" * If called more than once, returns the same builder instance.").ln();
}

__dl();$(__, expression_maybeToBuilder_53814988);

} else {
  __dl();$(__, expression_maybeToBuilder_53814988);
}
Open Source Used In kASA v1.5 2089

```java
__.out(" */").ln();
__.out(" ");
$___.eachLine, v.getBuilderAttributeAnnotation();
__.ln();
__.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  ___.dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    ___.dl();__.out("@Deprecated");
  }
  ___.dl();
}__.ln();
__.out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
  ___.dl();
  if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
    a_builderInitAccess_991723715.isBuilderFactory))) {
    ___.dl();___.dl();
    if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
      ___.dl();__.out("private ");
    }
    ___.dl();
  } else {
    ___.dl();$___.a_builderInitAccess_991723715.getIntializerAccess();
  }
  ___.dl();
}__.out("final ");
{final org.immutables.value.processor.meta.AttributeBuilderDescriptor
  n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
  $(___.n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
}__.out(" ");
$(___.v.names.getBuilder());
__.out(" () {").ln();
__.out(" if (this.");
$(___.v.name());
__.out(" == null ) ");.ln();
__.out(" this.");
$(___.v.name());
__.out(" = ");
{final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_createAttributeBuilder_175285279 = $cast(v.getAttributeBuilderDescriptor());

```
$(__, n_createAttributeBuilder_175285279.getQualifiedBuilderConstructorMethod());
    __.out("());
}
    __.out(";").ln();
    __.out("  } ").ln();
    __.out("  ");
$(__, nondefaultValueInBuilder, v);
    __.ln();
    __.out("  ");
$(__, mandatoryValueInBuilder, v);
    __.ln();
    __.ln();
    __.out("return this.");
$(__, v.name());
    __.out(";").ln();
    __.out("  ");
    __.out(" /**");
    __.out(" * Sets ");
    {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
     $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
    }
    __.out(" to the provided builder.");
    __.out(" */");
    __.out(" ");
    {final org.immutables.value.processor.meta.HasStyleInfo s_atCanIgnoreReturnValue_1431153190 =
     $cast(type);
     __.dl();
     if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation,
       "com.google.errorprone.annotations.CanIgnoreReturnValue"))
      {__dl();__out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
      }
     }
    __.dl();
}__._ln();
    __.out(" ");
$(__, eachLine, v.getBuilderAttributeAnnotation());
    __.ln();
    __.out(" ");
    {final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
     __dl();
     if ($if(a_deprecation_286924011.deprecated))
      {__dl();__out("@Deprecated");
      }
    }

Open Source Used In kASA v1.5 2091

```java
__dl();
__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueAttribute a_builderInitAccess_991723715 = $cast(v);
__dl();
if ($if($(a_builderInitAccess_991723715.isBuilderParameter, or,
a_builderInitAccess_991723715.isBuilderSwitcher()))) {
  __dl();
  if ($if(a_builderInitAccess_991723715.containingType.kind().isFactory())) {
    __dl();
    __out("private ");
  }
  __dl();
} else {
  __dl();
  $(__, a_builderInitAccess_991723715.getIntializerAccess());
}
__dl();
__out("final ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
__dl();
if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
  $(__, type_builderReturnType_1031721330.typeBuilder());
} else {
  $(__, type_builderReturnType_1031721330.typeBuilder().simple());
  $(__, type_builderReturnType_1031721330.generics().args());
}
__dl();
__out(" ");
$(__, v.names.setBuilder());
__out(" ");
$(__, v.atNullability());
$(__, v.getAttributeBuilderDescriptor().getQualifiedBuilderTypeName());
__out(" ");
$(__, v.name());
__out(" ") {".ln();
__out(" ");
$(__, checkNotIsSet, v);
__ln();
__out(" this.");
$(__, v.name());
__out(" = ");
$(__, v.name());
```
private BuilderReturnThis typeBuilder() {
    final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);

    if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
        $__(, nondefaultSetInBuilder, v);
        __ln();
        __out("    ");
        $__(, mandatorySetInBuilder, v);
        __ln();
        __out("    return ");
        __dl();
        __out("  ");
        __dl();
        __out("this");
        __dl();
    }

    __out(";"),ln();
    __out("  ");
    __dl();__out(""");

    if ($if(type.isGenerateClearBuilder())) {
        __dl();__ln();
        __out("  */");
        __dl();__it2.index++; 
        __out("  ");
        __dl();__ln();
        __out("  ");
        __dl();
        if ($if($(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue"))) {
            __dl();__out("(@com.google.errorprone.annotations.CanIgnoreReturnValue )");
            __dl();
        }
    }

    if ($if(s_atCanIgnoreReturnValue_1431153190, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue")) {
        __dl();__out("( )");
    }
```java
    public final org.immutables.value.processor.meta.ValueType type_builderReturnType_1031721330 = $cast(type);
    __dl();
    if ($if(type_builderReturnType_1031721330.getInnerBuilder().isExtending)) {
        __dl();$(__, type_builderReturnType_1031721330.typeBuilder());
    } else {
        __dl();$(__, type_builderReturnType_1031721330.typeBuilder().simple());
        $(___.type_builderReturnType_1031721330.generics().args());
    }
    __dl();
    __out(" ");
    $(___.type.names().clear());
    __out("() { ").ln();
    __out(" ");
    {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.LongBits.LongSet l : $in(positions.longs())) {
        __dl();__.ln();
        __out(" ");
        $(___.disambiguateField, type, "initBits");
        $(___.emptyIfZero, l.index);
        __out(" = ");
        __out(" ");
        __dl();__it2.index++;
        _it2.first = false;
    }
    __dl();__.ln();
    __out(" ");
    }
    ___.type.names().clear();
    __out(" ");
    {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.LongBits.LongSet l : $in(nondefaultsPositions.longs())) {
        __dl();__.ln();
        __out(" ");
        $(___.disambiguateField, type, "optBits");
        $(___.emptyIfZero, l.index);
        __out(" = 0 ");
        __out(" ");
        __dl();__it2.index++;
        _it2.first = false;
    }
    }
```

{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(setters)) {
  __dl();__ln();
  __out("  ");
  if ($if($v.isContainerType(), and, $v.isGenerateJdkOnly(), and, $v.isNullableCollector(), andnot, v.isNullable())) {
    __dl();__dl();__ln();
    __out("    ");
    ((___. v.name());
    __out(" != null ") ___.ln();
    __out("    ");
    ((___. v.name());
    __out("  ");
    ((___. defineOrResetBuildingFieldAlt, v, $false, v.isNullableCollector());
    __ln();
    __out("  ");
  }
  else {
    __dl();__ln();
    __out("    ");
    ((___. defineOrResetBuildingFieldAlt, v, $false, v.isNullableCollector());
    __ln();
    __out("    ");
  }
  __dl();__ln();
  __out("  ");
  __dl();__it2.index++;
  _it2.first = false;
}
__dl();__ln();
__out("  ");
{final org.immutables.value.processor.meta.ValueType type_builderReturnThis_1267082624 = $cast(type);
  __dl();
  if ($if(type_builderReturnThis_1267082624.getInnerBuilder().isExtending)) {
    __dl();__out("(");
    ((___. type_builderReturnThis_1267082624.typeBuilder());
    __out("  ");
  }
  __dl();__out("this");
}
__out(";").ln();
__out("  ");.ln();
if ($if(type.throwing)) {
    __out(" public ");
    __outType();
    __out(" ");
    __output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __out("(").ln();
            __out(" throws ");
            {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
             for (final java.lang.String t : __in(type.throwing)) {
                __out(" , ");
                __out(t);
                _it2.index++;
                _it2.first = false;
            }
            __out(" { ");
            __ln();
        }
    });
    __ln();
} else {
    __out(" public ");
    __outType();
    __out(" ");
    __out(" () { ").ln();
}

if ($if(positions.longs())) {
    __out(" ");
    __ln();
    if ($if(type.isUseCompactBuilder())) {
        __out(" if ( ");
        {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
         for (final java.lang.String t : __in(type.throwing)) {
            __out(" , ");
            __out(t);
            _it2.index++;
            _it2.first = false;
        }
        __out(" { ");
        __ln();
    }
for (final org.immutables.value.processor.meta.LongBits.LongSet l : $in(positions.longs())) {
    __.dl();___.dl();
    if ($if($(not, _it2.first))) {
        __.dl();__.out(" || ");
    }
    __.dl();___.dl();__$_.disambiguateField, type, "initBits");
    $(_, emptyIfZero, l.index);
    ___.dl();" != 0";
    ___.dl();_it2.index++;
    _it2.first = false;
} }
___.dl();___.out(" ").ln();
__.out(" throw new java.lang.IllegalStateException(formatRequiredAttributesMessage());").ln();
___.out(" ").ln();
___.out(" ");
} else {
    __.dl();__.ln();
    ___.out(" checkRequiredAttributes();").ln();
    ___.out(" ");
}
___.dl();__.ln();
___.out(" ");
___.dl();___.ln();
$(_, builderReturnValue, type);
___.ln();
___.out(" ").ln();
___.out(" ");
___.dl();
if ($if(type.isGenerateCanBuild()) {
    __.dl();__.ln();
    ___.ln();
    ___.out(" /**/").ln();
    ___.out(" * If all required attributes are set and calling { @link #");
    $(_.type.names().build);
    ___.out("()");
    ___.out(" * will return an instance and will not throw {@code IllegalStateException};").ln();
    ___.out(" * @return {@code true} if all mandatory attributes are initialized");
    ___.out(" */").ln();
    ___.out(" public boolean ");
    $(_, type.names().canBuild());
    ___.out(" () ").ln();
    ___.out(" ");
}
```java
if ($if(positions.longs())) {

    return {
        final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
        for (final org.immutables.value.processor.meta.LongBits.LongSet l : $in(positions.longs())) {

            if ($if($(not, _it2.first))) {
                $(__, disambiguateField, type, "initBits");
                $((__, emptyIfZero, l.index));
                _out(" == 0");
                _it2.index++;
                _it2.first = false;
            }

            _out(" && ");
            $(__, emptyIfZero, l.index);
            _it2.index++;
            _it2.first = false;
        }

            _out(";");
        } else {
            _out(" return true;");
            _out(" ");

            if ($if(type.isGenerateBuildOrThrow())) {
                _out(" ");
                if ($if($(classpath.isJava8(), ornot, type.isGenerateJdkOnly()))) {
                    _out(" /**");
                    _out(" ");
                }

                if ($if(type.kind().isFactory())) {
                    _out(" * Invokes {code ");
                    $(__, type.factoryOf());
                }
            }
        }
    }
}
```
__out("(...)} using the collected parameters and returns the result of the invocation").ln();
__out(" * @param <BOT> exception type").ln();
__out(" * @param exceptionSupplier used to create new exception from supplied error message").ln();
__out(" * @return A result of type { @code ");
$(__, type.typeValue());
__out(" }").ln();
__out(" ");

{else {
__dl();__ln();
__out(" * Builds a new { @link ");
$___. type.typeValue().relativeRaw();
__out(" ");
$___. type.typeValue().simple();
__out(" ").ln();
__out(" * @param <BOT> exception type").ln();
__out(" * @param exceptionSupplier used to create new exception from supplied error message").ln();
__out(" * @return An immutable instance of ");
$(__, type.name());
__ln();
__out(" ");

}__dl();__ln();
__out(" * @throws BOT The supplied exception { @code BOT } if any required attributes are missing").ln();
__out(" */").ln();
__out(" public <BOT extends Exception> ");
__dl();
if ($if(type.constitution.isSimple())) {
__dl();$___. type.typeValue().simple();
$___. type.generics().args();

} else {
__dl();$___. type.typeValue();

}
__dl();__out(" ");
$___. type.names().buildOrThrow();
__out("(");
{__dl();
if ($if(classpath.isJava8())) {
__dl();__out("java.util.function.Function");

} else {
__dl();$___. guava;
__out("base.Function");

}
__dl();
__out("<String, BOT> exceptionSupplier)").ln();
__out(" throws BOT");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final java.lang.String t : $in(type.throwing)) {
__dl();__out(", ");
$__();_it2.index++; _it2.first = false;
}
__dl();__out(" {").ln();
__out(" ");
__dl();
if ($if(positions.longs())) {
__dl();__ln();
__out(" checkRequiredAttributesOrThrow(exceptionSupplier);").ln();
__out(" ");
}
__dl();__ln();
__out(" ");
$__();__ln();
__out(" ");
$__();__ln();
__out(" ");

__dl();__ln();
__out(" ");
$__();__ln();
__out(" ");
__dl();__ln();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute p : $in(nondefaults)) {
final org.immutables.value.processor.meta.LongBits.BitPosition pos = $cast($in(nondefaultsPositions, p));
__dl();__ln();
__out(" ");
$__();
__out(" private boolean ");
$__();__out(" .ln()");
__out(" return ");
$__();
__out(" OPT_BIT_");
$__();
__out(" .ln()");
__out(" ");
}
if ($(not, type.isUseCompactBuilder())) {
    final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute m : $in(mandatories)) {
        final org.immutables.value.processor.meta.LongBits.BitPosition pos = $cast($(positions, m));
        ___out(" private boolean ");
        $(__, m.names.isSet());
        ___out(" ()");
        ___out(" return ");
        $(__, disambiguateField, type, "initBits");
        $(__, emptyIfZero, pos.index);
        ___out(" & INIT_BIT_");
        $(__, toConstant, m.name());
        ___out(" == 0;");
        ___out(" }\\n        ___out(" ");
        ___dl();_it2.index++;
        _it2.first = false;
    }
    ___dl();___ln();
    ___out(" ");
    ___dl();
}

if ($(type.isUseStrictBuilder(), and, $(nondefaultsPositions.longs(), or, positions.longs()))) {
    ___out(" private static void checkNotIsSet(boolean isSet, String name) ");
    ___out(" if (isSet) throw new java.lang.IllegalStateException("Builder of ");
    $(__, type.name());
    ___out(" is strict, attribute is already set: ");
    ___out(" }\\n    ___out(" ");
}

___dl();___ln();
___out(" ");
___dl();

if ($(positions.longs())) {
    ___out(" ");
    ___dl();
}

if ($(positions.longs())) {
    ___out(" ");
    ___dl();
}
private void checkRequiredAttributes() {
    __().checkRequiredOrThrow(type, positions, $false);
}

if ($if(type.isGenerateBuildOrThrow)) {
    __().checkRequiredOrThrow(type, positions, $false);
    __().dl();
    if ($if(type.isGenerateBuildOrThrow)) {
        __().dl();
        __().out(" ");
        __().dl();
        if ($if(classpath.isJava8(), ornot, type.isGenerateJdkOnly)) {
            __().dl();
            __().out(" ");
            __().dl();
            __().out(" private <T extends Exception> void checkRequiredAttributesOrThrow(");
            __().dl();
            if ($if(classpath.isJava8())) {
                __().dl();
                __().out("java.util.function.Function");
            } else {
                __().dl();
                __().out("guava");
                __().out("base.Function");
            }
        } else {
            __().dl();
            __().out("javassist.");
            __().out("Exception");
        }
    }
    __().dl();
}

<T extends Exception> void checkRequiredAttributesOrThrow(
    <T extends Exception> void checkRequiredAttributesOrThrow(");
    __().dl();
    __().out(" ");
    __().dl();
    __().out(" ");
    __().dl();
    __().out(" ");
    __().dl();
    __().out(" ");
    __().dl();
    __().out(" ");
    __().dl();
    __().out(" ");
}
if ($if(positions.longs())) {
    __dl();__ln();
    __out("  ");
}
}

if ($if(type.getThrowForInvalidImmutableState().hasAttributeNamesConstructor)) {
    __dl();__ln();
    __ln();
    __out("  private String");
    $("[");
    __out(" missingRequiredAttributesNames() {".ln();
    __out("    String");
    $("[");
    __out(" attributes = new String");
    $("[");
    $( mandates.size());
    $( "");
    __out(";").ln();
    __out(" ");
    final org.immutables.value.processor.meta.HasStyleInfo s_atVar_1287436599 = $cast(type);
    __dl();
    if ($if($s_atVar_1287436599, allowsClasspathAnnotation, "com.google.errorprone.annotations.Var")) {
        __dl();__out("@com.google.errorprone.annotations.Var ");
    }
}

}
try {
  final org.immutables.generator.Templates.Iteration _it2 = new
  org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute m : $in(mandatories)) {
    if (!$(__, m.names.isSet())) attributes = "{\c++\} = \"\";}
  return java.util.Arrays.copyOf(attributes, c);}
} else {
  for (final org.immutables.value.processor.meta.ValueAttribute m : $in(mandatories)) {
    if (!$(__, m.names.isSet())) attributes = "{\c++\} = \"\";}
    return java.util.Arrays.copyOf(attributes, c);}
}

if ($if($(type.isGenerateBuildOrThrow(), ornot,
type.getThrowForInvalidImmutableState().hasAttributeNamesConstructor))) {
  private String formatRequiredAttributesMessage() {
    return java.util.Arrays.copyOf(attributes, c);)
}
null
__out(" return "Cannot build ");
$___.type.name();
__out("", some of required attributes are not set " + attributes;").ln();
__out(" ");
__out(" ");
}
__dl();__ln();
__out(" ");
$___.rr.builderHelperMethods(), setters);
__ln();
__dl();
if ($if(type.constitution.hasImmutableInBuilder())) {
  __dl();__ln();
  __out(" ");
  $___.generateImmutable, type, $$false);
  __ln();
  __out(" ");
  __dl();
  if ($if(type.isGenerateWithInterface())) {
    __dl();__ln();
    __out(" ");
    $___.generateWithInterface, type, $$false);
    __ln();
    __out(" ");
  }
  __dl();__ln();
  __dl();
  if ($if(topLevel)) {
    __dl();__ln();
    __out(" ");
    $___.objectsUtility, type);
    __ln();
  }
  __dl();__ln();
  __dl();
  if ($if($topLevel, and, $(type.isGenerateJdkOnly(), and, type.isUseCollectionUtility()))) {
    __dl();__ln();
    __out(" ");
$(__, collectionUtility, type);
__ln();
}
__dl();__ln();
__dl();
if ($if(type.detectAttributeBuilders())) {
__dl();__ln();
__out(" ");
$(__, attributeBuilderTransformUtilities, type);
__ln();
}
__dl();__ln();
__out(" ");ln();
__dl();
if ($if($(type.getTelescopicBuild(), andnot, topLevel))) {
__dl();__ln();
$(__, generateTelescopicBuilderInterfaces, type);
__ln();
}
__dl();__ln();
__dl();_it1.index++;
_it1.first = false;
}
__dl();__ln();
__dl();
org.immutables.generator.Templates.Invokable builderReturnValue() { return builderReturnValue; }
private final org.immutables.generator.Templates.Invokable builderReturnValue = new FragmentDispatch(1, 19);
void _r19__builderReturnValue(org.immutables.generator.Templates.Invokation __) {
__dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
__ln();
__dl();
if ($if(type.kind().isFactory())) {
__dl();__ln();
$___.returnFactoryBuild, type);
__ln();
} else if ($if($((type.isUseSingleton(), andnot, type.getSettableAttributes())))) {
__dl();__ln();
__out("return ");
$___.factoryInstance().relative());
__out("(");ln();
} else if ($if(type.isGenerateBuilderUseCopyConstructor())) {
__dl();__ln();
$___.generateReturnBuilderConstructed, type);
```java
__.ln();

} else {
    __.dl();__.ln();
    __.out("return ");
    {final org.immutables.value.processor.meta.ValueType type_validated_1881291508 = $cast(type);
        final java.lang.Boolean qualified_validated_1881291508 = $cast($true);
        final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = new org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
                __.dl();final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = this;
                __.out("new ");
                $(__, type.typeImmutable().relative());
                __.out("(this)");
                __.dl();
            }
        });__.dl();__.dl();
        if ($if(type_validated_1881291508.isUseValidation())) {
            __.dl();__.dl();
            if ($if(qualified_validated_1881291508)) {
                $__(__, type_validated_1881291508.typeImmutable().relativeRaw());
                __.out(".");
            }
            __.dl();__.out("validate(");
            $(__, expression_validated_1881291508);
            __.out(")");
        } else {
            __.dl();$(__, expression_validated_1881291508);
        }
    __.dl();
}
__.dl();__.out(";").ln();
__.dl();__.ln();
}
org.immutables.generator.Templates.Invokable checkRequiredOrThrow() { return checkRequiredOrThrow; }
private final org.immutables.generator.Templates.Invokable checkRequiredOrThrow = new FragmentDispatch(3,
20);
void _t20__checkRequiredOrThrow(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    final org.immutables.value.processor.meta.LongBits.LongPositions positions = $cast(__.param(1));
    final java.lang.Boolean useSupplier = $if(__.param(2));
    __.ln();
}
```
if (") {
  final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.LongBits.LongSet l : $in(positions.longs())) {
    if ($if($not, _it1.first)) {
      __.dl();__out(" || ");
    }
    __.dl();$(__, disambiguateField, type, "initBits");
    $(__, emptyIfZero, l.index);
    __out(" != 0");
    __.dl();_it1.index++;
    _it1.first = false;
  }
  __.dl();__out(" ").ln();
  __.dl();
  if ($if(useSupplier)) {
    __.dl();__ln();
    __out(" throw exceptionSupplier.apply(formatRequiredAttributesMessage());");
  } else if ($if(type.getThrowForInvalidImmutableState().hasAttributeNamesConstructor)) {
    __.dl();__ln();
    __out(" throw new ");
    $(__, type.getThrowForInvalidImmutableState());
    __out("(missingRequiredAttributesNames());");
  } else {
    __.dl();__ln();
    __out(" throw new ");
    $(__, type.getThrowForInvalidImmutableState());
    __out("(formatRequiredAttributesMessage());");
  }
  __.dl();__ln();
  __.dl();
}

org.immutables.generator.Templates.Invokable buildFromAttributeNullableSupertype() { return buildFromAttributeNullableSupertype; }
private final org.immutables.generator.Templates.Invokable buildFromAttributeNullableSupertype = new FragmentDispatch(1, 21);
void __21__buildFromAttributeNullableSupertype(org.immutables.generator.Templates.Invokation __) {
  final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
  __.ln();
```java
__dl();
if ($if(v.isEncoding())) {
  __dl();__ln();
$(__, v.atNullableInSupertypeLocal());
$(__, v.getType());
__out(" ");
$(__, v.name());
__out("Value = instance.");
$(__, v.names.get);__out(";").ln();
__out("if ");
$(__, v.name());
__out("Value != null ").ln();
__out(" ");
$(__, rr.builderCopyFrom(), v);__out(" ");
$(__, v.name());
__out("Value = instance.");
$(__, v.names.get);__out(";").ln();
__out("if ");
$(__, v.name());
__out("Value != null ").ln();
__out(" ");
$(__, v.name());__out(" ");
} else if ($if(v.isCollectionType())) {
  __dl();__ln();
$(__, v.atNullableInSupertypeLocal());
$(__, v.getType());
__out(" ");
$(__, v.name());
__out("Value = instance.");
$(__, v.names.get);__out(";").ln();
__out("if ");
$(__, v.name());
__out("Value != null ").ln();
__out(" ");
$(__, v.names.addAll());__out(" ");
$(__, v.name());
__out("Value = instance.");
$(__, v.names.get);__out(";").ln();
__out("if ");
$(__, v.name());
__out("Value != null ").ln();
__out(" ");
$(__, v.name());__out(" ");
} else if ($if(v.isMapType())) {
  __dl();__ln();
$(__, v.atNullableInSupertypeLocal());
$(__, v.getType());
__out(" ");
$(__, v.name());
__out("Value = instance.");
$(__, v.names.get);__out(";").ln();
__out("if ");
$(__, v.name());
__out("Value != null ").ln();
__out(" ");
$(__, v.names.addAll());__out(" ");
$(__, v.name());
__out("Value = instance.");
$(__, v.names.get);__out(";").ln();
__out("if ");
$(__, v.name());
```
org.immutables.generator.Templates.Invokable buildFromAttribute() { return buildFromAttribute; }
private final org.immutables.generator.Templates.Invokable buildFromAttribute = new FragmentDispatch(1, 22);
void _t22__buildFromAttribute(org.immutables.generator.Templates.Invokation __) {
  final org.immutables.value.processor.meta.ValueAttribute v = __cast(__.param(0));
  __ln();
  __out("\n");
  if ($if(v.isEncoding())) {
    __ln();
    __out("(instance.");
  } else if ($if(v.isCollectionType())) {
    __ln();
    __out("\n");
  } else if ($if(v.isNullable())) {
    __ln();
    __out("\n");
  } else if ($if(v.isNonNull())) {
    __ln();
    __out("\n");
  }
}

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$.out(" ");
$.out(v.names.addAll());
$.out("(");
$.out("Value"):ln();
$.out(" ");
$.out(" ");

} else {
  $.dl();$.ln();
  $.out(v.names.addAll());
  $.out("instance.");
  $.out(" ");
  $.dl();
  if ($if(v.isNullable())) {
    $.dl();$.ln();
    $.atNullabilityLocal();
    $.getType();
    $.out(" ");
    $.name();
    $.out("Value = instance.");
    $.names.get();
    $.out(" ");
    $.out("if ( ");
    $.out("Value != null) { ");
    $.out(" ");
    $.names.putAll();
    $.out(" ");
    $.out(" ");
    $.out(" ");
    $.out(" }");
    $.out(" ");
    $.names.putAll();
    $.out(" ");
    $.out(" ");
    $.out(" ");
  } else {
    $.dl();$.ln();
    $.names.putAll();
    $.out("instance.");
    $.names.get();

  }
  $.dl();$.ln();
  $.out(" ");
} else if ($if(v.isMapType())) {
  $.dl();$.ln();
  $.out(" ");
  $.dl();
  if ($if(v.isNullable())) {
    $.dl();$.ln();
    $.atNullabilityLocal();
    $.getType();
    $.out(" ");
    $.name();
    $.out("Value = instance.");
    $.names.get();
    $.out(" ");
    $.out("if ( ");
    $.out("Value != null) { ");
    $.out(" ");
    $.names.putAll();
    $.out(" ");
    $.out(" ");
    $.out(" ");
  } else {
    $.dl();$.ln();
    $.names.putAll();
    $.out("instance.");
    $.names.get();

  }
\$(__, v.name());
__out("Value != null) {".ln();
__out(" ");
\$(__, v.names.init);
__out("(");
\$(__, v.name());
__out("Value);").ln();
__out(" ").ln();
__out(" ");
}
else {
__dl();__ln();
$(__, v.names.init);
__out("(instance.");
$(__, v.names.get);
__out("();").ln();
__out(" ");
}
__dl();__ln();
__dl();
};

org.immutables.generator.Templates.Invokable returnFactoryBuild() { return returnFactoryBuild; }
private final org.immutables.generator.Templates.Invokable returnFactoryBuild = new FragmentDispatch(1, 23);
void _t23__returnFactoryBuild(org.immutables.generator.Templates.Invokation __) {
__dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
__ln();
__out("return ");
$(__, type.factoryOf());
__out("()");
$(__, output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
__dl();final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
__dl();__dl();
if ($if($(!v.first))) {
__dl();__out(",").ln();
__out(" ");
}
__dl();$(__, valueFromBuilder, v, "");
__dl();_it1.index++;
_it1.first = false;
}
__dl();__dl();
});
org.immutables.generator.Templates.Invokable valueFromSuper() { return valueFromSuper; }
private final org.immutables.generator.Templates.Invokable valueFromSuper = new FragmentDispatch(2, 24);
void _t24__valueFromSuper(org.immutables.generator.Templates.Invokation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
  final java.lang.String expression = __.param(1).toString();
  __.dl();
  if ($if(v.isGuavaImmutableDeclared())) {
    __.dl();___.dl();
    if ($if(!$not, v.isNullable())) {
      __.dl();$___.requireNonNull, v.containingType;
      __.out("(");
     $___.expression);
      __.out(", ");
      $___.v.name();
      __.out(")");
    } else {
      __.dl();$___.expression);
      }
      __.dl();
    } else {
      __.dl();$___.valueFromValue, v, expression);
      }
      __.dl();___.dl();
};

org.immutables.generator.Templates.Invokable maybeToBuilder() { return maybeToBuilder; }
private final org.immutables.generator.Templates.Invokable maybeToBuilder = new FragmentDispatch(2, 25);
void _t25__maybeToBuilder(org.immutables.generator.Templates.Invokation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
  final java.lang.String expression = __.param(1).toString();
  __.dl();
  if ($if(v.isAttributeBuilder())) {
    __.dl();{final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_valueToBuilder_1442539515 =
      $cast(v.getAttributeBuilderDescriptor());
      final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 =
      new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
          __.dl();final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_valueToBuilder_1442539515 =
          $cast(v.getAttributeBuilderDescriptor());
          final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 =
          new org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
              __.dl();final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 =
              this;
              $___.expression);
              __.dl();
            }));___.dl();___.dl();
        }
      });
    __.dl();___.dl();
  } else {
    __.dl();$___.expression);
    }
    __.dl();
  } else {
    __.dl();$___.valueFromValue, v, expression);
    }
    __.dl();___.dl();
};
if ($if(n_valueToBuilder_1442539515.isCopyMethodOnValueInstance())) {
    __dl();$___.expression_valueToBuilder_1442539515;
    __out(".");
    ${___. n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod()};
    __out("(");
} else {
    __dl();$___. n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod();
    __out("(");
    ${___. expression_valueToBuilder_1442539515};
    __out(")");
}
__dl();
}

} else {
    __dl();$___. expression;
}
__dl();___.dl();
}

org.immutables.generator.Templates.Invokable valueToBuilder() { return valueToBuilder; }
private final org.immutables.generator.Templates.Invokable valueToBuilder = new FragmentDispatch(2, 26);
void _t26__valueToBuilder(org.immutables.generator.Templates.Invokation __) {
    __dl();final org.immutables.value.processor.meta.AttributeBuilderDescriptor n = $cast(___.param(0));
    final java.lang.String expression = ___.param(1).toString();
    __dl();
    if ($if(n.isCopyMethodOnValueInstance())) {
        __dl();$___. expression;
        __out(".");
        ${___. n.getQualifiedValueToBuilderMethod()};
        __out("(");
    } else {
        __dl();$___. n.getQualifiedValueToBuilderMethod();
        __out("(");
        ${___. expression};
        __out(")");
    }
    __dl();___.dl();
}

org.immutables.generator.Templates.Invokable valueFrom() { return valueFrom; }
private final org.immutables.generator.Templates.Invokable valueFrom = new FragmentDispatch(4, 27);
void _t27__valueFrom(org.immutables.generator.Templates.Invokation __) {
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```java
__.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(1));
final java.lang.String expression = __.param(2).toString();
final java.lang.Boolean withoutOptional = $if(__.param(3));
$(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();__ln();
        __out(" ");
        __dl();
        if ($if(withoutOptional)) {
            __.dl();__ln();
            __out(" ");
            $(__, valueFromValueNoOptional, type, v, expression);
            __ln();
            __out(" ");
        } else {
            __.dl();__ln();
            __out(" ");
            $(__, valueFromValue, v, expression);
            __ln();
            __out(" ");
        }
        __.dl();__ln();
        __dl();
    });
    __.dl();
});
org.immutables.generator.Templates.Invokable valueFromValue() { return valueFromValue; }
private final org.immutables.generator.Templates.Invokable valueFromValue = new FragmentDispatch(2, 28);
void t28__valueFromValue(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
    final java.lang.String expression = __.param(1).toString();
    $(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();__ln();
            __out(" ");
            __dl();
            if ($if(v.isEncoding())) {
                __.dl();__ln();
                __out(" ");
                $(__, rr.from(), v, expression);
                __ln();
                __out(" ");
            } else if ($if(v.isJdkOptional())) {
                __.dl();__ln();
                __out(" ");
            }
        }
    });
    __.dl();
});
```
if ($if(v.isJdkSpecializedOptional())) {
    __dl();$___.expression;
    __out(".isPresent() ? ");
    $___.expression;
    __out(".getAs");
    $___.toUpperCase, v.getUnwrappedElementType();
    __out("() : null");
}
else {
    __dl();$___.maybeCopyOf, v, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __dl();$___.expression;
            __out(".orElse(null)");
            __dl();}
    });
}
__dl();___.ln();
} else if ($if(v.isOptionalType())) {
    __dl();___.ln();
    __out(" ");
    __dl();

    if ($if($(v.getConsumedElementType(), ne, v.getWrappedElementType()))) {
        __dl();___.out("(");
        ___.out(v.getUnwrappedElementType());
        ___.out(" ");
        ___.dl();
    }
}
__dl();___.ln();
} else if ($if(v.isArrayType())) {
    __dl();___.ln();
    __out(" ");
    __dl();

    if ($if(v.isNullable())) {
        __dl();___.expression;
    } else {
        __dl();___.expression;
        __.out(" .clone()");
        ___.dl();
    }
} else if ($if(v.isAttributeValueKindCopy())) {
    __dl();___.ln();
    
    if ($if(v.isNullable())) {
        __dl();___.expression;
    } else {
        __dl();___.expression;
        __.out(" .clone()");
        ___.dl();
    }
} else {
    __dl();___.expression;
    __.out(" .clone()");
}
```java
org.immutables.generator.Templates.Invokable valueFromValueNoOptional() { return valueFromValueNoOptional;
}
private final org.immutables.generator.Templates.Invokable valueFromValueNoOptional = new FragmentDispatch(3, 29);
void _t29__valueFromValueNoOptional(org.immutables.generator.Templates.Invocation __) {

```
final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(1));
final java.lang.String expression = __.param(2).toString();
$(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {

@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __.dl();___.ln();
  __.dl();
  if ($if(v.isEncoding())) {
    __.dl();__.ln();
    __.dl();
    ___.out($"\n ");
    $(__, valueFromValue, v, expression);
    __.ln();
  } else if ($if($v.isTrueJdkOptional(), and, $(v.isJdkSpecializedOptional(), or, v.isOptionalAcceptNullable()))) {
    __.dl();___.ln();
    __.dl();
    $(__, maybeCopyOf, v, new org.immutables.generator.Templates.Fragment(0) {
      @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();$___.expression;
        __.dl();
      } });
    __.ln();
  } else if ($if(v.isJdkOptional())) {
    __.dl();___.ln();
    $(__, maybeCopyOf, v, new org.immutables.generator.Templates.Fragment(0) {
      @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();$___.expression);
        __.dl();
      } });
    __.ln();
  } else if ($if(v.isOptionalType())) {
    __.dl();___.ln();
    $(__, optionalOf, v);
    __.out("(");
    $(__, expression);
    __.out(",");
    $(__, expression);
    __.out(")\n ");
    __.dl();
  } else {
    __.dl();___.ln();
    __.dl();
    $(__, valueFromValue, v, expression);
    __.ln();
  }
})

}
org.immutables.generator.Templates.Invokable deepCopyOf() { return deepCopyOf; }
private final org.immutables.generator.Templates.Invokable deepCopyOf = new FragmentDispatch(2, 30);
void _t30__deepCopyOf(org.immutables.generator.Templates.Invokation __) { 
  __dl();final org.immutables.value.processor.meta.ValueAttribute v = __cast(__param(0));
  final java.lang.String expression = __param(1).toString();
  __dl();
  if ($if(v.isAttributeBuilder())) {
    __dl();final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_convertToValueType_1028768993 = __cast(v.getAttributeBuilderDescriptor());
    __out("convertToValueType");
    #__ convictionsType_1028768993 = __cast(n_convertToValueType_1028768993.getQualifiedValueTypeNameWithUnderscores());
  }
  __out("(");
  #__ expression;
  __out(")");
} else {
  __dl();$(__, v.attributeValueType.factoryCopyOf());
  __out("(");
  #__ expression;
  __out(")");
}
__dl();__dl();
}
org.immutables.generator.Templates.Invokable valueFromBuilder() { return valueFromBuilder; }
private final org.immutables.generator.Templates.Invokable valueFromBuilder = new FragmentDispatch(2, 31);
void _t31__valueFromBuilder(org.immutables.generator.Templates.Invokation __) { 
  __dl();final org.immutables.value.processor.meta.ValueAttribute v = __cast(__param(0));
  final java.lang.String expressionPrefix = __param(1).toString();
  #__ valueFromBuilderAlt, v, $$$true, expressionPrefix);
  __dl();
};
org.immutables.generator.Templates.Invokable valueFromBuilderAlt() { return valueFromBuilderAlt; }
private final org.immutables.generator.Templates.Invokable valueFromBuilderAlt = new FragmentDispatch(3, 32);
void _t32__valueFromBuilderAlt(org.immutables.generator.Templates.Invokation __) { 
  __dl();final org.immutables.value.processor.meta.ValueAttribute v = __cast(__param(0));
final java.lang.Boolean mayBeNull = $if(__.param(1));
final java.lang.String expressionPrefix = __.param(2).toString();
$(__, output.trim, new org.immutables.generator.Templates.Fragment(0)) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __.dl();__ln();
  __.dl();
  if ($if(v.isEncoding())) {
    __.dl();__ln();
    __.out(" ");
    __(, expressionPrefix);
    $(__, rr.fromBuild(), v);
    __.ln();
  } else if ($if(v.isTrueAttributeValueKindCopy())) {
    __.dl();__ln();
    __.out(" ");
    __.dl();
    if ($if(v.isTrueNullable())) {
      __.dl();__ln();
      __.out(" ");
      $(__, expressionPrefix);
      $(__, rr.fromBuild(), v);
      __.ln();
    }
  }
}
$___.deepCopyOf, v, new org.immutables.generator.Templates.Fragment(0)) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __.dl();$(__, expressionPrefix);
  $(__, v.name());
  __.dl();
}};
___.ln();
} else if ($if($v.isTrueCollectionType(), or, v.isTrueMapType())) {
  __.dl();__ln();
  __.out(" ");
  __.dl();
  if ($if($v.isTrueNullable()) {
    __.dl();__ln();
    __.out(" ");
    $(__, expressionPrefix);
    __.ln();
    __.out(" == null ? null : ");
    $(__, immutableCollectionBuild, v, $(expressionPrefix, v.name()));
    __.ln();
    __.out(" ");
  }) else if ($if($v.isTrueNullableCollector(), and, mayBeNull)) {
    __.dl();__ln();
    __.out(" ");
    $(__, expressionPrefix);
    $(__, v.name());
    __.out(" == null ? ");
} else if ($if($v.isTrueNullableCollector(), and, mayBeNull)) {
  __.dl();__ln();
  __.out(" ");
  $(__, expressionPrefix);
  $(__, v.name());
  __.out(" == null ? ");
$(__, emptyImmutableInstance, v, v.getGenericArgs());
  __out(" : ");
$(__, immutableCollectionBuild, v, $(expressionPrefix, v.name()));
  __ln();
  __out(" ");
}

 else {
  __dl();__ln();
  __out(" ");
  $(___.immutableCollectionBuild, v, $(expressionPrefix, v.name()));
  __ln();
  __out(" ");
}

__dl();__ln();
} else if ($if(v.isAttributeBuilder())) {
  __dl();__ln();
  __out(" ");
$(__.convertToValueType, v.getAttributeBuilderDescriptor());
  __out("(");
$(___.expressionPrefix);
$(___.v.name());
  __out(")").ln();
}

 else {
  __dl();__ln();
  __out(" ");
  $(___.expressionPrefix);
$(___.v.name());
  __ln();
}

__dl();__ln();
}__);
__dl();
}

private final org.immutables.generator.Templates.Invokable emptyImmutableInstance = new FragmentDispatch(2, 33);

void _t33__emptyImmutableInstance(org.immutables.generator.Templates.Invokation __) {
  __dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
final java.lang.String genericArgsOrEmpty = __.param(1).toString();
$(___.output.trim, new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __dl();__ln();
    __dl();
  }
});

org.immutables.generator.Templates.Invokable emptyImmutableInstance() { return emptyImmutableInstance; }
if ($if(v.isEncoding())) {
  _.dl(); _.ln();
  $.(__, rr.defaultValue(), v);
  _.ln();
} else if ($if($if(v.isJdkOptional(), or, v.isNullable()))) {
  _.dl(); _.ln();
  _.out("null").ln();
} else if ($if(v.isOptionalType())) {
  _.dl(); _.ln();
  _.out("\n");
  $.(__, optionalEmpty, v);
  _.ln();
} else if ($if(v.isMapType())) {
  _.dl(); _.ln();
  _.out("\n");
  _.dl();
  if ($if(v.isGenerateJdkOnly())) {
    _.dl(); _.ln();
    _.out("\n");
    _.dl();
    if ($if(v.typeKind().isSortedMap())) {
      _.dl(); _.ln();
      _.out("\n");
      $.(__, immutableCollectionCopyOfSafe, v, $$false, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
          _.dl(); _.out("java.util.Collections.");
          $.(__, v.getGenericArgs());
          _.out("emptyMap()".ln();
          _.dl();
        });
      }));
      _.ln();
      _.out("\n");
    } else {
      _.dl();_.ln();
      _.out("\njava.util.Collections.");
      $.(__, genericArgsOrEmpty);_.out("emptyMap()".ln();
      _.out("\n");
    }
  } else {
    _.dl(); _.ln();
    _.out("\njava.util.Collections.");
    $.(__, genericArgsOrEmpty);_.out("emptyMap()".ln();
    _.out("\n");
  }
} else {
  _.dl(); _.ln();
  _.out("\n");
} else {
  _.dl(); _.ln();
  _.out("\n");
$(__, guava);
$___.out("collect.Immutable");
$(__, v.getRawMapType());
$___.out(".");
$(__, genericArgsOrEmpty);
$___.out("of()").ln();
$___.out(" ");
}
$___.dl();___.ln();
} else if ($if(v.isCollectionType())) {
$___.dl();___.ln();
$___.out(" ");
$___.dl();
if ($if(v.isGenerateOrdinalValueSet())) {
$___.dl();___.ln();
$___.out(" org.immutables.ordinal.ImmutableOrdinalSet.");
$(__, genericArgsOrEmpty);
$___.out("of()").ln();
$___.out(" ");
} else if ($if(v.isGenerateJdkOnly())) {
$___.dl();___.ln();
$___.out(" ");
$___.dl();
if ($if(v.typeKind().isSortedSet())) {
$___.dl();___.ln();
$___.out(" ");
$(__, immutableCollectionCopyOfSafe, v, $$false, new org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
$___.dl();__.out("java.util.Collections.");
$(__, v.getGenericArgs());
$___.out("emptyList()");
$___.dl();
});
__.ln();
__.out(" ");
}
} else {
$___.dl();___.ln();
$___.out(" java.util.Collections.");
$(__, genericArgsOrEmpty);
$___.out("empty");
$(__, v.getRawCollectionType());
$___.out("()").ln();
$___.out(" ");
}
$___.dl();___.ln();
else if ($if(v.isCustomCollectionType())) {
    __.dl(); __.ln();
    __.out("\n");
    __.out(v.getRawType());
    __.out("\n");
    __.out(genericArgsOrEmpty);
    __.out("of\n");
    __.out("\n");
}
else {
    __.dl(); __.ln();
    __.out("\n");
    __.out(guava);
    __.out("\n");
    __.out(collect.Immutable\n");
    __.out(v.getRawCollectionType());
    __.out("\n");
    __.out(genericArgsOrEmpty);
    __.out("of\n");
    __.out("\n");
}
__.dl(); __.ln();
}
else {
    __.dl(); __.ln();
    __.out("null\n");
    __.out("\n");
    __.out(output.error, v.originalTypeElement(), new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl(); __.ln();
            __.out("Could not generate constructor for ");
            __.out(v.containingType.typeImmutable().relativeRaw());
            __.out(" Attribute \n");
            __.out(v.name());
            __.out(" does not have default value\n");
            __.out("\n");
            __.dl();
        }
    });
    __.ln();
}
__.dl(); __.ln();
__.dl();
};
org.immutables.generator.Templates.Invokable generateConstructorNoAttributes() { return
generateConstructorNoAttributes; }
private final org.immutables.generator.Templates.Invokable generateConstructorNoAttributes = new
FragmentDispatch(2, 34);
void _t34__generateConstructorNoAttributes(org.immutables.generator.Templates.Invokation __) {
  __.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
final java.lang.Iterable<org.immutables.value.processor.meta.ValueAttribute> attributes = $cast(__.param(1));
  __.ln();
  {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute v : $in(attributes)) {
    final java.lang.String n = $cast(v.name());
    __.dl();___.ln();
    ___.dl();
    if ($if(v.isEncoding())) {
      __.dl();___.ln();
      $(___.unitializedFieldValue(), v);
      ___.ln();
    } else if ($if(v.isPrimitive())) {
      __.dl();___.ln();
      ___.out("  ");
      ___.dl();
      if ($if(v.isBoolean())) {
        __.dl();___.ln();
        ___.out("  ");
        ___.dl();
        if ($if(v.isBoolean())) {
          __.dl();___.ln();
          ___.out("this.");
          ___.ln();
          ___.out(" = false; ").ln();
          ___.out(" ");
        } else {
          __.dl();___.ln();
          __.out("this.");
          __.ln();
          __.out(" = 0;");.ln();
          __.out(" ");
        }
        __.dl();___.ln();
      } else {
        __.dl();___.ln();
        __.out("this.");
        __.ln();
        __.out(" = null; ").ln();
        __.out(" ");
      }
    }
    __.dl();___.ln();
  }
  __.dl();___.ln();
  if ($if(v.isBoolean())) {
    __.dl();___.ln();
    __.out("this.");
    __.ln();
    __.out(" = false; ").ln();
    __.out(" ");
  } else {
    __.dl();___.ln();
    __.out("this.");
    __.ln();
    __.out(" = null; ").ln();
    __.out(" ");
  }
  __.dl();___.ln();
  __.dl();_it1.index++;
  _it1.first = false;
org.immutables.generator.Templates.Invokable generateConstructorDefaultAttributes() { return generateConstructorDefaultAttributes; }
private final org.immutables.generator.Templates.Invokable generateConstructorDefaultAttributes = new FragmentDispatch(2, 35);
void _t35__generateConstructorDefaultAttributes(org.immutables.generator.Templates.Invokation __) {
  _dl();
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  final java.lang.Iterable<org.immutables.value.processor.meta.ValueAttribute> attributes = $cast(__.param(1));

  final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute v : $in(attributes)) {
    if ($if($(not, $(v.isGenerateDefault, or, v.isGenerateDerived)))) {
      final java.lang.String n = $cast(v.name());
      _dl();
      if ($if(v.hasVirtualImpl())) {
        _dl();$(__, rr.virtualImpl(), v);
      } else {
        _dl();
        if ($if(type.isAnnotationType())) {
          _dl();
          _out("this.");
          ${(__, n);
        }
      }
      _dl();
      _out(" = ");
      ${(__, emptyImmutableInstance, v, ");
      _out(";\n      _dl();
      _it1.index++;
      _it1.first = false;
    }
  }
}

private final org.immutables.generator.Templates.Invokable generateConstructorDefaultAttributes = new FragmentDispatch(2, 35);
void _t35__generateConstructorDefaultAttributes(org.immutables.generator.Templates.Invokation __) {
  _dl();
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  final java.lang.Iterable<org.immutables.value.processor.meta.ValueAttribute> attributes = $cast(__.param(1));

  final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute v : $in(attributes)) {
    if ($if(v.isGenerateDefault)) {
      final java.lang.String n = $cast(v.name());
      _dl();
      if ($if(type.isAnnotationType())) {
        _dl();
        _out("this.");
        ${(__, n);
        _out(" = DEFAULT_VALUE_");
        ${(__, toConstant, n);
        _out(";\n      } else if ($if(Sif$(not, type.isGenerateSafeDerived()))} {
else {
    __dl();__ln();
    __out(" ");
    {final org.immutables.generator.Templates.Iteration _it3 = new org.immutables.generator.Templates.Iteration();
    for (final java.lang.String anj : $in(v.fieldInjectedAnnotations())) {
        __dl();__ln();
        __out(" ");
        $___.anj());
        __ln();
        __out(" ");
        __dl();_it3.index++;
        _it3.first = false;
    }
    __dl();__ln();
    __out(" ");
    {final org.immutables.value.processor.meta.ValueType type_jsonIgnore_782971179 = $cast(type);
    __dl();
    if ($if(type_jsonIgnore_782971179.isGenerateJacksonIngoreFields()) {
        __dl();__out("@com.fasterxml.jackson.annotation.JsonIgnore");
    }
    __dl();
    }
    __ln();
    __out(" private ");
    __dl();
    if ($if(v.isGenerateTransientDerived())) {
        __dl();__out("transient ");
    }
    __dl();__out("final ");
    $___.v.atNullability();
    $___.immutableImplementationType, v);
    __out(" ");
    $___.v.name());
    __out(" ");
    __out(" ");
    __dl();__ln();
    __dl();_it2.index++;
    _it2.first = false;
    }
    __dl();__ln();
    __dl();
    if ($if(type.isCacheHash()) {
        __dl();__ln();
        __out(" ");
        __dl();
        __out(" ");
        __dl();
        __out(" ");
    } else {
        __dl();__ln();
        __out(" ");
        {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
        for (final java.lang.String anj : $in(v.fieldInjectedAnnotations())) {
            __dl();__ln();
            __out(" ");
            ___.anj());
            __ln();
            __out(" ");
            __dl();_it2.index++;
            _it2.first = false;
        }
        __dl();__ln();
        __dl();
        if ($if(type.isCacheHash()) {
            __dl();__ln();
            __out(" ");
        } else {
            __dl();__ln();
            __out(" ");
        }
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final java.lang.String anj : $in(type.syntheticFieldsInjectedAnnotations())) {
  $.dl();$.ln();
  $.out(" ");
  $.ln();
  $.out(" ");
  $.dl();_it2.index++;
  _it2.first = false;
}
$.dl();$.ln();
$.out(" ");
{final org.immutables.value.processor.meta.ValueType type_jsonIgnore_782971179 = $cast(type);
  $.dl();
  if ($if(type_jsonIgnore_782971179.isGenerateJacksonIngoreFields())) {
    $.dl();$.out("@com.fasterxml.jackson.annotation.JsonIgnore");
  }
  $.dl();
  $.ln();
  $.out(" ");
  $.dl();
  if ($if(type.isUseLazyhash())) {
    $.dl();{final org.immutables.value.processor.meta.ValueType type_hiddenMutableState_1091893888 = $cast(type);
      $.dl();
      if ($if($(type_hiddenMutableState_1091893888, allowsClasspathAnnotation,
        "com.google.errorprone.annotations.Immutable"))) {
        $.dl();$.out("@SuppressWarnings("Immutable")");
      }
    }
    $.dl();
    $.ln();
    $.out(" ");
    $.dl();
    if ($if(type.isUseLazyhash())) {
      $.dl();{final org.immutables.value.processor.meta.ValueType type_hiddenMutableState_1091893888 = $cast(type);
        $.dl();
        if ($if($(type_hiddenMutableState_1091893888, allowsClasspathAnnotation,
          "com.google.errorprone.annotations.Immutable"))) {
          $.dl();$.out("@SuppressWarnings("Immutable")");
        }
      }
      $.dl();
    }
    $.dl();$.ln();
    $.out(" private");
    $.dl();
    if ($if(not, type.serial.isSimple())) {
      $.dl();$.out(" transient");
    }
  }
  $.dl();$.dl();
  if ($if(type.isUsePrehashed())) {
    $.dl();$.out(" final");
  }
}
if (type.isUseLazyhash()) {
    __dl(); __out("  // hashCode lazily computed");
}

if (type.isGenerateOrdinalValue()) {
    final org.immutables.value.processor.meta.ValueType type_jsonIgnore_782971179 = $cast(type);
    __dl();
    if (type_jsonIgnore_782971179.isGenerateJacksonIgnoreFields()) {
        __dl(); __out("@com.fasterxml.jackson.annotation.JsonIgnore");
    }
}

if (type.isGenerateOrdinalValue()) {
    final org.immutables.value.processor.meta.ValueType type_jsonIgnore_782971179 = $cast(type);
    __dl();
    if (type_jsonIgnore_782971179.isGenerateJacksonIgnoreFields()) {
        __dl(); __out("@com.fasterxml.jackson.annotation.JsonIgnore");
    }
}

final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final String anj : $in(type.syntheticFieldsInjectedAnnotations())) {
    __dl(); __ln();
    __out("    ");
    ((__, anj);
    __ln();
    __out("    ");
    __dl(); _it2.index++;
    _it2.first = false;
}

private final int ordinal;
for (final java.lang.String anj : $in(type.syntheticFieldsInjectedAnnotations())) {
    __.dl();___.ln();
    __.out("  ");
    $(__, anj);
    __.ln();
    __.out("  ");
    __.dl();_it2.index++;
    _it2.first = false;
}
__dl();___.ln();
___.out("  private final Domain domain;").ln();
}
__dl();___.ln();
___.dl();
if ($if(type.isUseSingleton())) {
    __.dl();___.ln();
    __.ln();
    __.out("  private ");
    $(__, type.typeImmutable().simple());
    __.out("() {} ");
    $(__, output.collapsible, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();___.ln();
            __.out("    ");
            $(__, generateConstructorDefaultAttributes, type, type.getImplementedAttributes());
            __.ln();
            __.out("    ");
            $(__, generateDerivedConstruction, type, noAttributes);
            __.ln();
            __.out("    ");
            $(__, generateAfterConstruction, type, $$false);
            __.ln();
            __.out("    ");
            __.dl();
        }
    });
    ___.out("  ").ln();
} else if ($if(type.isGeneratePrivateNoargConstructor())) {
    __.dl();___.ln();
    __.ln();
    __.out("  private ");
    $(__, type.typeImmutable().simple());
    __.out("() {} ");
    $(__, output.collapsible, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();___.ln();
            __.out("    ");
            $(__, generateConstructorNoAttributes, type, type.getImplementedAttributes());
            __.ln();
            __.out("    ");
            $(__, generateAfterConstruction, type, $$false);
            __.ln();
            __.out("    ");
            __.dl();
        }
    });
}
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```java
__ln();
__.out("    ");
$___.generateAfterConstruction, type, $false);
___.ln();
__.out("   ");
___.dl();
}
}).ln();
___.dl();
__.dl();
if ($if($(type.isUseConstructor(), andnot, type.isGenerateConstructorUseCopyConstructor()))) {
___.dl();__.ln();
__.ln();
$___.generateConstructor, type, $false, constructorAcceptType);
___.ln();
___.dl();__.ln();
___.dl();
if ($if(type.isUseOptionalAcceptNullableConstructor())) {
___.dl();__.ln();
__.ln();
$___.generateConstructor, type, $true, constructorAcceptTypeNoOptional);
__.ln();
}
___.dl();__.ln();
___.dl();
if ($if(type.isGenerateBuilderConstructor())) {
___.dl();__.ln();
__.ln();
__.out(" private ");
$___.type.typeImmutable().simple();
__.out(" ");
$___.type.typeBuilderImpl().relative());
__.out(" builder ") ").ln();
__.out(" ");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(getters)) {
if ($if($not, $(v.isGenerateDerived, or, v.isGenerateDefault))) {
final java.lang.String n = $cast(v.name());
___.dl();__.ln();
__.out(" ");
___.dl();
if ($if(v.hasVirtualImpl)) {

```
if (Sif(type.isGenerateSafeDerived())) {
  __dl(); __ln();
  __out(" ");
}

{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
 for (final org.immutables.value.processor.meta.ValueAttribute v : $in(getters)) {
  if (Sif(v.isGenerateDefault)) {
    final java.lang.String n = $cast(v.name());
    __dl(); __ln();
    __out("  if ");
    __dl();
  }
  if (Sif(v.isEncoding())) {
    __dl(); __out("builder.");
    $(__, rr.wasInit(), v);
  } else if (Sif(v.requiresTrackIsSet())) {
    __dl(); __out("builder.");
    $(__, v.names.isSet());
    __out("()");
  } else {
    __dl(); __out("builder.");
    $(__, n);
    __out(" != null");
  }

  __dl(); __out(" "); __ln();
  __out(" ");
  $(__, disambiguateField, type, "initShim");
  __out(".");
  $(__, v.names.init);
  __out("()");
  $(__, valueFromBuilderAlt, v, v.requiresTrackIsSet(), new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __dl(); __out("builder.");
      __dl();
      __out(" ");
    }
  });
  __dl(); __ln();
  __out(" ");
  __out(" ");
  __dl(); _it2.index++;
  _it2.first = false;
}

} __dl(); __ln();

{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
 for (final org.immutables.value.processor.meta.ValueAttribute v : $in(getters)) {

} __dl(); __ln();
if ($if(v.isGenerateDefault)) {
    final java.lang.String n = $cast(v.name());
___.dl();___.ln();
___.out("  ");
___.dl();
if ($if($(type.isAnnotationType(), ornot, type.isGenerateSafeDerived()))) {
    ___.dl();___.ln();
    ___.out(" this.");
    ___(n);
    ___.out(" = ");
    ___.dl();
if ($if(v.requiresTrackIsSet())) {
    ___.dl();___.out("builder.");
    ___(v.names.isSet());
    ___.out("()");
} else {
    ___.dl();___.out("builder.");
    ___(n);
    ___.out(" != null");
}
___.dl();___.ln();
___.out("  ");
___(valueFromBuilderAlt, v, v.requiresTrackIsSet(), new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();___.out("builder.");
    ___.dl();
});
___.ln();
___.out(" : ");
___.dl();
if ($if(type.isAnnotationType())) {
    ___.dl();___.out("DEFAULT_VALUE_");
    ___(toConstant, v.name());
} else {
    ___.dl(); final org.immutables.value.processor.meta.ValueAttribute v_valueFromSuper_1184295742 = $cast(v);
    final org.immutables.generator.Templates.Invokable expression_valueFromSuper_1184295742 = new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invocation __) {
            __.dl();final org.immutables.generator.Templates.Invokable expression_valueFromSuper_1184295742 = this;
            ___(invokeSuper, v);
            __.out(".");
            ___(v.names.get);
            __.out("()");
    });
}});
if ($if(v_valueFromSuper_1184295742.isGuavaImmutableDeclared())) {
    if ($if($(not, v_valueFromSuper_1184295742.isNullable()))) {
        requireNonNull(v_valueFromSuper_1184295742.containingType);
        $(__, expression_valueFromSuper_1184295742);
        $(__, ", ",");
        $(__, v_valueFromSuper_1184295742.name());
        $(__, "\n"));
    } else {
        expression_valueFromSuper_1184295742);
    }
} else {
    valueFromValue, v_valueFromSuper_1184295742,
expression_valueFromSuper_1184295742);
}

$out("\n") out("\n")

$(__, generateDerivedConstruction, type, noAttributes);__ln();
$out("\n")
$(__, generateAfterConstruction, type, $true);
$(__, ", ",");
$out("\n")

} else {
    $(__, expression_valueFromSuper_1184295742);
}

$out("\n")

if ($if(type.isUseCopyMethods())) {
    _it2.index++;
    _it2.first = false;
}}
$out("\n")
$(__, generateDerivedConstruction, type, noAttributes);__ln();
$out("\n")
$(__, generateAfterConstruction, type, $true);
$(__, ", ",");
$out("\n")

} else {
    $(__, expression_valueFromSuper_1184295742);
}

$out("\n")

if ($if(type.isUseCopyMethods())) {
    $(__, __ln());
    __dl();
}
if ($if($(type.factoryOf().isNew(), and, type.isGenerateConstructorUseCopyConstructor()))) {
    __dl();__ln();
    __out("/**").ln();
    __out("  * Construct a new immutable {@code ");
$___.type.name();
    __out("} instance.").ln();
    __out("  ");
    {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
        __dl();__ln();
        __out("  * @param ");
$___.v.name();
        __out(" The value for the {@code ");
$___.v.name();
        __out("} attribute");
        __dl();
        if ($if(v.isNullable())) {
            __dl();__out("can be {@code null}");
        }
    }
    __dl();__ln();
    __out(" */").ln();
    __out("  ");
    $___.eachLine, type.getConstructorAnnotations();
    __ln();
    __out("  ");
    $___.eachLine, type.constructorInjectedAnnotations();
    __ln();
    __out("  public ");
    $___.type.typeImmutable().simple();
    __out("(");
    $___.output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation ___) {
            __dl();__ln();
            __out(" ");
            };final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(setters)) {
        __dl();__dl();
        if ($if($not, _it2.first)) {
            

```java
__.dl();__.out(" ,").ln();
__.out(" ");

___.dl();$(__, v.getConstructorParameterAnnotations());
$___.atNullability();
$___.immutableImplementationType, v);
__.out(" ");
$___.v.name());
___.dl();_it2.index++;
_it2.first = false;
})
__.dl();__.dl();
})
__.out(" ").ln();
__.out(" ");

} else {
___.dl();___.ln();
__.out(" private ");
$___.type.typeImmutable().simple());
__.out("(");
$___.output.linesShortable, new org.immutables.generate.Templates.Fragment(0) {
@Override public void run(org.immutables generator.Templates.Invokation __) {
___.dl();___.ln();
__.out(" ");
___.dl();
if (Sif(type.isSynthCopyConstructor())) {
___.dl();$___.type.typeImmutable().relative());
__.out(" ");
$___.disambiguateField, type, "original");
__.out(" ").ln();
__.out(" ");

})
___.dl();(final org.immutables generator.TemplatesIteration _it2 = new
org.immutables generator.TemplatesIteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(setters)) {
___.dl();___.dl();
if ($if($(not, _it2.first))) {
___.dl();__.out(" ").ln();
__.out(" ");

})
___.dl();$___.atNullability());
$___.immutableImplementationType, v);
__.out(" ");
$___.v.name());
```
Open Source Used In kASA v1.5
org.immutables.generator.Templates.Invokable generateConstructor() { return generateConstructor; }
private final org.immutables.generator.Templates.Invokable generateConstructor = new FragmentDispatch(3, 37);
void _t37__generateConstructor(org.immutables.generator.Templates.Invokation __) {
  __dl(); final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  final java.lang.Boolean withoutOptional = $if(__.param(1));
  final org.immutables.generator.Templates.Invokable constructorAcceptTypeInvokable = $cast(__.param(2));
  __ln();
  __out(" ");
  __dl();
  if ($if(type.factoryOf().isNew())) {
    __dl(); __ln();
    __out(" /**"); __ln();
    __out(" * Construct a new immutable [code ");
    $(__, type.name());
    __out(" instance."); __ln();
    __out(" ");
    [final org.immutables.generator.Templates.Iteration __it1 = new org.immutables.generator.Templates.Iteration();
     for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
       __dl(); __ln();
       __out(" * @param ");
       $(___.v.name());
       __out(" The value for the [code ");
       $(___.v.name());
       __out(" ] attribute");
       __dl();
       if ($if(v.isNullable())) {
         __dl(); __out(" , can be [code null]");
       }
     }
    __dl(); __ln();
    __out(" */"); __ln();
    __out(" ");
    $(___.eachLine, type.getConstructorAnnotations());
    __ln();
    __out(" ");
    $(___.eachLine, type.constructorInjectedAnnotations());
    __ln();
    __out(" ");
    $(___.suppressAnyCovariantCastForOptional, type.getConstructorArguments());
    __ln();
    __out(" public ");
  }
Open Source Used In kASA v1.5  2146

$___.type.typeImmutable().simple();
___.out("(");
$___.output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();
    }
}

org.immutables.generator.Templates.Iteration __it1 = new org.immutables.generator.Templates.Iteration();

for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
    __.dl();
    if (!$if($(not, __it1.first))) {
        __.dl();
        __.out(",");
    }

    __.dl();
    __.ln();
    __.out("      ");
    $(__, v.getConstructorParameterAnnotations());
    $(__, v.atNullability());
    $(__, constructorAcceptTypeInvokable, v);
    __.out("   ");
    $(__, v.name());
    __.dl();
    __it1.index++;
    __it1.first = false;
}

___.dl();
___.ln();
___.out(") {".ln();
___.out("  ");

} else {
    __.dl();
    __.ln();
    __.out("  ");
    $(__, suppressAnyCovariantCastForOptional, type.getConstructorArguments());
    __.ln();
    __.out("   private ");
    $(__, type.typeImmutable().simple());
    __.out("   ");
    $(__.output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();
        }
    }
}

org.immutables.generator.Templates.Iteration __it1 = new org.immutables.generator.Templates.Iteration();

for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
    __.dl();
    if (!$if($(not, __it1.first))) {
        __.dl();
        __.out(",");
    }

    __.dl();
    __.ln();
    __.out("      ");
    $(__, v.atNullability());
    __.dl();
    if (!$if($(not, __it1.first))) {
        __.dl();
        __.out(",");
    }

    __.dl();
    __.ln();
    __.out("      ");
    $(__, v.atNullability());
Open Source Used In kASA v1.5 2147

```java
$___.constructorAcceptTypeInvokable (v);
___.out(" ");
$___.v.name();
___.dl();___.it1.index++;
___.it1.first = false;
}
___.dl();___.dl();
});
___.out(") {").ln();
___.dl();
}
___.dl();
if ($if($(type.getConstructorOmitted(), or, $(type.hasEncodingValueOrVirtualFields(), or,
$(type.isGenerateSafeDerived(), and, type.hasDerivedAttributes())))) {
___.dl();___.ln();
___.out(" ");
final org.immutables.generator.Templates.Invokable shim = new
org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
___.dl();final org.immutables.generator.Templates.Invokable shim = this;
$___.disambiguateField, type, "initShim");
___.dl();
});___.dl();___.ln();
___.out(" ");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
final java.lang.String n = $cast(v.name());
___.dl();___.ln();
___.dl();
if ($if($(v.isGenerateDefault, and, type.isGenerateSafeDerived()))) {
___.dl();___.ln();
___.out(" ");
$___.shim;
___.out(".");
$___.v.names.init;
___.out("(");
$___.valueFrom, type, v, n, withoutOptional);
___.out(";").ln();
} else if ($if(v.hasVirtualImpl())} {
___.dl();___.ln();
___.out(" ");
$___.rr.virtualImpl(), v);
___.out(" = ");
$___.valueFrom, type, v, n, withoutOptional);
___.out(";").ln();
```

} else {
    __dl();__ln();
    __out("    this.");
    $(__, n);
    __out(" = ");
    $(__, valueFrom, type, v, n, withoutOptional);
    __out(";").ln();
}

} __dl();__ln();
__out("  ");
__dl();_it1.index++;
_it1.first = false;
}

} __dl();__ln();
__out("  ");
$___.generateConstructorDefaultAttributes, type, type.getConstructorOmitted();
__ln();
__out("  ");
$___.generateDerivedConstruction, type, type.getConstructorArguments();
__ln();

} else {
    __dl();__dl();__ln();
    __out("  ");
    {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
        final java.lang.String n = $cast(v.name());
        __dl();__ln();
        __out("    this.");
        $(__, n);
        __out(" = ");
        $(__, valueFrom, type, v, n, withoutOptional);
        __out(";").ln();
        __out("  ");
        __dl();_it1.index++;
        _it1.first = false;
    }
    __dl();__ln();
}

}

} __dl();__ln();
__out("  ");
$___.generateAfterConstruction, type, $false;
__ln();
__out("  ").ln();
__dl();
}
public org.immutables.generator.Templates.Invokable buildFromMandatoryAttribute() { return buildFromMandatoryAttribute; }

private final org.immutables.generator.Templates.Invokable buildFromMandatoryAttribute = new FragmentDispatch(2, 38);

void _t38__buildFromMandatoryAttribute(org.immutables.generator.Templates.Invokation __) {
  __dl();
  final org.immutables.generator.Templates.Invokable buildAttribute = $cast(___param(0));
  final org.immutables.value.processor.meta.ValueAttribute v = $cast(___param(1));
  __ln();
  __dl();
  if ($if(v.isMandatory())) {
    __dl();
    __ln();
    __out("if (instance.");
    __( v.names.isSet());
    __out(") {").ln();
    __out(" ");
    __( buildAttribute, v);
    __ln();
    __out("!").ln();
  } else {
    __dl();
    __( buildAttribute, v);
    __ln();
  }
  __dl();
  __ln();
  __dl();
}

org.immutables.generator.Templates.Invokable dynamicFromModifiableCheck() { return dynamicFromModifiableCheck; }

private final org.immutables.generator.Templates.Invokable dynamicFromModifiableCheck = new FragmentDispatch(3, 39);

void _t39__dynamicFromModifiableCheck(org.immutables.generator.Templates.Invokation __) {
  __dl();
  final org.immutables.value.processor.meta.ValueType type = $cast(___param(0));
  final java.lang.String varName = __.param(1).toString();
  final java.lang.String returnStatement = __.param(2).toString();
  __ln();
  __dl();
  if ($if(type.kind().isModifiable())) {
    __dl();
    __ln();
    __out("if (";
    __( varName);
    __out(" instanceof ");
    __( type.typeModifiable().relativeRaw());
    __( type.generics().unknown);
    __out(" ").ln();
  }
}
org.immutables.generator.Templates.Invokable generateSafeDerivedShim() { return generateSafeDerivedShim; }
private final org.immutables.generator.Templates.Invokable generateSafeDerivedShim = new FragmentDispatch(1, 40);
void _t40__generateSafeDerivedShim(org.immutables.generator.Templates.Invokation __) {
  __dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __ln();
  (final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
  java.util.Collection<org.immutables.value.processor.meta.ValueAttribute> deriveds =
  org.immutables.generator.Intrinsics.$collect();
  for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getImplementedAttributes())) {
    if ($if($v.isGenerateDefault, or, v.isGenerateDerived)) {
      deriveds.add(v);
    } else {
      __dl();__ln();
      __out(" return ");
      __(type.names().from);
      __out("(");
      __(type.typeModifiable());
      __out(" ");
      __(varName);
      __out(";");__ln();
      __out(" ");
      __(returnStatement);
      __ln();
      __out(" ");
    }
  }
  __dl();__ln();
  __out("}").ln();
}
private static final byte STAGE_INITIALIZING = -1;
private static final byte STAGE_UNINITIALIZED = 0;
private static final byte STAGE_INITIALIZED = 1;

final org.immutables.value.processor.meta.ValueType type_hiddenMutableState_1091893888 = $cast(type);
if ($if($(type_hiddenMutableState_1091893888, allowsClasspathAnnotation, com.google.errorprone.annotations.Immutable))) {
  @SuppressWarnings("Immutable")
}

private transient volatile InitShim initShim = new InitShim();

private final class InitShim {

  final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute f : $in(deriveds)) {
    if ($if(f.isEncoding())) {
      if ($if(_it2.first)) {
        if ($if($(type, allowsClasspathAnnotation, com.google.errorprone.annotations.CanIgnoreReturnValue))) {
          @com.google.errorprone.annotations.CanIgnoreReturnValue
        }
      }
      _it2.index++;
      _it2.first = false;
    }
  }

  private final class InitShim {
  
    final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(deriveds)) {
  
    }
  }

  private final class InitShim {
    
    final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(deriveds)) {
    
    }
    final.org.immutables.generator.Templates.Invokable stage = new
org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl(); final org.immutables.generator.Templates.Invokable stage = this;
        $(__, disambiguateField, type, new org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
                __.dl(); $___. v.name());
                __.out("BuildStage");
                __.dl();
            }
        });
        __.dl();
    }

    final org.immutables.generator.Templates.Invokable invokeSuperGet = new
    org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl(); final org.immutables.generator.Templates.Invokable invokeSuperGet = this;
            $(__, disambiguateAccessor, type, new org.immutables.generator.Templates.Fragment(0) {
                @Override public void run(org.immutables.generator.Templates.Invokation __) {
                    __.dl(); $(__, v.names.get);
                    __.out("Initialize");
                    __.dl();
                }
            });
            __.dl();
        }
    }

    __.dl();
    __.ln();
    __.out("private byte ");
    $(___. stage);
    __.out(" = STAGE_UNINITIALIZED;").ln();
    __.out(" private ");
    $(___. immutableImplementationType, v);
    __.out(" ");
    $(___. v.name());
    __.out(".").ln();
    __.out(" ");
    __.dl();

    if ($if(v.isEncoding())) {
        __.dl(); $(___. rr.shimFields(), v);
    }
}

___.dl(); ___.ln();
___.ln();
___.out(" ");
$(___. immutableImplementationType, v);
___.out(" ");
$(___. v.names.get);
___.out(" in ").ln();
___.out(" if ");
$(___. stage);
___.out(" == STAGE_INITIALIZING) throw new ");
Open Source Used In kASA v1.5 2153

```java
$___.out("""((formatInitCycleMessage());""").ln();
$___.out("  if ("";  
$___.out("" == STAGE_UNINITIALIZED) {"").ln();
$___.out("  ");  
$___.out(" = STAGE_INITIALIZING;").ln();
$___.out("  this.";);  
$___.v.name();  
$___.out(" = ");
{
final org.immutables.value.processor.meta.ValueAttribute v_valueFromSuper_1184295742 = $cast(v);
final org.immutables.generator.Templates.Invokable expression_valueFromSuper_1184295742 = new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __dl();final org.immutables.generator.Templates.Invokable expression_valueFromSuper_1184295742 = this;
    __dl();
    if ($if(v.defaultInterface())) {
      __dl();$(___.invokeSuperGet);
    } else {
      __dl();$(___.invokeSuperQualified, v);
      __out(".";)
      $(___.v.names.get);
      }
      __out("()";)
      __dl();
    }
  });__dl();__dl();
  if ($if(v_valueFromSuper_1184295742.isGuavaImmutableDeclared)) {
    __dl();__dl();
    if ($if($not, v_valueFromSuper_1184295742.isNullable())) {
      __dl();$___.requireNonNull, v_valueFromSuper_1184295742.containingType;
      __out("(";)
      $(___.expression_valueFromSuper_1184295742);
      __out(";\"";)
      $(___.v_valueFromSuper_1184295742.name());
      __out("\"\");
    } else {
      __dl();$(___.expression_valueFromSuper_1184295742);
    }
    __dl();
  } else {
    __dl();$(___.valueOfValue, v_valueFromSuper_1184295742, expression_valueFromSuper_1184295742);
  }
```
if ($if(v.isEncoding())) {
    __dl();$(__, rr.shimAssign(), v);
}
__dl();__ln();
__out(" ");
$__ stage;
__out(" = STAGE_INITIALIZED;").ln();
__out(" }").ln();
__out(" return this.");
$__ v.name();
__out(";").ln();
__out(" ");
__dl();
if ($if(v.isGenerateDefault)) {
    __dl();$(__, rr.shimAccessor(), v);
}
__dl();__ln();
__out(" ");
$__dl();
if ($if(v.isGenerateDefault)) {
    __dl();__ln();
    __ln();
    __out(" void ");
    $__ v.names.init;
    __out("()");
    $__ immutableImplementationType, v;
    __out(" ");
    $__ v.name();
    __out(" ");
    __out(" this.");
    $__ v.name();
    __out(" = ");
    $__ v.name();
    __out(";");
    __dl();
    if ($if(v.isEncoding())) {
        __dl();$(__, rr.shimAssign(), v);
    }
}
private String formatInitCycleMessage() {
    java.util.List<String> attributes = new java.util.ArrayList();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(deriveds)) {
        final org.immutables.generator.Templates.Invokable stage = new 
          org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
              $(__, disambiguateField, type, new org.immutables.generator.Templates.Fragment(0) {
                @Override public void run(org.immutables.generator.Templates.Invokation __) {
                  $(__, v.name());
                  BuildStage;
                }
              });
            }
          });
          final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
          for (final org.immutables.value.processor.meta.ValueAttribute v : $in(deriveds)) {
            if (stage == STAGE_INITIALIZING) attributes.add("v.name()");
            _it2.index++;
            _it2.first = false;
          }
          return "Cannot build ", attribute initializers form cycle " + attributes;
    }
}
```java
private final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(deriveds)) {
  if ($if(v.defaultInterface())) {
    __.dl();___.ln();
    final org.immutables.generator.Templates.Invokable invokeSuperGet = new org.immutables.generator.Templates.Fragments(0) {
    @Override public void run(org.immutables.generator.Templates.Invocation __) {
      __.dl();final org.immutables.generator.Templates.Invokable invokeSuperGet = this;
      $(__, disambiguateAccessor, type, new org.immutables.generator.Templates.Fragments(0) {
        @Override public void run(org.immutables.generator.Templates.Invocation __) {
          __.dl();$___.v.names.get);
          __.out("Initialize");
          __.dl();
        }
      });
      __.dl();___.ln();
      __.ln();
      __.out("private ");
      $(__, v.atNullable());
      $(__, v.getType());
      __.out(" ");
      $(__, invokeSuperGet);
      __.out(" ")
      __.ln();
      __.out(" return ");
      $(__, invokeSuper, v);
      __.out(".");
      $(__, v.names.get);
      __.out(";").ln();
      __.out(" ").ln();
      __.dl();___.it2.index++;
      ___.it2.first = false;
    }
  }
  __.dl();___.ln();
  __.dl();___.it1.index++;
  ___.it1.first = false;
}
___.dl();___.ln();
___.dl();
}
org.immutables.generator.Templates.Invokable constructorAcceptTypeNoOptional() { return
constructorAcceptTypeNoOptional; }
private final org.immutables.generator.Templates.Invokable constructorAcceptTypeNoOptional = new FragmentDispatch(1, 41);
void __t41__constructorAcceptTypeNoOptional(org.immutables.generator.Templates.Invocation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(___.param(0));
```
```java
$___.output.trim, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();___.ln();
        __.out("  ");
        __.dl();
        if ($if(a.isOptionalType())) {
            __.dl();___.ln();
            __.out("    ");
            __.dl();
            $(__, unwrappedOptionalType, a);
            __.ln();
            __.out("     ");
        } else {
            __.dl();___.ln();
            __.out("    ");
            $(__, constructorAcceptType, a);
            __.ln();
            __.out("     ");
        }
        __.dl();___.ln();
        __.dl();
    }
}

org.immutables.generator.Templates.Invokable constructorAcceptType() { return constructorAcceptType; }
private final org.immutables.generator.Templates.Invokable constructorAcceptType = new FragmentDispatch(1, 42);
void _t42__constructorAcceptType(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
    $(___, output.trim, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();___.ln();
            __.out("  ");
            __.dl();
            if ($if(a.isEncoding())) {
                __.dl();___.ln();
                __.out("    ");
                $(__, rr.constructorAcceptType(), a);
                __.ln();
            } else if ($if(a.typeKind().isMultimapKind())) {
                __.dl();___.ln();
                __.out("    ");
                $(__, guava);
                __.out(".collect.Multimap<");
                $(__, a.getConsumedElementType());
                __.out(" , ? extends ");
                $(__, a.getSecondaryElementType());
            } else {
                __.dl();___.ln();
                __.out("   ");
                $(__, a.getSecondaryElementType());
            }
        }
    });
    __.dl();
};
```
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
final org.immutables.value.processor.meta.ValueAttribute jval = $cast(type.getJacksonValue());
__dl();__ln();
__ln();
__out("/**").ln();
$___.out(javadocGenerics, type);
__ln();
__out(" * @param jsonValue to construct object from").ln();
__out(" * @return An immutable value type").ln();
__out(" * @deprecated Do not use this method directly, it exists only for the <em>Jackson</em>-binding infrastructure").ln();
__out(" */").ln();
__out("@Deprecated").ln();
__dl();
if (!$if(type.isUseBuilder())) {
__dl();__ln();
__out("@com.fasterxml.jackson.annotation.JsonCreator").ln();
__dl();
__out("static");
$_..type.generics().def();
__out(" ");
$_..type.typeImmutable().relative();
__out(" fromJson(");
$_..jval.getType();
__out(" jsonValue) ").ln();
final org.immutables.generator.Templates.Invokable cast = new
org.immutables.generator.Templates.Frag}
Open Source Used In kASA v1.5

```java
��▽(" ");
$cies,_.type.typeBuilder().relative());
▽out(" builder = ");
$cies,_.castBuildStagedBuilder, type, new org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __dl();$cies,_.factoryBuilder().relative());
  .out("()");
  __dl();
});
.出(".").ln();
.出(" ");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
 for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
  if ($if($(v, eq, jval))) {
    __dl();__ln();
    __out(" ");
    __dl();
  if ($if(v.isEncoding())) {
    __dl();__ln();
    __out(" builder.");
    $cies, rr.builderCopyFrom(), v);
    __out("(jsonValue);"),ln();
    __out(" ");
  } else if ($if(v.isCollectionType())) {
    __dl();__ln();
    __out(" builder.");
    $cies, v.names.addAll());
    __out("(jsonValue);"),ln();
    __out(" ");
  } else if ($if(v.isMapType())) {
    __dl();__ln();
    __out(" builder.");
    $cies, v.names.putAll());
    __out("(jsonValue);"),ln();
    __out(" ");
  } else {
    __dl();__ln();
    __out(" builder.");
    $cies, v.names.init);
    __out("(jsonValue);"),ln();
    __out(" ");
  }
}
__dl();__ln();
__out(" ");
__dl();_it2.index++;
```
@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  __.out("Cannot generate JSON code when there are no builders, constructors or singletons available");

  __.dl();
  __.ln();
  __.out("    ");

}

___.dl();
___.ln();
___.out("    ");

{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute o :
    type.getWithSettableAfterConstruction()) {
    if (if$(o, eq, jval)) {
      __.dl();
      __.ln();
      __.out("    instance = instance.");
      $(___. o.names.with);
      __.out("(jsonValue);"),ln();
      __.out("    ");
      __.dl();
      _it2.index++;
      _it2.first = false;
    }
  }
  __.dl();
  __.ln();
  __.out("    return instance;"),ln();
}

___.dl();
___.ln();
___.out("  ");

___.dl();
___.ln();
___.out("  ");

if (else) {
  __.dl();
  __.ln();
  __.ln();
  __.out("/**");ln();
  __.dl();
  _it1.index++;
  _it1.first = false;
}

___.dl();
___.ln();
___.out("    ");

} else {
  __.dl();
  __.ln();
  __.ln();
  __.out("/**");ln();
  __.out(" * Utility type used to correctly read immutable object from JSON representation.");ln();
  __.out(" * @deprecated Do not use this type directly, it exists only for the <em>Jackson</em>-binding infrastructure");ln();
  __.out(" */");ln();
  $(___. atGenerated, type);
__ln();
__out("@Deprecated").ln();
__dl();__ln();
{final org.immutables.value.processor.meta.ValueType type_hiddenMutableState_1091893888 = $cast(type);
  __dl();
  if ($if($(type_hiddenMutableState_1091893888, allowsClasspathAnnotation, "com.google.errorprone.annotations.Immutable")) {
    __dl();__out("@SuppressWarnings("Immutable")");
  }
  __dl();
}
__ln();
{final org.immutables.value.processor.meta.ValueType type_overrideJsonDeserialize_1691212826 = $cast(type);
  __dl();
  if ($if(type_overrideJsonDeserialize_1691212826.isJacksonDeserialized()) {
    __dl();__out("@com.fasterxml.jackson.databind.annotation.JsonDeserialize");
  }
  __dl();
}
__ln();
{final org.immutables.value.processor.meta.ValueType type_overrideJsonTypeInfo_1598944724 = $cast(type);
  __dl();
  if ($if(type_overrideJsonTypeInfo_1598944724.isJacksonJsonTypeInfo()) {
    __dl();__out("@com.fasterxml.jackson.annotation.JsonTypeInfo(use=com.fasterxml.jackson.annotation.JsonTypeInfo.Id.NONE)");
  }
  __dl();
}
__ln();
__out("static final ");
$(__, output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __dl();__out("class Json");
    $(__, type.generics());
    __ln();
    __out(" ");
    $(__, extendsImplements, type);
    __dl();
  }});
__ln();
__out(" ");
$(__, serialVersionUID, type);
```java
(ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
    if ($if($not, v.jacksonAnyGetter)) {
        _dl();__ln();
        __out(" ");
        _dl();
    }
    if ($if(v.isEncoding())) {
        _dl();__ln();
        __out(" ");
        _dl();
    }
    if ($if(v.instantiation.supportsDefaultValue())) {
        _dl();__ln();
        __out(" ");
        $(__, v.getType());
        __out(" ");
        $(__, v.name());
        __out(" = ");
        $(__, rr.defaultValue(), v);
        __out(";").ln();
        __out(" ");
    }
    if ($if(v.isOptionalType())) {
        _dl();__ln();
        __out(" ");
        if ($if($cast(v)) {
            _dl();__out("@javax.annotation.Nullable ");
        }
        _dl();
    }
    $(__, v.getType());
    __out(" ");
    $(__, v.name());
    __out(";").ln();
    __out(" ");
}
```
__dl();__out("@javax.annotation.Nullable ");
____dl();
}
__dl();
$c((v.getType()));
____out(" ");
$c((v.getName()));
____out(" = ");
{final org.immutables.value.processor.meta.ValueAttribute a_optionalEmpty_1867206284 = $cast(v);
$c((a_optionalEmpty_1867206284.getRawType()));
____dl();
__dl();
if ($if(a_optionalEmpty_1867206284.isJdkOptional())) {
__dl();__out("empty");
} else if ($if($a_optionalEmpty_1867206284.isFugueOptional(), or,
a_optionalEmpty_1867206284.isJavaslangOptional())) {
__dl();__out("none");
}
}
__dl();__out("absent");

}
__dl();__out("()");
} __out(";").ln();
__out(" ");
} else if ($if($v.isCollectionType(), or, v.isMapType())) {
__dl();__ln();
__out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
__dl();
if ($if($s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable")) {
__dl();__out("@javax.annotation.Nullable ");
}
}
__dl();
$c((v.getType()));
____out(" ");
$c((v.getName()));
____out(" = ");
$c((emptyImmutableInstance, v, ");
____out(";").ln();
____out(" ");
} else if ($if(v.isPrimitive())) {
__dl();__ln();
}
__out(" ");
$___.v.getType();
__out(" ");
$___.v.name();
__out(";");ln();
__out(" ");

} else {
  __dl();__ln();
  __out(" ");
  {final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
    __dl();
    if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
      __dl();__out("@javax.annotation.Nullable ");
    }
    __dl();
  }
  $(___.v.getType());
  __out(" ");
  $(___.v.name());
  __out(";");ln();
  __out(" ");

}__dl();__ln();
__out(" ");
__dl();
if ($if($(v.isPrimitive(), or, $(v.requiresTrackIsSet(), andnot, v.jacksonAnyGetter)))) {
  __dl();__ln();
  __out(" boolean ");
  $(___.disambiguateField, type, $(v.name(), "IsSet"));
  __out(";");ln();
  __out(" ");

}__dl();__ln();
__dl();_it1.index++;_it1.first = false;
}}
__dl();__ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
    if ($if(v.jacksonAnyGetter)) {
      __dl();__ln();
      __out(" final ");
      $(___.v.getType());
      __out(" ");
    }
Open Source Used In kASA v1.5  2167

$$(__, v.name());
  __.out(" = new java.util.HashMap");
$$(__, v.getGenericArgs());
  __.out("();").ln();
  __.dl();_it1.index++; _it1.first = false;
}}
  __.dl();___.ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
    if ($if($(not, v.jacksonAnyGetter))) {
      __.dl();____.ln();
      $(__, eachLine, v.getAnnotations());
      ____.ln();
      $$(__, eachLine, v.initializerInjectedAnnotations());
      ____.ln();
      _____.out(" public void ");
      $(__, v.names.beanSet());
      _____.out("(");
      $$(__, v.atNullability());
      $$(__, v.getType());
      _____.out(" ");
      $$(__, v.name());
      _____.out(".").ln();
      _____.out(" this.");
      $$(__, v.name());
      _____.out(" = ");
      $$(__, v.name());
      _____.out(";").ln();
      _____.out(" ");
    }
    else {
      __.dl();
    }
    if ($if($(v.isPrimitive(), or, $(v.requiresTrackIsSet(), andnot, v.jacksonAnyGetter)))) {
      __.dl();_____._ln();
      _____.out(" this.");
      $(__, disambiguateField, type, $v.name(), "IsSet");
      _____.out(" = true;").ln();
      _____.out(" ");
    }
  }
  __.dl();_____._ln();
  _____.out(" ").ln();
  __.dl();_it1.index++; _it1.first = false;
}}
  __.dl();_____._ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
    __.dl();__.ln();
    __.ln();
    __.out("  @com.fasterxml.jackson.annotation.JsonAnySetter").ln();
    __.out("  public void set");
    $(__, toUpper, v.name());
    __.out("(");
    $(__, v.getWrappedFirstElementType());
    __.out(" key, ");
    $(__, v.getWrappedSecondaryElementType());
    __.out(" value \")
    __.out("  this.");
    $(__, v.name());
    __.out(".put(key, value;\")
    __.out("  }\")
    __.dl();__it1.index++;
    __it1.first = false;
}]
___.dl();__.ln();
{final org.immutables.generator.Templates.Iteration __it1 = new org.immutables.generator.Templates.Iteration();
for (final java.lang.String signature : $in(type.getNonAttributeAbstractMethodSignatures())) {
    ___.dl();__.ln();
    ___.out("  @Override");
    ___.dl();__.ln();
    ___.out("  ");
    $(__, signature);
    ___.out("  \{ throw new UnsupportedOperationException(); \} \")
    ___.dl();__it1.index++;
    __it1.first = false;
}]
___.dl();__.ln();
{final org.immutables.generator.Templates.Iteration __it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getAllAccessibleAttributes())) {
    ___.dl();__.ln();
    ___.out("  ");
    ___.dl();
    if ($if(v.isGenerateDerived)) {
        ___.dl();__.ln();
        ___.out("  @com.fasterxml.jackson.annotation.JsonIgnore").ln();
        ___.out("  ");
    }
    ___.dl();__.ln();
}
___.dl();__.ln();
___.out("  @Override");
___.dl();__.ln();
___.out(" ");
$(__, v.toSignature());
```java
__out(" { throw new UnsupportedOperationException(); }").ln();
__dl();__it1.index++;
__it1.first = false;
}
__dl();__ln();
__out(" ");
$___.generateJsonWithUnsupported, type);
__ln();
__out(" ").ln();
__ln();
__out("/**").ln();
$___.javadocGenerics, type);
__ln();
__out(" * @param json A JSON-bindable data structure").ln();
__out(" * @return An immutable value type").ln();
__out(" * @deprecated Do not use this method directly, it exists only for the <em>Jackson</em>-binding infrastructure").ln();
__out(" * /").ln();
__out("@Deprecated").ln();
__dl();
if ($if($(classpath.available, "com.fasterxml.jackson.annotation.JsonCreator.Mode")))
{ __dl();__ln();
  __out("@com.fasterxml.jackson.annotation.JsonCreator(mode =
com.fasterxml.jackson.annotation.JsonCreator.Mode.DELEGATING")").ln();
} else {
  __dl();__ln();
  __out("@com.fasterxml.jackson.annotation.JsonCreator").ln();
}
__dl();__ln();
__out("static");
$___.type.generics().def());
__out(" ");
$___.type.typeImmutable().relative());
__out(" fromJson(Json");
$___.type.generics().args());
__out(" json ").ln();
final org.immutables.generator.Templates.Invokable cast = new
org.immutables.generator.Templates.Invokable.Templates.Invokation __)
{ __dl();final org.immutables.generator.Templates.Invokable cast = this;__dl();
if ($if($type.constitution.returnsAbstractValueType(), or, type.getInnerBuilder().isExtending))
{ __dl();__out(" ");
$___.type.typeImmutable().relative());
__out(" ");
```
if ($if(type.isUseBuilder())) {
    ...
    if ($if($(v.requiresTrackIsSet(), or, v.isPrimitive())) {
        ...
        if (json.
            disambiguateField,
            v.name(),
            "IsSet")
            ...
            if (json.
                ... != null) {
                ...
            } else {
                ...
            }
    } else {
        ...
    }
} else {
    ...
    if ($if(v.requiresTrackIsSet(), or, v.isPrimitive())) {
        ...
        if (json.
            ... != null) {
                ...
            } else {
                ...
            }
} else {
    ...
    if ($if(v.isEncoding())) {
        ...
        if (json.
            rr.builderCopyFrom(),
            v)
        ...
    } else {
        ...
    }
} else if ($if(v.isCollectionType())) {
    __.out("builder.");
    __.out("(json.");
    __.out("),");
    __.dl();
    __.names.addAll();
    __.out(";");
    return cast;
}

} else if ($if(type.isUseSingletonOnly())) {
    __.out("builder.");
    __.out("),");
    __.dl();
    __.it1.index++;
    __.out(";");
    return type.factoryInstance().relative();
}

} else {
    __.out("builder.");
    __.out("),");
    __.dl();
    __.it1.index++;
    __.out(";");
    return type.factoryInstance().relative();
}

}}

} else {
    __.out("builder.");
    __.out("),");
    __.dl();
    __.it1.index++;
    __.out(";");
    return type.factoryInstance().relative();
}
__.out(" ");
$(__, varDecl);
__.out(" = ");
$(__, cast);
$(__, type.factoryInstance().relative());
__.out("()");ln();
__.out(" ");
}
else {
  __dl();__ln();
  __out(" ");
  $(__, output.error, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __dl();__out("Cannot generate JSON code when there are no builders, constructors or singletons available");
      __dl();
    }
  });
  __ln();
  __out(" ");
}
__dl();__ln();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v :
$in(type.getWithSettableAfterConstruction())) {
  __dl();__ln();
  __out(" ");
  __dl();
  if ($if($(v.requiresTrackIsSet(), or, v.isPrimitive()))) {
    __dl();__ln();
    __out(" if (json.");
    $(__, disambiguateField, type, $(v.name(), "IsSet"));
    __out(" )").ln();
    __out(" ");
  } else {
    __dl();__ln();
    __out(" if (json.");
    $(__, v.name());
    __out(" != null )").ln();
    __out(" ");
  }
  __dl();__ln();
  __out(" ");
  $(__, v.names.with);
  __out("(json.");
}
```java
private final org.immutables.generator.Templates.Invokable generateAccessorMethods = new FragmentDispatch(1, 44);

void _t44__generateAccessorMethods(org.immutables.generator.Templates.Invokation __) {
    final org.immutables.value.processor.meta.ValueType type = __cast(__.param(0));
    final org.immutables.value.processor.meta.ValueAttribute v : __in(type.getImplementedAttributes()) {
        @Override
        public Class<? extends java.lang.annotation.Annotation> annotationType() {
            return __cast(v.typeAbstract()).class;
        }
    }
}
```
if ($if(v.docComment)) {
    __dl();__ln();
    {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
     for (final java.lang.String d : $in(v.docComment)) {
        __dl();__ln();
        __out(" *\n    ");
        $(__, d);
        __dl();__ln();
        __dl();_it2.index++;
        _it2.first = false;
    }
    __dl();__ln();
    __out(" ");
} else {
    __dl();__ln();
    __out(" ");
    __dl();
    if ($if(v.isEncoding())) {
        __dl();__ln();
        {final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
         for (final java.lang.String d : $in(v.instantiation.exposeDoc())) {
            __dl();__ln();
            __dl();__ln();
            __out(" *\n        ");
            __dl();
            if ($if($(singular, v.instantiation.exposeDoc()))) {
                __dl();__out(" ");
            }
            __dl();$___.v.instantiation.filterDoc, d);
            __ln();
            __dl();_it2.index++;
            _it2.first = false;
        }
        __dl();__ln();
        __out(" ");
    }
    __dl();$_v.instantiation.filterDoc, d);
    __ln();
    __dl();_it2.index++;
    _it2.first = false;
}}
__dl();__ln();
__out(" ");
}
__dl();__ln();
__dl();
if ($if(v.isArrayType())) {
    __dl();__ln();
    __out(" * @return A cloned \{ @code ");
    $(__, v.name());
```java
__out("} array").ln();
} else if ($if(v.isGenerateDerived)) {
  __dl();__ln();
  __out(" * @return The computed-at-construction value of the { @code ");
  $(__, v.name());
  __out("} attribute").ln();
}

} else {
  __dl();__ln();
  __out(" * @return The value of the { @code ");
  $(__, v.name());
  __out("} attribute").ln();
}

__dl();__ln();
__out(" ");

__dl();__ln();
__out(" */");

{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final java.lang.CharSequence a : $in(v.getAnnotations())) {
  if ($if($(a, ne, "@com.fasterxml.jackson.annotation.JsonAnyGetter"))) {
    __dl();__ln();
    $(__, a);
    __ln();
    __dl();_it2.index++;
    _it2.first = false;
  }
}}

__dl();__ln();
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final java.lang.String anj : $in(v.accessorInjectedAnnotations())) {
  __dl();$(__, anj);
  __dl();_it2.index++;
  _it2.first = false;
}

__dl();__ln();

if ($if(v.jacksonAnyGetter)) {
  __dl();__out("@com.fasterxml.jackson.annotation.JsonAnyGetter");
}

__dl();__ln();
__dl();

if ($if(v.jacksonValue)) {
  __dl();__out("@com.fasterxml.jackson.annotation.JsonValue");
}
```
final org.immutables.value.processor.meta.ValueAttribute a_deprecation = $cast(v);
__dl();
if ($if(a_deprecation.deprecated)) {
__dl(); __out("@Deprecated");
}
__dl();
__ln();
__out("@Override").ln();
__out("  ");
__dl();
if ($if(v.isEncoding())) {
__dl(); __ln();
$___.rr.accessor(), v, new org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
__dl();
__dl();
__out("  ");
}};
__ln();
__out("  ");
} else if ($if(v.isJdkOptional())) {
__dl(); __ln();
$___.v.getAccess();
$___.v.getType();
__out("  ");
$___.v.names.get();
__out("() { ").ln();
__dl();
if ($if(v.isJdkSpecializedOptional())) {
__dl(); __ln();
__out(" return ");
$___.v.name();
__out(" != null").ln();
__out("  ? ");
$___.v.getRawType();
__out(" of(");
$___.v.name();
__out("  ").ln();
__out("  ");
$___.v.getRawType();
__out(" .empty();");
} else {
__dl(); __ln();
__out(" return ");
$___.v.getRawType();
}
likely a continuation of code, possibly a scenario or script. Each line has a corresponding line with a corresponding line.
else if ($if(v.isArrayType())) {
    ___.dl();_.ln();
    ___.out(" return ");
    $(___. valueFromValue, v, v.name());
    ___.out(";".).ln();
}

else {
    ___.dl();_.ln();
    ___.out(" return ");
    $(___. v.name());
    ___.out(";".).ln();
}

_.dl();_.ln();
_.out("} ").ln();
_.out("
");

if ($if(type.isGenerateOrdinalValue())) {
    ___.dl();_.ln();
    _.ln();
    ___.out("/** @inheritDoc */").ln();
    ___.out("@Override").ln();
    ___.out("public int ordinal() { ").ln();
    ___.out(" return ordinal;").ln();
    ___.out(" }"").ln();
    ___.out(" ");
}

_.dl();_.ln();
_.dl();

org.immutables.generator.Templates.Invokable generateObjectUtilityMethods() { return
generateObjectUtilityMethods;
}

private final org.immutables.generator.Templates.Invokable generateObjectUtilityMethods = new FragmentDispatch(1, 45);

void _t45__generateObjectUtilityMethods(org.immutables.generator.Templates.Invokation __) {
    ___.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
final org.immutables.generator.Templates.Invokable equalToType = new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();final org.immutables.generator.Templates.Invokable equalToType = this;
        __.dl();
        if ($if(type.isAnnotationType())) {
            __.dl();$___.type.typeAbstract().relativeRaw());
        } else {
            __.dl();$___.type.typeImmutable().relativeRaw());
            $(___.type.generics().unknown);
        }
        __.dl();___.ln();
    }
};___.ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
final java.util.List<org.immutables.value.processor.meta.ValueAttribute> getters = $cast(type.getEquivalenceAttributes());
___.dl();___.ln();
___.dl();
if ($if($not(type.isEqualToFinal))) {
    ___.dl();___.ln();
    ___.dl();
    if ($if($ornot(type.isUseReferenceEquality(), type.isEqualToDefined))) {
        ___.dl();___.ln();
        ___.ln();
        ___.out("/**").ln();
        ___.dl();
        if ($if(type.isAnnotationType())) {
            ___.dl();___.ln();
            ___.dl();
            ___.out(" * This instance is equal to any implementation of the {@link ");
            $(___.type.typeValue().relativeRaw());
            ___.out("} type with equal attribute values.").ln();
        } else {
            ___.dl();___.ln();
            ___.out(" * This instance is equal to all instances of { code ");
            $(___.type.typeImmutable().simple());
            ___.out(" that have equal attribute values.").ln();
        }
    } else {
        ___.dl();___.ln();
        ___.out(" * This instance is equal to all instances of { code ");
        $(___.type.typeImmutable().simple());
        ___.out("} that have equal attribute values.").ln();
    }
}
___.dl();___.ln();
___.dl();
if ($if(type.isUseReferenceEquality())) {
    ___.dl();___.ln();
    ___.out(" * As instances of the { code ");
    $(___.type.typeImmutable().simple());
__out("} class are interned, the [@code equals] method is implemented").ln();
__out(" * as an efficient reference equality check.").ln();
}
__dl();__ln();
__out(" * @return [@code true] if [@code this] is equal to [@code another] instance").ln();
__out(" */".).ln();
__out("@Override").ln();
__out("public boolean equals(");
{final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(type);
__dl();
if ($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable")) {
__dl();__out("@javax.annotation.Nullable ");
}
__dl();
}
__out("Object another) {".).ln();
__out(" ");
__dl();
if ($(type.isUseReferenceEquality())) {
__dl();__ln();
__out(" return this == another;".).ln();
__out(" ");
} else {
__dl();__ln();
__out(" if (this == another) return true;".).ln();
__out(" return another instanceof ");
$(__, equalToType);
__ln();
__out(" && equalTo(");
$(__, equalToType);
__out(") another;".).ln();
__out(" ");
}
__dl();__ln();
__out("} ").ln();
}
__dl();__ln();

}
__ln();
__dl();
if (Slf(type.isEqualToDefined, or, Slf(type.isCacheHash(), or, getters))) {
  __dl();__ln();
  __dl();__ln();
} else {
  __dl();__ln();
  __out("@SuppressWarnings("MethodCanBeStatic")").ln();
}
__dl();__ln();
__out("private boolean equalTo(");
Slf(__, equalToType);
__out(" another) ").ln();
__out(" ");
__dl();
if (Slf(type.isEqualToDefined)) {
  __dl();__ln();
  __out(" return super.equals(another);").ln();
  __out(" ");
} else {
  __dl();__ln();
  __out(" ");
  __dl();
  if (Slf(type.isCacheHash())) {
    __dl();__ln();
    __out(" ");
    __dl();
    if (Slf(type.isAnnotationType())) {
      __dl();__ln();
      __out(" if (another instanceof ");
      Slf(__, type.typeImmutable().relativeRaw());
      __out(" ) ").ln();
      __out(" final int anotherHashCode = ");
      Slf(__, type.typeImmutable().relativeRaw());
      __out(" another).hashCode;").ln();
      __out(" ");
      __dl();
      if (Slf(type.isUseLazyhash())) {
        __dl();__out("hashCode != 0 && anotherHashCode != 0 && anotherHashCode != otherHashCode && ");
      }
    }
  } else {
    __dl();__out("hashCode != 0 && anotherHashCode != 0 && ");
  }
}
__dl();__out("return false;");ln();
__out(" ");ln();
__out(" ");
} else {
    __.dl();__.ln();
    __.out("if ( ");
    __.dl();
    if ($if(type.isUseLazyhash())) {
        __.dl();__.out("hashCode != 0 && another.hashCode != 0 && ");
    }
    __.dl();__.out("hashCode != another.hashCode) return false;");.ln();
    __.out(" ");
}
___.dl();__.ln();
___.out(" ");

} ___.dl();__.ln();
___.out(" return ");
___.dl();
if ($if($not, getters)) {
    ___.dl();__.out("true");
}
___.dl();{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(getters)) {
        ___.dl();_.dl();
        if ($if($not, _it2.first)) {
            ___.dl();__.ln();
            ___.ln();
            ___.out(" && ");
        }
        _it2.index++;
        _it2.first = false;
    }
    ___.dl();$.equalsAttribute, v, type.isAnnotationType();
    ___.dl();_it2.index++; _it2.first = false;
}
___.dl();__.out(";").ln();
___.out(" ");

} ___.dl();__.ln();
___.out(""").ln();

} ___.dl();__.ln();
final org.immutables.generator.Templates.Invokable computeHashCodeBody = new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {

final org.immutables.generator.Templates.Invokable computeHashCodeBody = this;

final org.immutables.generator.Templates.Invokable h = new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    $(__, disambiguateField, type, "h");
    __dl();
  };
};

if ($if($(type.isAnnotationType(), and, getters.isEmpty()))) {
  __dl();
  __out("  return 0;").ln();
} else if ($if(type.isAnnotationType())) {
  __dl();
  __out("  @com.google.errorprone.annotations.Var ");
  $cast(type);
}

final org.immutables.value.processor.meta.HasStyleInfo s_atVar_1287436599 = $cast(type);

if ($if($s_atVar_1287436599, allowsClasspathAnnotation, "com.google.errorprone.annotations.Var")) {
  __dl();
  __out("@com.google.errorprone.annotations.Var ");
}

__out("int ");
$h;
__out(" = 0;").ln();

{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute v : $in(getters)) {
    __dl();
    $cast(v.isArrayType());
    __out("  ");
    $h;
    __out(" += 127 * "');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
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    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
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    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hashCode("');
    __out(" .hashCode() ^ java.util.Arrays.hash Cod
} else {
    __.dl();__.ln();
    __.out("  ");
    $(__, h);
    __.out(" += 127 * \\");
    $(__, v.names.get);
    __.out("\\.hashCode() ^ ");
    $(__, v.name());
    __.out("\\.hashCode();").ln();
}
___.dl();__.ln();
___.out("  ");
___.out(" return ");
$(__, h);
___.out(";").ln();
} else if ($if(getters.isEmpty())) {
    __.dl();__.ln();
    __.out("  ");
    $(__, type.hashCode());
    __.out(";").ln();
} else {
    __.dl();__.ln();
    __.out(" int ");
    $(__, h);
    __.out(" = 5381;\n");
    {final org.immutables.value.processor.meta.HasStyleInfo s_atVar_1287436599 = $cast(type);
        __.dl();
        if ($if($(s_atVar_1287436599, allowsClasspathAnnotation, "com.google.errorprone.annotations.Var"))) {
            __.dl();___.out("@com.google.errorprone.annotations.Var ");
        }
        __.dl();
    }
___.dl();
___.out(" int ");
$(__, h);
___.out(" = 5381;\n");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(getters)) {
        __.dl();__.ln();
        __.dl();
        if ($if(v.isEncoding())) {
            __.dl();__.ln();
            __.out(" ");
            $(__, h);
        }
    }
}
__.out(" += (");$(__, h);
__.out(" << 5) + (");$(__, rr.hash(), v);
__.out(");").ln();} else if ($if(v.isArrayType())) {
  __.dl();__.ln();
  __.out(" ");$(__, h);
  __.out(" += (");$(__, h);
  __.out(" << 5) + java.util.Arrays.hashCode(");$(__, v.name());
  __.out(");").ln();} else if ($if($v.isNullable(), or, v.isJdkOptional())) {
  __.dl();__.ln();
  __.out(" ");$(__, h);
  __.out(" += (");$(__, h);
  __.out(" << 5) + ");$(__, objectsHashCode, type);
  __.out("(");$(__, v.name());
  __.out(")");.ln();} else if ($if(v.isPrimitive())) {
  __.dl();__.ln();
  __.out(" ");$(__, h);
  __.out(" += (");$(__, h);
  __.out(" << 5) + ");$(__, primitiveHashCode, v);
  __.out(";").ln();} else {
  __.dl();__.ln();
  __.out(" ");$(__, h);
  __.out(" += (");$(__, h);
  __.out(" << 5) + ");$(__, v.name());
  __.out(";").ln();
} else {
  __.dl();__.ln();
  __.out(" ");$(__, h);
  __.out(" += (");$(__, h);
  __.out(" << 5) + ");$(__, v.name());
  __.out(";").ln();
} __.dl();__.ln();
___.it2.index++;
```java
if ($if(type.isHashCodeDefined)) {
    __.dl(); __.ln();
    __.out("  ");
    __.dl();
    if ($if(type.isUsePrehashed())) {
        __.dl(); __.ln();
        __.out("/**");
        __.out(" * Returns the precomputed-on-construction hash code from the supertype implementation of [@code super.hashCode()]").ln();
        __.out(" * @return The hash code value").ln();
        __.out(" */").ln();
        __.out("@Override").ln();
        __.out(" public int hashCode() { ").ln();
        __.out(" return hashCode;").ln();
        __.out(" }").ln();
        __.out(" ");
    } else {
        __.dl(); __.ln();
        __.ln();
        __.out("/**").ln();
        __.dl();
        if ($if(!($not, getters))) {
            __.dl(); __.ln();
            __.out(" * Returns a constant hash code value.").ln();
        } else if ($if(type.isCacheHash())) {
            __.dl(); __.ln();
            __.out(" * Returns a ");
            __.dl();
            if ($if(type.isUsePrehashed())) {
                __.dl(); __.out("precomputed-on-construction");
            }
        }
    }
```
} else {
    __.dl();__.out("lazily computed");

} __.dl();__.out(" hash code from attributes: ");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute a : $in(getters)) {
    __.dl();___.dl();
    if ($if($(not, _it2.first))) {
        __.dl();___.out(",
        ");
    }
    __.dl();__.out("{ @code ");
$___.a.name());
    __.out(" }");
    __.dl();_it2.index++;
    _it2.first = false;
} }
___.dl();___.out(".").ln();
}

} else {
    __.dl();___.ln();
    __.out(" * Computes a hash code from attributes: ");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute a : $in(getters)) {
    __.dl();___.dl();
    if ($if($(not, _it2.first))) {
        __.dl();___.out(",
        ");
    }
    __.dl();__.out("{ @code ");
$___.a.name());
    __.out(" }");
    __.dl();_it2.index++;
    _it2.first = false;
} }
___.dl();___.out(".").ln();

}
___.dl();___.ln();
___.out(" * @return hashCode value").ln();
___.out(" */").ln();
___.out(" @Override").ln();
___.out("public int hashCode() {").ln();
___.dl();
if ($if(type.isUsePrehashed())) {
    __.dl();___.ln();
___.out(" * @return hashCode value").ln();
___.out(" */").ln();
___.out(" @Override").ln();
___.out("public int hashCode() {").ln();
___.out(" */");
___.dl();
if ($if(type.isUsePrehashed())) {
    __.dl();___.ln();
}
__out("  return hashCode;").ln();
__out("  ");
} else if ($if($(not, getters))) {
  __dl();__ln();
__out("  return 0;").ln();
__out("  ");
} else if ($if(type.isUseLazyhash())) {
  __dl();__ln();
__out("  int h = this.hashCode;").ln();
__out("  if (h == 0) {".ln();
__out("    h = ");
$(__, disambiguateAccessor, type, "computeHashCode");
__out("();").ln();
__out("  this.hashCode = h;").ln();
__out("  }").ln();
__out("  return h;").ln();
__out("  ");
}
else {
  __dl();__ln();
$(__, computeHashCodeBody);
__ln();
__out("  ");
}
__dl();__ln();
__out("}").ln();
__out("  ");
__dl();
if ($if($(type.isCacheHash(), and, getters)) {
  __dl();__ln();
  __ln();
__out("private int ");
$(__, disambiguateAccessor, type, "computeHashCode");
__out("();").ln();
$(__, computeHashCodeBody);
__ln();
__out(" ");
__out(" ");
}
__dl();__ln();
}
__dl();__ln();
__dl();_it1.index++;
_it1.first = false;
}
org.immutables.generator.Templates.Invokable generateToString() { return generateToString; }
private final org.immutables.generator.Templates.Invokable generateToString = new FragmentDispatch(1, 46);
void _t46__generateToString(org.immutables.generator.Templates.Invokation __) {
    __.dl(); final org.immutables.value.processor.meta.ValueType type = __cast(__.param(0));
    __.ln();
    __.dl();
    if ($if($not(type.isToStringDefined))) {
        __.dl(); __.ln();
        __.ln();
        __.out("/**").ln();
        __.out(" * Prints the immutable value @code "{type.name()}"\n");
        __.out(" */");
        __.dl();
        if ($if(type.getEquivalenceAttributes())) {
            __.dl(); __.out(" with attribute values");
        }
        __.dl(); __.out(".").ln();
        __.out(" * @return A string representation of the value\n");
        __.out(" */\n");
        __.out("@Override\n");
        __.out("public String toString() \n");
        __.dl();
        if ($if($not(type.getEquivalenceAttributes()))) {
            __.dl(); __.ln();
            __.out(" ");
            __.dl();
            if ($if(type.isAnnotationType())) {
                __.dl(); __.ln();
                __.out(" return \"";)
                $__().type.name();
                __.out("\":\n");
                __.out(" ");
            } else {
                __.dl(); __.ln();
                __.out(" return \"\n");
                $__().type.name();
                __.out("\n\n");
                __.out(" ");
            }
        } else {
            __.dl(); __.ln();
            __.out(" return \"\n");
            $__().type.name();
            __.out("\n\n");
            __.out(" ");
        }
    }
}

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} else if ($if(type.isGenerateJdkOnly())) {
  __.dl();__.ln();
  __.out(" ");
  __.dl();

  if ($if(type.hasOptionalAttributes())) {
    __.dl();__.ln();
    __.out(" ");
    $(__, flag.set());
    __.dl();__.ln();
    __.out(" java.lang.StringBuilder builder = new java.lang.StringBuilder(");
    __.dl();

    if ($if(type.isAnnotationType())) {
      __.dl();__.out("" @");
      $(__, type.name());
      __.out("(@");
    } else {
      __.dl();__.out("\" ");
      $(__, type.name());
      __.out("\" ");
    }

  } else {
    __.dl();__.out("\" ");
    $(__, type.name());
    __.out("\" ");
  }

  __.dl();__.out("\"").ln();
  __.out(" ");
  final org.immutables.generator.Templates.Invokable startLen = new
  org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __.dl();final org.immutables.generator.Templates.Invokable startLen = this;
      $(__, output.length, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
          __.dl();___.dl();
          if ($if(type.isAnnotationType())) {
            __.dl();__.out("@ ");
            $(__, type.name());
            __.out("(@");
          } else {
            __.dl();$(__, type.name());
            __.out(" @/");
          }

        } else {
          __.dl();$(__, type.name());
          __.out(" ");
        }

      } };
      __.dl();___.dl();
    });
    __.dl();
  } else {
    __.dl();__.ln();
    __.out(" ");
```java
if (flag.is) {
    __.dl();
    __.out("if (builder.length() > ");
    $(__, startLen);
    __.out(" ");
}

__.dl();
__.out("builder.append\("", ");

__.dl();
__.ln();
__.out("    builder.append(");
$__(__, v.names.raw);
__.out("=").append(");__

{final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
 final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new
 org.immutables.generator.Templates.Fragment(0) {
     @Override public void run(org.immutables.generator.Templates.Invokation __) {
         __.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
         $(__, v.name());
         __.dl();
     }__);__.dl();___.dl();
    if (a_maybeMasked_1900495401.getRedactedMask()) {
        __.dl();$__(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
    } else {
        __.dl();$__(__, value_maybeMasked_1900495401);
    }
    __.dl();
    __.out(");___.ln();
} else if (v.isOptionalType()) {
    __.dl();___.ln();
    __.out(" ");___.ln();
    __.out(" ");
} else if ($if(v.isOptionalType())) {
    __.dl();___.ln();
    __.out(" if (")
    $(__, v.name());
    __.out(" ");
    {final org.immutables.value.processor.meta.ValueAttribute a_optionalPresent_7673529996 = $cast(v);
     __.dl();
     if ($if($(a_optionalPresent_7673529996.isDefined, or,
     a_optionalPresent_7673529996.isFugueOptional(), or,
     a_optionalPresent_7673529996.isJavaslangOptional())) {
        __.dl();___.out("isDefined");
    } else {
        __.dl();___.out("isPresent");
    }
````
}
__.dl();__.out("()");
}
__.out(") {").ln();
__.out(" ");
__.dl();
if ($if($(not, _it1.first))) {
__.dl();__.dl();
if ($if(flag.is)) {
__.dl();__.out("if (builder.length() > ");
$(__, startLen);
__.out(") ");
}
__.dl();__.out("builder.append(\", \");");
}
__.dl();__.ln();
__.out(" builder.append(\"");
$(__, v.names.raw);
__.out("=\").append(");
{final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new
org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
__.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
$(__, v.name());
__.out(".");
$(__, optionalGet, v);
__.dl();
}};__.dl();__.dl();
if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
__.dl();$(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
} else {
__.dl();$(__, value_maybeMasked_1900495401);
}
__.dl();
}
__.out(");").ln();
__.out(" }").ln();
__.out(" ");
} else {
__.dl();__.ln();
__.out(" ");

Open Source Used In kASA v1.5 2195


if (!$if($not, _it1.first)) {
  __.dl();
  if ($if(flag.is)) {
    __.dl();
    __.out("if (builder.length() > ");
    $(__, startLen);
    __.out(" ");
  }
  __.dl();
  builder.append("\n");
}

___.dl();$(__, flag.clear());
___.ln();
___.out(" builder.append("\n");
$(__, v.names.raw);
___.out("=").append("");
{final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
 final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new
 org.immutables.generator.Templates.Fragment(0) {
   @Override public void run(org.immutables.generator.Templates.Invokation __) {
     __.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
     $(__, v.name());
     __.dl();
   }};___.dl();
  if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
    __.dl();$(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
  } else {
    __.dl();$(__, value_maybeMasked_1900495401);  
  }
}

___.dl();
___.out(" ").ln();
___.out(" ");

___.dl();___.ln();
___.out(" ");
___.dl();___.index++;
_it1.first = false;
}}
___.dl();___.ln();
___.out(" return builder.append(");___.dl();
if ($if(type.isAnnotationType())) {
  __.dl();___.out("\n");

} else {
  __dl();__out("\n\n" +");
}

__dl();__out("\n\n" +");

} else {
  __dl();__ln();
  __out("  return ");
  __dl();
  if ($if(type.isAnnotationType())) {
    __dl();__out("\n\n" +");
    $(__, type.name());
    __out("\n\n" +");
  } else {
    __dl();__out("\n\n" +");
    $(__, type.name());
    __out("\n\n" +");

  }
  __dl();__ln();
  __out("  ");

{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
 for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getEquivalenceAttributes())) {
  __dl();__ln();
  __out("  ");
  __dl();
  if ($if(v.isRedactedCompletely())) {
    __dl();__dl();__ln();
    __out("  ");
  } else if ($if(v isArrayType())) {
    __dl();__ln();
    __out("  +\n\n" +");
    __dl();
    if ($if($not, _it1.first))) {
      __dl();__out("  ");
    }
  }
  __dl();$(__, v.names.raw);
  __out("=" + ");

{final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
 final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
  }
};
}
if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
    __.dl();__$(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
} else {
    __.dl();__$(__, value_maybeMasked_1900495401);
}
___.ln();
___.out("      ");
else if ($if(v.isEncoding())) {
    __.dl();___.ln();
    __.out("      + " + \\
    ___.dl();
    if ($if($if(v.names.raw))) {
        __.dl();___.out("", ");
    }
    ___.dl();__$(__, v.names.raw);
    __.out("=" + "");
} final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
        __.out("/");
        $___.rr.string(), v);
        __.out("/");
        __.dl();
    });___.dl();___.dl();
    if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
        __.dl();__$(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
    } else {
        __.dl();__$(__, value_maybeMasked_1900495401);
    }
};___.dl();
} else if ($if(v.names.raw)) {
    __.dl();___.ln();
    __.out("      ");
} else if ($if(v.isEncoding())) {
    __.dl();___.ln();
    __.out("      + " + \\
    ___.dl();
    if ($if($if(v.names.raw))) {
        __.dl();___.out("", ");
    }
    ___.dl();__$(__, v.names.raw);
    __.out("=" + "");
} final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
        __.out("/");
        $___.rr.string(), v);
        __.out("/");
        __.dl();
    });___.dl();___.dl();
    if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
        __.dl();__$(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
    } else {
        __.dl();__$(__, value_maybeMasked_1900495401);
    }
};___.dl();
} else if ($if(v.names.raw)) {
    __.dl();___.ln();
    __.out("      ");
} else {
    __.dl();___.ln();
    ___.out("    + \"\"");
    __.dl();
    if ($if($not, __.it1.first)) {
        __.dl();__.out("", ");
    }
    __.dl();$___.v.names.raw;
    __.out("=\" + ");
    final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
    final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new
    org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
            $$(___.v.name());
            __.dl();
        }
        __.dl();___.dl();
        if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
            __.dl();$(___.literal.string, a_maybeMasked_1900495401.getRedactedMask());
        } else {
            __.dl();$(___.value_maybeMasked_1900495401);
        }
        __.dl();
    };
    __.ln();
    __.out("    ");
    __.dl();___.ln();
    __.out("\"");
    __.dl();___.it1.index++;
    __.it1.first = false;
}
___.ln();
___.out(" + ");
___.dl();
if ($if(type.isAnnotationType())) {
    __.dl();___.out("\"");
} else {
    __.dl();___.out("\"");
}
___.dl();___.out(";").ln();
___.out(" ");
Open Source Used In kASA v1.5 2200
__out(")
__out(" ");
} else if ($if(v.isArrayType())) {
__dl();__in();
__out("  ");
$__ = v.names.raw;
__out(" ");
} else if ($if(v.isJdkOptional())) {
__dl();__dl();
__dl();__dl();
__dl();
__dl();
$__ = v.name();
__out(" ");
} else if ($if(v.isJdkOptional())) {
__dl();__dl();__dl();
__dl();
__dl();
$__ = v.name();
__dl();
Open Source Used In kASA v1.5 2202

```java
__.dl();
__.out("\n").ln();
__.out(" ");
} else if ($if(v.isGuavaOptional())) {
  __.dl();___.ln();
  ___.out(" .add("\n");
  $(___. v.names.raw);
  ___.out("\n", "");
  [final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
   final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new
   org.immutables.generator.Templates.Fragment(0) {
     @Override public void run(org.immutables.generator.Templates.Invokation __) {
       __.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
       $(___. v.name());
       __.out(" .orNull()");
       __.dl();
     }]);___.dl();
   if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
     ___.dl();$(___. literal.string, a_maybeMasked_1900495401.getRedactedMask());
   } else {
     ___.dl();$(___. value_maybeMasked_1900495401);
   }
  }
}

else if ($if(v.isOptionalType())) {
  __.dl();__.ln();
  ___.out(" ");
} else if ($if(v.isOptionalType())) {
  __.dl();___.ln();
  ___.out(" .add("\n");
  $(___. v.names.raw);
  ___.out("\n", "");
  [final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);
   final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = new
   org.immutables.generator.Templates.Fragment(0) {
     @Override public void run(org.immutables.generator.Templates.Invokation __) {
       __.dl();final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
       $(___. v.name());
       __.out(".");
       $(___. optionalPresent, v);
       __.out(" ? ");
       $(___. v.name());
       __.out(".");
       $(___. optionalGet, v);
       __.out(" : null");
       __.dl();
     }];___.dl();
  }
}
```

__Open Source Used In kASA v1.5 2202__
if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
    $(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
} else {
    $(__, value_maybeMasked_1900495401);
}

if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
    $(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
} else {
    $(__, value_maybeMasked_1900495401);
}

@Override public void run(org.immutables.generator.Templates.Invocation __) {
    final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = $cast(v);
    final org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            final org.immutables.generator.Templates.Invokable value_maybeMasked_1900495401 = this;
            $(__, v.name());
        }
    }
    if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
        $(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
    } else {
        $(__, value_maybeMasked_1900495401);
    }
}

if ($if(a_maybeMasked_1900495401.getRedactedMask())) {
    $(__, literal.string, a_maybeMasked_1900495401.getRedactedMask());
} else {
    $(__, value_maybeMasked_1900495401);
}

final org.immutables.value.processor.meta.ValueAttribute a_maybeMasked_1900495401 = $cast(v);

_its��.index++;
_its��.first = false;

}}

_its��.index++;
_its��.first = false;

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_its��.index++;
_its��.first = false;

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_its��.index++;
_its��.first = false;

}}
org.immutables.generator.Templates.Invokable generateDerivedConstruction() { return
generateDerivedConstruction; }
private final org.immutables.generator.Templates.Invokable generateDerivedConstruction = new
FragmentDispatch(2, 47);
void _t47__generateDerivedConstruction(org.immutables.generator.Templates.Invokation __) {
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  final java.lang.Iterable<org.immutables.value.processor.meta.ValueAttribute> constructorArgs =
  $cast(__.param(1));
  if ($if($(a.isGenerateDefault, or, a.isGenerateDerived))) {
    if ($if(a.isEncoding())) {
      ...
    } else if ($if(a.isEncoding() { ...
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  }
} else if ($if(a.isEncoding())) {
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} else if ($if(a.isEncoding())) {
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} else if ($if(a.isEncodin...
if ($if(type.isGenerateSafeDerived())) {
    final org.immutables.generator.Templates.Invokable shim = new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            $(__, disambiguateField, type, "initShim");
        }
    };__dl();__ln();
    final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute a : $in(type.getImplementedAttributes())) {
        if ($if($(a.isGenerateDefault, or, a.isGenerateDerived))) {
            __dl();__ln();
            if ($if(a.isEncoding())) {
                $(__, rr.shimAssignExtract(), a, shim);
            } else if ($if($(a, notin, constructorArgs))) {
                __out("this.");
                $(__, a.names.get);
                __out("();");
            }
        }
        __dl();__ln();
        _it1.index++;
        _it1.first = false;
    }
}
org.immutables.generator.Templates.Invokable generateAfterConstruction() { return generateAfterConstruction; }
private final org.immutables.generator.Templates.Invokable generateAfterConstruction = new FragmentDispatch(2, 48);

void _t48__generateAfterConstruction(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    final java.lang.Boolean usingBuilder = $if(__.param(1));
    __.ln();
    __.out("  ");
    __.dl();
    if ($if(type.isUsePrehashed())) {
        __.dl();___.out("this.hashCode = ");
        __.dl();
        if ($if(type.isHashCodeDefined)) {
            __.dl();___.out("super.hashCode()");
        } else {
            __.dl();$(__, disambiguateAccessors, type, "computeHashCode");
            __.out("()");
        }
    } else {
        __.dl();$(__, disambiguateAccessors, type, "computeHashCode");
        __.out("()");
    }
    __.dl();___.out(";").ln();
    __.out("  ");
}

___.dl();___.ln();
___.out("  ");
___.dl();
if ($if(type.isGenerateOrdinalValue())) {
    __.dl();___.ln();
    __.out("this.ordinal = 0;".ln();
    __.out("  ");
    __.dl();
    if ($if(usingBuilder)) {
        __.dl();___.ln();
        __.out("this.domain = builder.domain;".ln();
        __.out("  ");
    } else {
        __.dl();___.ln();
    }
}
if ($if(type.isGenerateSafeDerived())) {
___.dl();____.ln();
___.out("this.");
$___.disambiguateField, type, "initShim");
___.out(" = null;");ln();
___.out(" ");
}
___.dl();____.ln();
___.dl();
}
}

org.immutables.generator.Templates.Invokable generateReturnCopy() { return generateReturnCopy; }

private final org.immutables.generator.Templates.Invokable generateReturnCopy = new FragmentDispatch(3, 49);
void _t49__generateReturnCopy(org.immutables.generator.Templates.Invocation __) {
___.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
final org.immutables.value.processor.meta.ValueAttribute modified = $cast(__.param(1));
final java.lang.String expression = __.param(2).toString();
$___.generateReturnCopyRaw, type, modified.name(), expression);
___.dl();
}];

org.immutables.generator.Templates.Invokable generateReturnCopyRaw() { return generateReturnCopyRaw; }

private final org.immutables.generator.Templates.Invokable generateReturnCopyRaw = new FragmentDispatch(3, 50);
void _t50__generateReturnCopyRaw(org.immutables.generator.Templates.Invocation __) {
___.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
final java.lang.String modified = __.param(1).toString();
final java.lang.String expression = __.param(2).toString();
___.ln();
___.out("return ");
{final org.immutables.value.processor.meta.ValueType type_validated_1881291508 = $cast(type);
final java.lang.Boolean qualified_validated_1881291508 = $cast($false);
final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invocation __) {

}];

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private final org.immutables.generator.Templates.Invokable expression_validated_1881291508 = this;

$__().out("new ");
$(___.type.typeImmutable().relativeRaw());
$(___.type.generics().diamond());
$__().out("(");
$(___.output.linesShortable, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
        __.dl();__.ln();
        __.out("    ");
        __.dl();
        if ($if(type.isSynthCopyConstructor())) {
            __.dl();__.out("this,").ln();
            __.out("    ");
        }
    }
});
$__().dl();

for (final org.immutables.value.processor.meta.ValueAttribute a : Sin(type.getImplementedAttributes())) {
    if ($if($not, a.isGenerateDerived())) {
        __.dl();__.dl();
        if ($if($not, _it1.first)) {
            __.dl();__.out(",").ln();
            __.out("    ");
        }
    }
    __.dl();__.dl();
    if ($if(a.name(), eq, modified)) {
        __.dl();$(___.expression);
    } else {
        __.dl();__.out("this.");
        __.dl();
        if ($if(a.hasVirtualImpl())) {
            __.dl();$___.a.names.get();
            __.out("()");
        } else {
            __.dl();$__.a.name();
        }
    }
}
$___.it1.first = false;
});
if ($if($if(type_validated_1881291508.isUseValidation())) {
    __.dl();
    if ($if(qualified_validated_1881291508)) {
        __.dl();
        __.out(.);
    }
    __.dl();
    __.out("validate(");
    $(__, expression_validated_1881291508);
    __.out(");");
}
___.dl();
}
___.out(";").ln();
___.dl();
}
___.out(";");ln();
___.dl();
};

org.immutables.generator.Templates.Invokable generateReturnCopyContextual() { return generateReturnCopyContextual; }
private final org.immutables.generator.Templates.Invokable generateReturnCopyContextual = new FragmentDispatch(2, 51);
void _t51__generateReturnCopyContextual(org.immutables.generator.Templates.Invokation __) {
    __.dl();
    final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    final org.immutables.value.processor.meta.ValueAttribute modified = $cast(__.param(1));
    __.ln();
    {final org.immutables.value.processor.meta.ValueType type_generateReturnCopy_879511243 = $cast(type);
     final org.immutables.value.processor.meta.ValueAttribute modified_generateReturnCopy_879511243 = $cast(modified);
     final java.lang.String expression_generateReturnCopy_879511243 = $cast("newValue");
     $(__, generateReturnCopyRaw, type_generateReturnCopy_879511243, modified_generateReturnCopy_879511243.name(), expression_generateReturnCopy_879511243);
    }
    __.ln();
    __.dl();
};

org.immutables.generator.Templates.Invokable generateReturnBuilderConstructed() { return generateReturnBuilderConstructed; }
private final org.immutables.generator.Templates.Invokable generateReturnBuilderConstructed = new FragmentDispatch(1, 52);
void _t52__generateReturnBuilderConstructed(org.immutables.generator.Templates.Invokation __) {
org.immutables.generator.Templates.Invokable generateCopyMethods() { return generateCopyMethods; }
private final org.immutables.generator.Templates.Invokable generateCopyMethods = new FragmentDispatch(1, 53);
void _t53__generateCopyMethods(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    __.ln();
    __.dl();
    if ($if(type.isUseCopyMethods())) {
        __.dl();___.ln();
        ___.out("  ");
        ___.dl();
        final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
            ___.dl();___.ln();
            ___.out("    ");
            ___.dl();
            if ($if(v.isEncoding())) {
                ___.dl();___.ln();
                $(__, rr.copyMethods(), v, new org.immutables.generator.Templates.Fragment(0) {
                    @Override public void run(org.immutables.generator.Templates.Invokation __) {
                        ___.dl();___.ln();
                        $(__, generateReturnCopyContextual, type, v);
                        ___.ln();
                        ___.dl();
                    }
                });
            } else if ($if(v.isArrayType())) {
                ___.dl();___.ln();
                ___.ln();
                ___.out("    ");
                ___.ln();
                ___.out("      ");
                ___.ln();
                ___.out("      ");
                ___.ln();
            }
        }
    } else if ($if(v.isEncoding())) {
        ___.dl();___.ln();
        $(__, rr.copyMethods(), v, new org.immutables.generator.Templates.Fragment(0) {
            @Override public void run(org.immutables.generator.Templates.Invokation __) {
                ___.dl();___.ln();
                $(__, generateReturnCopyContextual, type, v);
                ___.ln();
                ___.dl();
            }
        });
    } else if ($if(v.isArrayType())) {
        ___.dl();___.ln();
        ___.ln();
        ___.out("      ");
        ___.ln();
        ___.out("      ");
        ___.ln();
    } else {
        ___.dl();$(__, expression_validated_1881291508);
        ___.out("\n");
    }
    ___.dl();
}
__out("",).ln();
__out(" * The array is cloned before being saved as attribute values.").ln();
__out(" * @param elements The non-null elements for ");
$___.v.name();
__ln();
__out(" * @return A modified copy of { @code this @} object").ln();
__out(" */");ln();
{final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
  __dl();
  if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or, a_varargsSafety_1368213209.hasTypeVariables)) {
    __dl();__out("@SafeVarargs @SuppressWarnings("varargs")");
  }
  __dl();
}

{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
  __dl();
  if ($if(a_deprecation_286924011.deprecated)) {
    __dl();__out("@Deprecated");
  }
  __dl();
}
__ln();
__out("public final ");
$___.type.typeImmutable().relative();
__out(" ");
$___.v.names.with();
__out("(");
$___.v.atNullability();
$___.v.getElementType();
__out("... elements ").ln();
__out(" ");
$___.v.atNullabilityLocal();
$___.immutableImplementationType, v);
__out(" new Value = ");
__dl();
if ($if(v.isNullable())) {
  __dl();__out("elements == null ? null : ");
}
__dl();__out("elements.clone();").ln();
__out(" ");
$___.generateReturnCopyContextual, type, v);
__ln();
private final...

if ($if(v.isNullable())) {
  __dl();__ln();
  __out("if (elements == null) {");__ln();
  __out("    ");__ln();

  } else if ($if(v.isCollectionType())) {

    __out("/**").ln();
    __out(" * Copy the current immutable object with elements that replace the content of ");
    {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
     $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
    }
    __out("*/").ln();
    __out(" * @param elements The elements to set").ln();
    __out(" * @return A modified copy of { @code this } object").ln();
    __out(" */").ln();
    {final org.immutables.value.processor.meta.ValueAttribute a_varargsSafety_1368213209 = $cast(v);
     __dl();
     if ($if($(a_varargsSafety_1368213209.isNonRawElementType(), or,
      a_varargsSafety_1368213209.hasTypeVariables))) {
       __dl();__out("@SafeVarargs @SuppressWarnings("varargs")");
     }
     __dl();
    }
    __ln();
    {final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
     __dl();
     if ($if(a_deprecation_286924011.deprecated)) {
       __dl();__out("@Deprecated");
     }
     __dl();
    }
    __ln();
    __out("public final ");
    $(__, type.typeImmutable().relative());
    __out(" ");
    $(__, v.names.with);
    __out("() ");
    $(__, v.atNullability());
    $(__, v.getUnwrappedElementType());
    __out("... elements ");__ln();
    __out(" ");
    __dl();
    if ($if(v.isNullable())) {
      __dl();__ln();
      __out(" if (elements == null) ");__ln();
      __out(" ");
    }
{final org.immutables.value.processor.meta.ValueType type_generateReturnCopy_879511243 = $cast(type);
  final org.immutables.value.processor.meta.ValueAttribute modified_generateReturnCopy_879511243 = $cast(v);
  final java.lang.String expression_generateReturnCopy_879511243 = $cast("null");
  $(__, generateReturnCopyRaw, type_generateReturnCopy_879511243, modified_generateReturnCopy_879511243.name(), expression_generateReturnCopy_879511243);
}

__.ln();
__.out(" } ").ln();
__.out(" ");

}
__.dl();__.ln();
__.out(" ");
__.dl();
if ($if($(v.isGenerateJdkOnly(), and, v.isPrimitiveElement()))) {
  __.dl();__.ln();
  __.out(" java.util.ArrayList");
  $(__, v.getWrappedElementType());
  __.out(" > wrappedList = new java.util.ArrayList");
  $(__, asDiamond, v.getWrappedElementType());
  __.out("(elements.length); ").ln();
  __.out(" for ");
  $(__, v.getUnwrappedElementType());
  __.out(" element : elements ");
  __.out(" wrappedList.add(element); ").ln();
  __.out(" ");
  __.out(" ");
  $(__, immutableImplementationType, v);
  __.out(" newValue = ");
  $(__, immutableCollectionCopyOfSafe, v, $$false, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __.dl();__.out("wrappedList");
      __.dl();
    }});
  __.out(";");
  __.ln();
  __.out(" ");
} else {
  __.dl();__.ln();
  __.out(" ");
  $(__, v.atNullabilityLocal());
  $(__, immutableImplementationType, v);
  __.out(" newValue = ");
  $(__, valueFromValue, v, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __.dl();__.dl();
    }});
if ($if(v.wrapArrayToIterable())) {
    __.dl();$.arrayAsList(v, "elements");
}
else {
    __.dl();___.out("elements");
}
___.dl();___.dl();
}));
___.out(";").ln();
___.out(" ");
___.dl();___.ln();
___.out(" ");
$(__. generateReturnCopyContextual, type, v);
___.ln();
___.out(""").ln();
___.ln();
___.out("/**").ln();
___.out("* Copy the current immutable object with elements that replace the content of ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
___.out(".").ln();
___.out("* A shallow reference equality check is used to prevent copying of the same value by returning
{ @code this }").ln();
___.out("* @param elements An iterable of ");
$___.v.name();
___.out(" elements to set").ln();
___.out("* @return A modified copy of { @code this } object").ln();
___.out("*"").ln();
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
___.dl();
if ($if(a_deprecation_286924011.deprecated)) {
    __.dl();___.out("@Deprecated");
}
___.dl();
___.ln();
___.out("public final ");
$(___. type.typeImmutable().relative());
___.out(" ");
$(___.v.names.with);
___.out("(");
$(___.v.atNullability());
__out("Iterable<");
$___.v.getConsumedElementType();
__out(">");
__out(" elements) {".ln();
$___.v.name();
__out(" == elements) return this;");
__out(" ");
$___.atanNullabilityLocal();
$___.immutableImplementationType, v;
__out(" newValue = ");
__dl();
if ($if(v.isNullable())) {
__dl();__out("elements == null ? null : ");
}
__dl();{final org.immutables.value.processor.meta.ValueAttribute a_immutableCollectionCopyOf_975579906 = $cast(v);
 final java.lang.String expression_immutableCollectionCopyOf_975579906 = $cast("elements");
$___.immutableCollectionCopyOfSafe, a_immutableCollectionCopyOf_975579906, $true,
expression_immutableCollectionCopyOf_975579906);
}
__out(";").ln();
__out(" ");
$___.generateReturnCopyContextual, type, v);
__ln();
__out(" ");
__out(" ");
} else if ($if(v.isOptionalType())) {
__dl();__ln();
__ln();
__out("/**");
__out(" * Copy the current immutable object by setting a <i>present</i> value for the optional ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
}
__out(" * @param value The value for ");
$___.v.name();
__dl();
if ($if(v.isOptionalAcceptNullable())) {
__dl();__out(" , [@code null] is accepted as [@code ");
{final org.immutables.value.processor.meta.ValueAttribute a_optionalEmpty_1867206284 = $cast(v);
$___.a_optionalEmpty_1867206284.getRawType());
__out(".");
__dl();
if ($if(a_optionalEmpty_1867206284.isJdkOptional())) {
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```java
__dl();__out("empty");
} else if ($(a_optionalEmpty_1867206284.isFugueOptional(), or,
a_optionalEmpty_1867206284.isJavaslangOptional())) {
    __dl();__out("none");
} else {
    __dl();__out("absent");
}

__dl();__out("()");
}
__out("}";
}
__dl();__ln();
__out("return A modified copy of {code this} object").ln();
__out("*/").ln();
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __dl();
    if ($(a_deprecation_286924011.deprecated)) {
        __dl();$(__, atNullable, a_deprecation_286924011);
    }
    __dl();
    __ln();
__out("public final ");
$__$.type.typeImmutable().relative();
__out(" ");
$__$.v.names.with();
__out("()");
{final org.immutables.value.processor.meta.ValueAttribute a_unwrappedOptionalType_1615308684 = $cast(v);
    __dl();
    if ($(a_unwrappedOptionalType_1615308684.isOptionalType(), and,
a_unwrappedOptionalType_1615308684.isOptionalAcceptNullable())) {
        __dl();$(__, atNullable, a_unwrappedOptionalType_1615308684);
        $(___.a_unwrappedOptionalType_1615308684.getWrappedElementType());
    } else {
        __dl();$(___.a_unwrappedOptionalType_1615308684.getUnwrappedElementType());
    }
    __dl();
}
__out(" value ").ln();
    __dl();
    if ($(v.isJdkOptional())) {
```

if ($if($v.isPrimitiveElement(), or, $(v.isJdkSpecializedOptional(), or, v.isOptionalAcceptNullable()))) {
    __.dl();__.ln();
    __.out(" ");
    __.dl();
} else {
    __.dl();__.ln();
    __.out(" ");
    $(__, immutableImplementationType, v);
    __.out(" newValue = value;");.ln();
    __.out(" ");
}

if ($if(v_maybeCopyOf_1779456614.isGenerateImmutableCopyOf)) {
    __.dl();__.out("immutableCopyOf(");
    $(__, expression_maybeCopyOf_1779456614);
    __.out(")");
} else {
    __.dl();
}

if ($if(v_maybeCopyOf_1779456614.isGenerateImmutableCopyOf)) {
    __.dl();__.out("immutableCopyOf(");
    $(__, expression_maybeCopyOf_1779456614);
    __.out(")");
} else {
    __.dl();$
}
$(__, objectsEqual, type);
  __out("(this.");
$(__, v.name());
  __out(".newValue) return this;").ln();
  __out(" -");
}
  else {
    __dl();__ln();
    __out(" if (this.");
$(__, v.name());
    __out(" == newValue) return this;").ln();
    __out(" -");
  }
}
  __dl();__ln();
  __out(" -");
$(__, generateReturnCopyContextual, type, v);
  __ln();
}
else {
  __dl();__ln();
  __out(" -");
$(__, immutableImplementationType, v);
  __out(" newValue = ");
  {final org.immutables.value.processor.meta.ValueAttribute a_optionalOf_332927268 = $cast(v);
    __dl();
    if ($if($(not, a_optionalOf_332927268.isOptionalAcceptNullable()))) {
      __dl();__dl();
      if ($if(a_optionalOf_332927268.isFugueOptional(), or, a_optionalOf_332927268.isJavaslangOptional())) {
        __dl();__out("some");
      } else if (a_optionalOf_332927268.isJdkOptional()) {
        __dl();__out("ofNullable");
      } else if (a_optionalOf_332927268.isFugueOptional()) {
        __dl();__out("option");
      } else if (a_optionalOf_332927268.isJavaslangOptional()) {
        __dl();__out("of");
      } else {
        __dl();__out("fromNullable");
      }
    } else {
      __dl();__out("if (a_optionalOf_332927268.isOptionalAcceptNullable()) {
        __dl();__dl();
        if ($if(a_optionalOf_332927268.isJdkOptional()) {
          __dl();__out("ofNullable");
        } else if (a_optionalOf_332927268.isFugueOptional()) {
          __dl();__out("option");
        } else if (a_optionalOf_332927268.isJavaslangOptional()) {
          __dl();__out("of");
        } else {
          __dl();__out("fromNullable");
        }
      } else {
        __dl();__out("if (a_optionalOf_332927268.isOptionalAcceptNullable()) {
          __dl();
          if ($if(a_optionalOf_332927268.isJdkOptional()) {
            __dl();__out("ofNullable");
          } else if (a_optionalOf_332927268.isFugueOptional()) {
            __dl();__out("option");
          } else if (a_optionalOf_332927268.isJavaslangOptional()) {
            __dl();__out("of");
          } else {
            __dl();__out("fromNullable");
          }
        } else {
          __dl();
        }
      }
    }
  }
}
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__out(" ");

} else {
  __dl();__ln();
  __out(" if (this.");
  $(__, v.name());
  __out(".");
  {final org.immutables.value.processor.meta.ValueAttribute a_optionalPresent_767352996 = $cast(v);
   __dl();
   if ($if($(a_optionalPresent_767352996.isFugueOptional(), or,
       a_optionalPresent_767352996.isJavaslangOptional()))) {
     __dl();__out("isDefined");
   } else {
     __dl();__out("isPresent");
   }
   __dl();__out("()");  
   __out(" & & this.");
  $(__, v.name());
  __out(".");
  }final org.immutables.value.processor.meta.ValueAttribute a_optionalGet_1683307643 = $cast(v);
  __dl();
  if ($if(a_optionalGet_1683307643.isJdkSpecializedOptional())) {
    __dl();__out("getAs");
    $(__, toUpper, a_optionalGet_1683307643.getElementType());
  } else {
    __dl();__out("get");
  }
  __dl();__out("()");  
  __out(" == value) return this;");ln();
  __out(" ");
}
__dl();__ln();
__out(" ");
$(__, generateReturnCopyContextual, type, v);
__ln();
}
__dl();__ln();
__out(" ");

```java
    __ln();
    __out("/**").ln();
    __out(" * Copy the current immutable object by setting an optional value for the ");
    {final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
    $(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);
    }
    __out(" attribute.").ln();
    __dl();
    if ($if($(v.isJdkOptional(), and, v.hasSimpleScalarElementType()))) {
        __dl(); __ln();
        __out(" * An equality check is used on inner nullable value to prevent copying of the same value by returning
        {@code this}.").ln();
    } else if ($if(v.isJdkOptional())) {
        __dl(); __ln();
        __out(" * A shallow reference equality check is used on unboxed optional value to prevent copying of the
        same value by returning {@code this}.").ln();
    } else if ($if(v.hasSimpleScalarElementType())) {
        __dl(); __ln();
        __out(" * An equality check is used to prevent copying of the same value by returning {@code this}.").ln();
    } else {
        __dl(); __ln();
        __out(" * A shallow reference equality check on the optional value is used to prevent copying of the same
        value by returning {@code this}.").ln();
    }
    __dl(); __ln();
    __out(" * @param optional A value for ");
    $(__, v.name());
    __ln();
    __out(" * @return A modified copy of {@code this} object").ln();
    __out(" */").ln();
    $(__, suppressCovariantCastForOptional, v);
    __ln();
    {final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
    __dl();
    if ($if(a_deprecation_286924011.deprecated)) {
        __dl(); __out("@Deprecated");
    }
    __dl();
    }
    __ln();
    __out("public final ");
    $(__, type.typeImmutable().relative());
    __out(" ");
    $(__, v.names.with);
```
if (this.
{final org.immutables.value.processor.meta.ValueAttribute a_optionalPresent_767352996 = $cast(v);
__dl();__out("isDefined")
}
else {
__dl();__out("isPresent");

}
__dl();__out("()");

__out("&& this.");
$(__, v.name());
__out(".");
{final org.immutables.value.processor.meta.ValueAttribute a_optionalGet_1683307643 = $cast(v);
__dl();
if ($if(a_optionalGet_1683307643.isJdkSpecializedOptional())) {
__dl();__out("getAs");
$_($toUpper, a_optionalGet_1683307643.getElementType());
}
else {
__dl();__out("get");
}
__dl();__out("()");
```java
}__out(" == value.");
{final org.immutables.value.processor.meta.ValueAttribute a_optionalGet_1683307643 = $cast(v);
__dl();
if (SIf(a_optionalGet_1683307643.isJdkSpecializedOptional())) {
__dl();__out("getAs");
$(__, toUpper, a_optionalGet_1683307643.getElementType());
} else {
__dl();__out("get");
}
__dl();__out("()");
}
__out(") return this;").ln();
__out(" ");
}
__dl();__ln();
__out(" ");
{final org.immutables.value.processor.meta.ValueType type_generateReturnCopy_879511243 = $cast(type);
final org.immutables.value.processor.meta.ValueAttribute modified_generateReturnCopy_879511243 = $cast(v);
final java.lang.String expression_generateReturnCopy_879511243 = $cast("value");
$(__, generateReturnCopyRaw, type_generateReturnCopy_879511243, modified_generateReturnCopy_879511243.name(), expression_generateReturnCopy_879511243);
}
__ln();
__out(" */").ln();
__out(" ");
} else if ($if(v.isMapType())) {
__dl();__ln();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
final java.lang.String gE = $cast(v.getConsumedElementType());
final java.lang.String uK = $cast(v.getUnwrapped ElementType());
final java.lang.String wK = $cast(v.getWrappedElementType());
final java.lang.String uV = $cast(v.getUnwrappedSecondaryElementType());
final java.lang.String wV = $cast(v.getWrappedSecondaryElementType());
__dl();__ln();
__ln();
__out("/**").ln();
```
__out(" * Copy the current immutable object by replacing the ").ln();
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518565892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518565892, a_sourceDocRef_1518565892.names.raw);
}
__out(" map with the specified map.").ln();
__out(" * Nulls are not permitted as keys or values.").ln();
__out(" * A shallow reference equality check is used to prevent copying of the same value by returning
{@code this}").ln();
__out(" * @param entries The entries to be added to the ");
$(__, v.name());
__out(" @return A modified copy of {@code this} object").ln();
__out(" */").ln();
{final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
  __dl();__out(" @Deprecated");
}
__dl();
}
__ln();
__out("public final ");
$(__, type.typeImmutable().relative());
__out(" ");
$(__, v.names.with);
__out("(");
$(__, v.atNullability());
__dl();
if ($if(v.isMultimapType())) {
  __dl();$(__, guava);
  __out(".collect.Multimap");
}
else {
  __dl();__out("java.util.Map");
}
__dl();__out("<");
$(__, gE);
__out("", ? extends ");
$(__, wV);
__out(" > entries { ").ln();
__out(" if (this.");
$(__, v.name());
__out(" == entries) return this;");ln();
__out(" ");
$(__, v.atNullabilityLocal());
$(__, immutableImplementationType, v);
__out(" newVale = ");
$(__, valueFromValue, v, "entries");
__out(";".ln);
__out(" ");
$(__, generateReturnCopyContextual, type, v);
__ln();
__out("} ").ln();
__out(" ");
__dl();_it2.index++;
_it2.first = false;
}
__dl();__ln();
__out(" ");

} else {
__dl();__ln();
__ln();
__out("/** ").ln();
__out(" * Copy the current immutable object by setting a value for the ");
{final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$___.sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);

__out(" attribute.").ln();
__out(" ");
__dl();
if ($if($(v.isPrimitive(), and, v.isFloatType()))) {
__dl();__ln();
__out(" * A value strict bits equality used to prevent copying of the same value by returning [@code this]. ").ln();
__out(" ");
} else if ($if($(v.isPrimitive(), or, v.isEnumType()))) {
__dl();__ln();
__out(" * A value equality check is used to prevent copying of the same value by returning [@code this]. ").ln();
__out(" ");
} else if ($if$(v.hasSimpleScalarElementType(), or, v.isSuppressedOptional)) {
__dl();__ln();
__out(" * An equals check used to prevent copying of the same value by returning [@code this]. ").ln();
__out(" ");

} else {
__dl();__ln();
__out(" * A shallow reference equality check is used to prevent copying of the same value by returning [@code this]. ").ln();
__out(" ");

}


```java
__out("* @param value A new value for ");
$(__, v.name());
__dl();
if ($if(v.isNull()) {
  __dl();__out("(can be [code null])");
}
__dl();__ln();
__out("* @return A modified copy of the [code this] object").ln();
__out("*/").ln();

final org.immutables.value.processor.meta.ValueAttribute a_deprecation_286924011 = $cast(v);
__dl();
if ($if(a_deprecation_286924011.deprecated)) {
  __dl();__out("@Deprecated");
}
__dl();

if ($if(v.isFloat()) {
  __dl();__ln();
  __out(" if (Float.floatToIntBits(this.");
$(__, v.name());
__out(") == Float.floatToIntBits(value)) return this;");.ln();
__out(" ");
} else if ($if(v.isDouble()) {
  __dl();__ln();
  __out(" if (Double.doubleToLongBits(this.");
$(__, v.name());
__out(") == Double.doubleToLongBits(value)) return this;");.ln();
__out(" ");
} else if ($if($v.isPrimitive(), or, v.isEnumType()) {
  __dl();__ln();
  __out(" if (this.");
$(__, v.name());
__out(" == value) return this;");.ln();
```

__out("   ");
} else if ($if($(v.hasSimpleScalarElementType(), or, v.isSuppressedOptional))) {
    __dl();__ln();
    __out("   ");
    __dl();__ln();
    __out("   ");

} else {
    __dl();__ln();
    __out("   ");
    __dl();
    if ($if($v.attributeValueType, and, v.typeKind().isRegular())) {
        __dl();__ln();
        __out("   ");
        __dl();
        if ($if(v.isAttributeBuilder())) {
            __dl();__ln();
            __out("   ");
            __dl();
            if ($if(n_valueToBuilder_1442539515.isCopyMethodOnValueInstance())) {
                __dl();$(__, expression_valueToBuilder_1442539515);
                __out(".");
                $(__, n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod());
                __out("()");
            } else {
                __dl();$(__, n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod());
                __out("(");
                __out(""");
            }
        } else {
            __dl();$(__, expression_valueToBuilder_1442539515);
            __out(""");
        }
    } else {
        __dl();$(__, v.name());
        __out("== value) return this;");__ln();
        __out("   ");

    }
}


Open Source Used In kASA v1.5 2231
if ($if($(v.isNullable(), or, type.isGeneratePrivateNoargConstructor()))) {
    if (v.equals(value)) return this;
}

return newValue = value;
if ($if($v.isNullable(), or, type.isGeneratePrivateNoargConstructor())) {
  if ($if($objectsEqual, type);
      out("this.");
      v.name());
      out("newValue) return this;");ln();
      out(" ");
    } else {
      if ($if(this.");
      v.name());
      out("equals(newValue) return this;");ln();
      out(" ");
    }
  }
}

}$(__, generateReturnCopyContextual, type, v);
out(" ");
}

}
org.immutables.generator.Templates.Invokable defaultAnnotationValues() {
    return defaultAnnotationValues;
}

private final org.immutables.generator.Templates.Invokable defaultAnnotationValues = new FragmentDispatch(1, 54);

void _t54__defaultAnnotationValues(org.immutables.generator.Templates.Invokation __) {
    __dl();
    final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    __ln();
    if (defaultAnnotationValues) {
        __dl();
        final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        final java.util.List<org.immutables.value.processor.meta.ValueAttribute> defaults = $cast(type.getDefaultAttributes());
        __dl();
        if (defaults) {
            __dl();
            __ln();
            final org.immutables.generator.Templates.Iteration _it2 = new org.immutables.generator.Templates.Iteration();
            for (final org.immutables.value.processor.meta.ValueAttribute a : defaults) {
                __dl();
                __ln();
                __out("private static final ");
                __($__, a.getType());
                __out(" DEFAULT_VALUE_");
                __($__, toConstant, a.name());
                __out(";"),ln();
                __dl();
                _it2.index++;
                _it2.first = false;
            }
            __dl();
        }
        __ln();
        __out("static {"),ln();
        __out(" try {"),ln();
        __out(" ");
        __ln();
        __ln();
        __out(" private static final ");
        __($__, a.getName());
        __out(" DEFAULT_VALUE_");
        __($__, toConstant, a.name());
        __out(" =");ln();
        __out(" cast(");
        __($__, type.typeAbstract().relative());
        __out(".class.getDeclaredMethod("),ln();
        __out("\n"),ln();
        __out("\n");
        __dl();
        _it2.index++;
        _it2.first = false;
    }
}
__ln();
__out(" } catch(Exception e) {"),ln();
__out(" throw new ExceptionInInitializerError(e);"),ln();
__out(" }"),ln();
private final org.immutables.generator.Templates.Invokable forwardingEnclosingFactoryMethods = new FragmentDispatch(1, 55);
void _t55__forwardingEnclosingFactoryMethods(org.immutables.generator.Templates.Invocation __) {
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __out(" ");
  __dl();
  if ($if(type.constitution.isImplementationHidden())) {
    __dl();
    __out(" ");
    __dl();
    if ($if(type.isUseSingleton())) {
      __out("/**");
      __out(" * Returns a default immutable singleton value of ");
      $(__, type.name());
      __out(".");
      $(__, javadocGenerics, type);
      __out(" */");
      __out("public static");
      $(__, type.generics().def());
      __out(" ");
      $(__, type.typeValue().relative());
      __out(" ");
      $(__, type.factoryInstance().simple());
Open Source Used In kASA v1.5  2236
$(__, eachLine, type.getConstructorAnnotations());
__ln();
$(__, eachLine, type.constructorInjectedAnnotations());
__ln();
__out("public static");
$(__, type.generics().def());
__out(" ");
$(__, type.typeValue().relative());
__out(" ");
$(__, type.factoryOf().simple());
__out("\n");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
  __dl();
  __dl();
  if ($(not, _it1.first)) {
    __dl();
  }
  __dl();
  __out(" , ");
  __dl();
  __dl();
  __dl();
  if ($(not, _it1.first)) {
  }
  __dl();
  __out("\n");
  __out(" return ");
  __out("\n");
  $(__, type.factoryOf().simple());
  __out("\n");
  {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
   for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
     __dl();
     __dl();
     if ($(not, _it1.first)) {
     }
     __dl();
     __dl();
     if ($(not, _it1.first)) {
     }
     __dl();
     __out("\n");
     __out("\n");
     $(__, constructorAcceptType, v);
     __out("\n");
     __dl();
     __dl();
     __dl();
     __dl();
     __dl();
     __dl();
     _it1.index++;
     _it1.first = false;
   }
   __dl();
   __out("\n");
   __out(" return ");
   __out("\n");
   $(__, type.factoryOf().simple());
   __out("\n");
   {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta(ValueAttribute v : $in(type.getConstructorArguments())) {
      __dl();
      __dl();
      if ($(not, _it1.first)) {
      }
      __dl();
      __dl();
      if ($(not, _it1.first)) {
      }
      __dl();
      __out("\n");
      __out("\n");
      $(__, constructorAcceptType, v);
      __out("\n");
    }
    __dl();
    __dl();
    __dl();
    __dl();
    __dl();
    __dl();
    _it1.index++;
    _it1.first = false;
  }
  }
}
```java
    __.dl();___.out("\n");
    __.out("\n");

}
___.dl();____.ln();
___.ln();
___.out("/**\n");
___.out(" * Construct a new immutable { @code }\n");
$(__, type.name());
___.out(" } instance." ),ln();
$(__, javadocGenerics, type);
___.ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
    ___.dl();____.ln();
    ___.out(" * @param ");
    $(___, v.name());
    ___.out(" The value for the { @code }\n");
    $(___, v.name());
    ___.out(" } attribute" );
    ___.dl();
    if ($(v.isNull())) {
        ___.dl();____.out(" can be { @code null }\n");
    }
    ___.dl();____.ln();
    ___.dl();_it1.index++;   
    _it1.first = false;
}
}___.dl();____.ln();
___.out(" * @return An immutable ");
$(___, type.name());
___.out(" instance\n");
___.out(" */\n");
$(___, eachLine, type.getConstructorAnnotations());
___.ln();
$(___, eachLine, type.constructorInjectedAnnotations());
___.ln();
$(___, type.generics(),def());
___.out(" \n");
$(___, type.typeValue(),relative());
___.out(" \n");
$(___, type.factoryOf(),simple());
___.out("\n");
}final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
```

Open Source Used In kASA v1.5 2238
if ($if($not, _it1.first))) {
    __dl();__out(",");
}

$__();$(__, v.getConstructorParameterAnnotations());
$__();v.atNullability();
$__();constructorAcceptType, v);
__out(" ");
$__();v.name();
__dl();_it1.index++;
_it1.first = false;
}
__dl();__out(" ");ln();
__out(" return ");
$__();type.typeImmutable().relative();
__out(".");
$__();type.names().of();
__out(" ");
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
  for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getConstructorArguments())) {
    __dl();__dl();
    if ($if($not, _it1.first))) {
      __dl();__out(",");
    }
    __dl();$__();
    __dl();_it1.index++;
    _it1.first = false;
  }
  __dl();__out(" ");ln();
  __out(" ");ln();
  __out(" ");ln();
}
__dl();__ln();
__out(" ");
}

org.immutables.generator.Templates.Invokable javadocBuilderExample() { return javadocBuilderExample; }
private final org.immutables.generator.Templates.Invokable javadocBuilderExample = new FragmentDispatch(1, 56);
void _t56__javadocBuilderExample(org.immutables.generator.Templates.Invokation __) {
    __dl();final org.immutables.value.processor.meta.ValueType type = $cast(__param(0));
Open Source Used In KASA v1.5  2240

```java
$__().ln();
$__().out(" * <pre>").ln();
$__().out(" * ");
$__().out("()").ln();

{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
 for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getSettableAttributes())) {
   __().__().ln();
   __().out(" ");
   __().dl();
   if ($if(v.isEncoding())) {
      __().__().ln();
      __().out(" * ");
      $__().rr.builderCopyFrom(), v);
      __().out("(");
      $__().docEscaped, v.getType());
      __().out("//");
   } else if ($if(v.isNullable())) {
      __().__().ln();
      __().out(" ");
      $__().rr.builderCopyFrom(), v);
      __().out("(");
      $__().null() // nullable ");
   } else if ($if(v.isCollectionType())) {
      __().__().ln();
      __().out(" ");
      $__().__().ln();
      __().out(" ");
      $__().null() // nullable ");
   } else if ($if(v.isCollectionType())) {
      __().__().ln();
      __().out(" ");
   } else if ($if(v.isCollectionType())) {
      __().__().ln();
      __().out(" ");
   }
   __().__().ln();
   __().out(" ");
}
```

Open Source Used In KASA v1.5 2240
} __out(" elements").ln();
__out(" ");
} else if (Sif(v.isMapType())) {
__dl();__ln();
__out(" * 
"); $(__, v.names.put());
__out("[");
$(__, v.names.putAll());
__out(");
$(__, docEscaped, v.getUnwrappedElementType());
__out(" => ");
$(__, docEscaped, v.getUnwrappedSecondaryElementType());
__out(" ) // ");
\} final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);

} __out(" mappings").ln();
__out(" ");

} else {
__dl();__ln();
__out(" * 
"); $(__, v.names.init);__out("(");
$(__, docEscaped, v.getElementType());
__out(" ) // ");
__dl();
if (Sif(v.isMandatory())) {
__dl();__out("required");
} else {
__dl();__out("optional");

} __dl();__out(" ");
\} final org.immutables.value.processor.meta.ValueAttribute a_sourceDocRef_1518656892 = $cast(v);
$(__, sourceDocLink, a_sourceDocRef_1518656892, a_sourceDocRef_1518656892.names.raw);

} __ln();
__out(" ");

} __dl();__ln();
__dl();_it1.index++;_it1.first = false;
org.immutables.generator.Templates.Invokable immutableImplementationType() { return immutableImplementationType; }
private final org.immutables.generator.Templates.Invokable immutableImplementationType = new FragmentDispatch(1, 57);
void _t57__immutableImplementationType(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  final org.immutables.value.processor.meta.ValueAttribute v = __.param(0);
  __.ln();
  $(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __.dl();
      __.ln();
      __.dl();
      if ($(v.isEncoding())) {
        __.dl();
        __.ln();
        $(__, rr.implType(), v);
        __.ln();
      } else if ($(v.isJdkOptional())) {
        __.dl();
        __.dl();
        __.ln();
        $(__, atNullable, v);
        __.ln();
      } else if ($(v.isCustomCollectionType())) {
        __.dl();
        __.ln();
        $(__, v.implementationType());
        __.ln();
      } else if ($(v.isGenerateOrdinalValueSet(), andnot, v.isGenerateJdkOnly())) {
        __.dl();
        __.ln();
        $(__, org.immutables.ordinal.ImmutableOrdinalSet);
        __.ln();
      } else if ($(v.isCollectionType(), andnot, v.isGenerateJdkOnly())) {
        __.dl();
        __.ln();
        $(__, guava);
        __.ln();
      } else if ($(v.isCollectionType(), andnot, v.isGenerateJdkOnly())) {
        __.dl();
        __.ln();
      }
    }
  });
}
if ($if(a.isGenerateSortedSet())) {
  __.dl();__.ln();
  __.out("createUnmodifiableSortedSet(");
  $(__, a.hasReverseOrder());
  __.out("), createSafeList(");
  $(__, expression);
  __.out("), false, false)).ln();
  __.out(" ");
} else if ($if(a.isGenerateEnumSet())) {
  __.dl();__.ln();
  __.out("createUnmodifiableEnumSet(");
  $(__, expression);
  __.out(")").ln();
  __.out(" ");
} else if ($if(a.isGenerateOrdinalValueSet())) {
  __.dl();__.ln();
  __.out("Not implemented generate OrdinalValue set for JDK only");
  __.dl();
  __.ln();
  __.out(" ");
} else if ($if(a.isListType())) {
  __.dl();__.ln();
  __.out("createUnmodifiableList(true, ");
  __.dl();
  if ($if(a.isAttributeBuilder())) {
    __.dl();$(__, convertToValueType, a.getAttributeBuilderDescriptor());
    __.out("\n");
    $(__, expression);
    __.out("\n");
  } else {
    __.dl();$(__, expression);
  }
  __.dl();__.out("\n").ln();
  __.out(" ");
} else if ($if(a.isSetType())) {
  __.dl();__$_.setType(), a.getAttributeBuilderDescriptor());
  __.out("\n");
  $(__, expression);
  __.out("\n");
  __.out(" ");
}
} else if ($if(a.isGenerateEnumMap())) {
__dl();__ln();
__out("createUnmodifiableEnumMap(false, false, ");
$___.expression();
$___.out(""").ln();
__out(" ");
} else if ($if(a.isGenerateSortedMap())) {
__dl();__ln();
__out("createUnmodifiableSortedMap()");
$___.a.hasReverseOrder();
__out("false, false, "");
$___.expression();
__out(""").ln();
__out(" ");
} else if ($if(a.isMapType())) {
__dl();__ln();
__out("createUnmodifiableMap(false, false, ");
$___.expression();
__out(""").ln();
__out(" ");
}
__dl();__ln();

} else {
__dl();__ln();
__out(" ");
__dl();
if ($if($a.isGenerateOrdinalValueSet(), or, $a.isGenerateEnumSet(), or, $a.isGenerateEnumMap()))) {
__dl();__ln();
__out(" ");
$___.immutableCollectionCopyOf(a, new org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
__dl();$___.expression();
__out("\n");
__dl();
});
__ln();
__out(" ");
}
else {
__dl();__ln();
__out(" ");
__dl();
if ($if(a.isAttributeBuilder())) {
__dl();$___.guava();
__out("\ncollect.ImmutableList.copyOf("");
$___.convertToValueType(a.getAttributeBuilderDescriptor());
```java
__.out("(");
$___.expression;
__.out(".build())");
}

$___.dl();$___.ln();
$___.out(" ");

$___.dl();$___.ln();

$___.dl();$___.ln();

$___.dl();

org.immutables.generator.Templates.Invokable immutableCollectionCopyOf() { return immutableCollectionCopyOf; }
private final org.immutables.generator.Templates.Invokable immutableCollectionCopyOf = new FragmentDispatch(2, 59);
void _t59__immutableCollectionCopyOf(org.immutables.generator.Templates.Invokation __) {
    $___.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
    final java.lang.String expression = __.param(1).toString();
    $___.out(immutableCollectionCopyOfSafe, a, $$true, expression);
    $___.dl();
}

org.immutables.generator.Templates.Invokable immutableCollectionCopyOfSafe() { return immutableCollectionCopyOfSafe; }
private final org.immutables.generator.Templates.Invokable immutableCollectionCopyOfSafe = new FragmentDispatch(3, 60);
void _t60__immutableCollectionCopyOfSafe(org.immutables.generator.Templates.Invokation __) {
    $___.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
    final java.lang.Boolean safe = $if(__.param(1));
    final java.lang.String expression = __.param(2).toString();
    $___.out(output.trim, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            $___.dl();$___.ln();
            if ($if(a.isGenerateJdkOnly())) {
                $___.dl();$___.ln();
                final org.immutables.generator.Templates.Invokable safeList = new
```
```java
@Override public void run(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.generator.Templates.Invokable safeList = this;
    __.dl();
    if ($if(safe)) {
        __.dl();___.out("createSafeList(");
        ${__, expression};
        __.out(",");
        ${__, a.nullElements.ban()};
        __.out(",");
        ${__, a.nullElements.skip()};
        __.out(")");
    } else {
        __.dl();${__, expression};
    }
    __.dl();___.ln();
    __.out(" ");
    __.dl();
}];___.dl();___.ln();
___.out(" ");
___.dl();
if ($if(a.isGenerateSortedSet())) {
    __.dl();___.ln();
    ___.out(" createUnmodifiableSortedSet("");
    ${__, a.hasReverseOrder()};
    __.out(" ");
    ${__, safeList};
    __.out(")").ln();
    __.out(" ");
} else if ($if(a.isGenerateEnumSet())) {
    __.dl();___.ln();
    ___.out(" createUnmodifiableEnumSet(");
    ${__, expression};
    __.out(" ");
    __.out(" ");
    __.ln();
} else if ($if(a.isGenerateOrdinalValueSet())) {
    __.dl();___.ln();
    __.out(" ");
    ${__, output.error, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();___.out("Not implemented generate OrdinalValue set for JDK only");
            __.dl();
        }});___.ln();
    __.out(" ");
} else if ($if(a.isListType())) {
    __.dl();___.ln();
    __.out(" ");
    $(__, output.error, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __.dl();___.out("Not implemented generate OrdinalValue set for JDK only");
            __.dl();
        }});___.ln();
    __.out(" ");
} else if ($if(a.isListType())) {
    __.dl();___.ln();
    __.out(" createUnmodifiableList(false, ");
```
nullElements.skip());
__out(" ");
$___.expression().ln();
__out(" ");
} else if ($if(a.isGenerateSortedMap())) {
__dl();__ln();
__out(" createUnmodifiableSortedMap(");
$___.hasReverseOrder();
__out(" ");
$___.safe, and, a.nullElements.ban());
__out(" ");
$___.nullElements.skip());
__out(" ");
$___.expression();
__out(" ");
} else if ($if(a.isMapType())) {
__dl();__ln();
__out(" createUnmodifiableMap(");
$___.safe, and, a.nullElements.ban());
__out(" ");
$___.nullElements.skip());
__out(" ");
$___.expression();
__out(" ");
} else {
__dl();__ln();
__out(" ");
$___.expression();
__ln();
__out(" ");
}  
__dl();__ln();

} else {
  __dl();__ln();
  __out(" ");
  __dl();
  if ($if(a.isGenerateSortedSet())) {
    __dl();__ln();
    __out(" ");
    $(__, guava);
    __out(".collect.ImmutableSortedSet.copyOf("").ln();
    __out(" ");
    __dl();
    if ($if(a.hasNaturalOrder())) {
      __dl();__ln();
      __out(" ");
      $(__, guava);
      __out(".collect.Ordering.<");
      $(__, a.getElementType());
      __out("natural()").ln();
      __out(" ");
    } else {
      __dl();__ln();
      __out(" ");
      $(__, guava);
      __out(".collect.Ordering.<");
      $(__, a.getElementType());
      __out(">natural().reverse()").ln();
      __out(" ");
    }
  } else if ($if(a.isGenerateEnumSet())) {
    __dl();__ln();
    __out(" ");
    $(__, guava);
    __out(".collect.Sets.immutableEnumSet(");
    __out(" ").ln();
    __out(" ");
  } else if ($if(a.isGenerateOrdinalValueSet())) {
    __dl();__ln();
    __out(" ");
    $(__, expression);
    __out(" ").ln();
    __out(" ");
  } else if ($if(a.isGenerateEnumSet())) {
    __dl();__ln();
    __out(" ");
    $(__, guava);
    __out(".collect.Sets.immutableEnumSet(";
    $(__, expression);
    __out(" ").ln();
    __out(" ");
  } else if ($if(a.isGenerateOrdinalValueSet())) {
__.out(".collect.Immutable");
$___.a.getRawCollectionType();
__.out(".copyOf()");
$___.expression();
__.out(" ");
} else if ($if(a.isGenerateSortedMap())) {
  __dl();__ln();
  __out(" ");
  ___.guava();
  ___.collect.ImmutableSortedMap.copyOf(___.expression());
  ___.out(" ");
  __dl();
  if ($if(a.hasNaturalOrder())) {
    ___.guava();
    __.collect.Ordering.<___.getElementType()>natural().ln();
    ___.out(" ");
  } else {
    ___.guava();
    __.collect.Ordering.<___.getElementType()>natural().reverse().ln();
    ___.out(" ");
  }
} else {
  ___.guava();
  __.collect.Ordering.<___.getElementType>();
  ___.out("natural().reverse()").ln();
  __.out(" ");
}
___.out(" ").ln();
___.out(" ");
} else if ($if(a.isGenerateEnumMap())) {
  ___.guava();
  __.collect.Maps.immutableEnumMap(___.expression());
  ___.out(" ");
}
else if ($if(a.isMapType())) {
  ___.guava();
  __.collect.Arrays.immutableEnumMap("");
  ___.expression();
  ___.out(" ");
}
else if ($if(a.isMapType())) {
  ___.guava();
  __.collect.Arrays.immutableEnumMap("");
  ___.expression();
  ___.out(" ");
}
public org.immutables.generator.Templates.Invokable equalsAttribute() { return equalsAttribute; }
private final org.immutables.generator.Templates.Invokable equalsAttribute = new FragmentDispatch(2, 61);
void _t61__equalsAttribute(org.immutables.generator.Templates.Invokation __) {
  __dl();
  final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  final java.lang.Boolean useAccessor = $if(__.param(1));
  __dl();
  final org.immutables.generator.Templates.Invokable getOther = this;
  __dl();
  __dl();
} });

private final org.immutables.generator.Templates.Invokable thisAttr = new org.immutables.generator.Templates.Invokable();
private final org.immutables.generator.Templates.Invokable thisAttr = this;
private final org.immutables.generator.Templates.Invokable getOther = new org.immutables.generator.Templates.Invokable();
private final org.immutables.generator.Templates.Invokable getOther = this;
public org.immutables.generator.Templates.Invokable arrayAsList() { return arrayAsList; }
private final org.immutables.generator.Templates.Invokable arrayAsList = new FragmentDispatch(2, 62);
void _t62__arrayAsList(org.immutables.generator.Templates.Invokation __) {
  __dl();final org.immutables.value.processor.meta.ValueAttribute a = __.param(0);
  final java.lang.String expression = __.param(1).toString();
  $___.output.trim, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __dl();__.ln();
      if ($if(a.isUnwrappedElementPrimitiveType())) {
        __dl();__.ln();
        __.out("
      } else if ($if(a.isNullable(), or, a.isJdkOptional())) {
        ___.dl();__.ln();
        __.out(" ");
        __(_.objectsEqual, a.containingType);
        __.out("(");
        ___.out("");
        __(_.thisAttr);
        __.out(" ");
        __(_.getOther);
        __.out(")").ln();
      } else {
        ___.dl();__.ln();
        ___.dl();
      }
      __.dl();
    }
  });
  __.dl();
}

@Override public void run(org.immutables.generator.Templates.Invokation __) {
  ___.dl();
  if ($if(a.isUnwrappedElementPrimitiveType())) {
    ___.dl();__.ln();
    __.out(" ");
    ___.dl();
  } else if ($if(a.isGenerateJdkOnly())) {
    __.dl();__.ln();
    __.out(" ");
    ___.dl();
  }
  if ($if(a.isGenerateJdkOnly())) {
    __.dl();__.ln();
    __.out(" ");
    ___.dl();
  }
  if ($if(a.isGenerateJdkOnly())) {
    __.dl();__.ln();
    __.out(" ");
    ___.dl();
  }
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    ___.dl();
  }
}
@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __.dl();___.ln();
  __.out("  ");
  $(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
      __.dl();___.ln();
      __.out("  ");
      $(__, expression);___.dl();___.ln();
      __.out("  ");
    }
  }));
  __.dl();
}
public org.immutables.generator.Templates.Invokable primitiveHashCode() {
    return primitiveHashCode;
}

private final org.immutables.generator.Templates.Invokable primitiveHashCode = new FragmentDispatch(1, 64);

void _t64__primitiveHashCode(org.immutables.generator.Templates.Invokation __) {
    final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
    $(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __dl();
            __ln();
            if ($if(v.isInt())) {
                __dl();
                __ln();
                __out(" ");
                __out(v.name());
                __ln();
            } else if ($if(v.isGenerateJdkOnly())) {
                __dl();
                __ln();
            } else if ($if(v.isImmutablesGenerator.JdkOnly())) {
                __dl();
                __ln();
            } else {
                __dl();
                __ln();
            }
        }
    });
}
if ($(classpath.isJava8(), andnot, $(classpath.available, "android.R"))) {
    __.dl();___.ln();
    __.out("  ");
$.(__, v.getWrapperType());
    __.out(" .hashCode(");
$.(__, v.name());
    __.out(")").ln();
    __.out(" ");
} else if ($(v.isLong())) {
    __.dl();__.ln();
    __.out(" (int ");
$.(__, v.name());
    __.out(" ^ ");
$.(__, v.name());
    __.out(" >>> 32)").ln();
    __.out(" ");
} else if ($(v.isBoolean())) {
    __.dl();__.ln();
    __.out(" ");
$.(__, v.name());
    __.out(" ? 1231 : 1237")\.ln();
    __.out(" ");
} else if ($(v.isFloat())) {
    __.dl();__.ln();
    __.out(" Float.floatToIntBits(");
$.(__, v.name());
    __.out(" ");
} else if ($(v.isDouble())) {
    __.dl();__.dl();__.ln();
    __.out(" Double.valueOf(");
$.(__, v.name());
    __.out(" ");
} else {
    __.dl();__.ln();
    __.out(" (int ");
$.(__, v.name());
    __.ln();
    __.out(" ");
}

} else {
public org.immutables.generator.Templates.Invokable objectsEqual() { return objectsEqual; }

private final org.immutables.generator.Templates.Invokable objectsEqual = new FragmentDispatch(1, 65);
void _t65__objectsEqual(org.immutables.generator.Templates.Invokation __) {
  __dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __dl();
  if ($if(type.isGenerateJdkOnly())) {
    __dl();
    if ($if(hasAndroid)) {
      __dl();
      __out("    ");
      __dl();
      __out("    ");
      $(__, topSimplePrefix, type);
      __out("equals").ln();
      __out("    ");
    } else if ($if(hasObjects)) {
      __dl();
      __out("    ");
      __dl();
      __out("    ");
      __out("    ");
    } else {
      __dl();
      __out("    ");
      $(__, topSimplePrefix, type);
      __out("equals").ln();
    }
  } else {
    __dl();
    __out("    ");
    $(__, topSimplePrefix, type);
    __out("equals").ln();
public org.immutables.generator.Templates.Invokable objectsHashCode() { return objectsHashCode; }

private final org.immutables.generator.Templates.Invokable objectsHashCode = new FragmentDispatch(1, 66);

void _t66__objectsHashCode(org.immutables.generator.Templates.Invokation __) {
    final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    $(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
            final java.lang.Boolean hasObjects = $cast($classpath.available, "java.util.Objects");
            final java.lang.Boolean hasAndroid = $cast($classpath.available, "android.R");

            if ($if(type.isGenerateJdkOnly())) {

            } else {
                __.out(" ");
                __.dl();
            }

            if ($if($hasObjects, andnot, hasAndroid)) {

            } else {
                __.out(" ");
                $(__, guava);
                __.out(" .base.Objects.equal").ln();
                __.out(" ");

            }

            __.dl();
            __.out(" ");
            __.dl();
            __.dl();
            __.ln();
            __.dl();
            __.ln();
            __.dl();
            __.ln();

            __.ln();
            __.dl();
            __.ln();
            __.dl();
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            __.dl();
            __.ln();
            __.dl();
            __.ln();
            __.dl();
            __.ln();
            __.dl();
        }});
        __.dl();
    });
}
__dl(); __ln();
__out(" ");
__dl();
if ($if(hasAndroid)) {
__dl(); __ln();
__out(" ");
$___.topSimplePrefix, type);
__out("hashCode").ln();
__out(" ");
} else if ($if(hasObjects)) {
__dl(); __ln();
__out(" java.util.Objects.hashCode").ln();
__out(" ");
}
else {
__dl(); __ln();
__out(" ");
$___.topSimplePrefix, type);
__out("hashCode").ln();
__out(" ");
}
__dl(); __ln();
} else {
__dl(); __ln();
__out(" ");
__dl();
if ($if($hasObjects, andnot, hasAndroid)) {
__dl(); __ln();
__out(" java.util.Objects.hashCode").ln();
__out(" ");
}
else {
__dl(); __ln();
__out(" ");
$___.guava);
__out(".base.Objects.hashCode").ln();
__out(" ");
}
__dl(); __ln();
} __dl(); __ln();
__dl(); __it1.index++;__dl(); __it1.first = false;
public org.immutables.generator.Templates.Invokable requireNonNull() { return requireNonNull; }
private final org.immutables.generator.Templates.Invokable requireNonNull = new FragmentDispatch(1, 67);

@override public void run(org.immutables.generator.Templates.Invocation invocation) {
    final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    $(__, output.trim, new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
            final java.lang.Boolean hasObjects = $cast($(classpath.available, "java.util.Objects"));
            final java.lang.Boolean hasAndroid = $cast($(classpath.available, "android.R"));
            if ($if(type.getThrowForNullPointer())) {
                __dl();__ln();
                out(" ");
                $(__, topSimplePrefix, type);
                out("requireNonNull").ln();
            } else if ($if(type.isGenerateJdkOnly())) {
                __dl();__ln();
                out(" ");
                if ($if(hasAndroid)) {
                    __dl();__ln();
                    out(" ");
                    $(__, topSimplePrefix, type);
                    out("requireNonNull").ln();
                    out(" ");
                } else if ($if(hasObjects)) {
                    __dl();__ln();
                    out(" ");
                    __dl();__ln();
                    out(" java.util.Objects.requireNonNull").ln();
                    out(" ");
                } else {
                    __dl();__ln();
                    out(" ");
                    $(__, topSimplePrefix, type);
                    out("requireNonNull").ln();
                    out(" ");
                }
            }
            __dl();__ln();
        }
    });
}
} else {
__dl();__ln();
__out("  ");
__dl();
if ($if($hasObjects, andnot, hasAndroid)) {
__dl();__ln();
__out("  java.util.Objects.requireNonNull").ln();
__out("  ");
} else {
__dl();__ln();
__out("    ");
$___.guava);
__out("    .base.Preconditions.checkNotNull").ln();
__out("  ");
}
__dl();__ln();
__dl();__ln();
__dl();__it1.index++;
_it1.first = false;
}
__dl();__ln();
__dl();
}

public org.immutables.generator.Templates.Invokable objectsUtility() { return objectsUtility; }
private final org.immutables.generator.Templates.Invokable objectsUtility = new FragmentDispatch(1, 68);
void _t68__objectsUtility(org.immutables.generator.Templates.Invokation __) {
__dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
__ln();
__dl();
if ($if(type.getThrowForNullPointer())) {
__dl();__ln();
__ln();
__out("private static <T> T requireNonNull(T object, String message) ").ln();
__out("    if (object == null) throw ");
$___.type.getThrowForNullPointer();
__out("(message);").ln();
__out("    return object;").ln();
__out(""").ln();
}
__dl();__ln();
if (Slf(type.isGenerateJdkOnly())) {
    //
    //
    final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    final java.lang.Boolean haveObjects = $cast($classpath.available, "java.util.Objects");
    final java.lang.Boolean haveAndroid = $cast($classpath.available, "android.R");
    //
    //
    if ($if($haveAndroid, ornot, haveObjects)) {
    //
    //
    if ($if($not, type.getThrowForNullPointer())) {
    //
    //
    private static <T> T requireNonNull(T object, String message) {
    //
    //
    private static int hashCode(Object object) {
    //
    //
    private static boolean equals(Object left, Object right) {
    //
    }
    //
    //
    if ($if(type.isUseNullSafeUtilities())) {
    //
    //
    }
    //
    if ($if(type.useNullSafeUtilities)) {
    //
    //
    }
    //
    //
    _it1.index++;
    _it1.first = false;
    //
    //
    }
public org.immutables.generator.Templates.Invokable attributeBuilderTransformUtilities() { return attributeBuilderTransformUtilities; }
private final org.immutables.generator.Templates.Invokable attributeBuilderTransformUtilities = new FragmentDispatch(1, 69);
void _t69__attributeBuilderTransformUtilities(org.immutables.generator.Templates.Invokation __) {
    final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    __.ln();
    __.ln();
    if ($if(type.detectAttributeBuilders())) {
        __.dl();
        __.ln();
        __.ln();
        final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getUniqueAttributeBuilderAttributes())) {
            __.dl();
            __.ln();
            __.ln();
            __.out("private static ");
            $(__, v.getAttributeBuilderDescriptor().getQualifiedValueTypeName());
            __.out("( convertToValue ");
            $(__, n_convertToValueType_1028768993.getQualifiedValueTypeNameWithUnderscores());
            __.out(")");
        }
    }
    __.dl();
    __.ln();
}
}.__dl();
}.__out(" ");
$(__.v.getAttributeBuilderDescriptor().getQualifiedBuilderTypeName());
}.__out(" builder) ").ln();
}.__out(" if (builder == null) return null;").ln();
}.__out(" return builder.");
$(__.v.getAttributeBuilderDescriptor().getBuildMethod());
}.__out("();").ln();
}.__out(" ");.ln();
}ln();
{final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
}.__dl();
if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
}.__dl();}.__out("@javax.annotation.Nullable ");

}
}.__dl();
}.__ln();
}ln();
}ln();
}ln();
if (if(v.hasAttributeValue())) {
}.__dl();}.__out(" ");
}else {
}.__dl();}.__out(" ");
{final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_convertToValueType_1028768993 = $cast(v.getAttributeBuilderDescriptor());
}.__out("convertToValueType");
}.__out(" ");
{final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_convertToValueType_1028768993 = $cast(v.getAttributeBuilderDescriptor());
}.__out(" ");
{final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
}.__dl();
if ($if(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
}.__dl();}.__out("@javax.annotation.Nullable ");

}.__dl();
}.__out(" ");
if ($if(v.hasAttributeValue())) {
  __.dl();$___.attributeValueType.typeAbstract().absolute();
}

} else {
  __.dl();$___.getAttributeBuilderDescriptor().getQualifiedValueType();
}

___.dl();___.out(" value");
___.out(" if (value == null) return null; ");
___.out(" return ");

final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_valueToBuilder_1442539515 = $cast(v.getAttributeBuilderDescriptor());
final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 = new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 = this;
    __.dl();
  }
};

if ($if(n_valueToBuilder_1442539515.isCopyMethodOnValueInstance())) {
  __.dl();$___.expression_valueToBuilder_1442539515();
  __.out(" ");
  $(_.n_valueToBuilder_1442539515().getQualifiedValueToBuilderMethod());
  __.out(" ");
}

} else {
  __.dl();$___.n_valueToBuilder_1442539515().getQualifiedValueToBuilderMethod();
  __.out(" ");
  $(_.expression_valueToBuilder_1442539515());
  __.out(" ");
}

___.dl();
___.out(" ");
$(_.v.getAttributeBuilderDescriptor().getBuildMethod());
___.out(" ");
___.out(" ");
___.ln();

final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
___.dl();
if ($if(s_atNullable_105894042().allowsClasspathAnnotation("javax.annotation.Nullable")) {
  __.dl();___.out("@javax.annotation.Nullable ");
}

___.dl();
private static convertToBuilderType(final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_convertToBuilderType_187063380 = $cast(v.getAttributeBuilderDescriptor());
    __out("convertToBuilderType");
    $(__, n_convertToBuilderType_187063380.getQualifiedValueTypeNameWithUnderscores());
}
__out("\n");
final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
__dl();
if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable")) {
    __dl();__out("@javax.annotation.Nullable ");
}
__dl();
__out("\n");
__dl();
if ($if(v.hasAttributeValue())) {
    __dl();$__ out("valueToBuilder_1442539515 = new org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 = new org.immutables.generator.Templates.Fragment(0) {
    @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __dl();final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 = this;
    __out("value");
    __dl();
    }};__dl();__dl();
    if ($if(n_valueToBuilder_1442539515.isCopyMethodOnValueInstance())) {
        __dl();$__ out("expression_valueToBuilder_1442539515 = this;
        __out("value");
        __dl();
        };
    } else {
        __dl();$(__, expression_valueToBuilder_1442539515);
        __out("\n");
        $(__, n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod());
        __out("\n");
    }
} else {
    __dl();$(__, n_valueToBuilder_1442539515);
final org.immutables.value.processor.meta.ValueAttribute v :
$in(type.getUniqueAttributeBuilderListAttributes())

private static java.util.List<
$__,
$.convertToValueType(Iterable<? extends
$__,
$.getQualifiedBuilderTypeName());
$cast(v.getAttributeBuilderDescriptor());
   __.out("convertToBuilderType");
   $(__, n_convertToBuilderType_187063380).getQualifiedValueTypeNameWithUnderscores();

   }
   __.out("(");
   $(__, v.getAttributeBuilderDescriptor().getQualifiedValueTypeName());
   __.out("... valueArray") "{\n   __.out("}\n   $(__, copyBuilderListBody, v, $false, $true, new org.immutables.generator.Templates.Fragment(0) {
      @Override public void run(org.immutables.generator.Templates.Invokation __) {
         __.dl();___.out("valueArray");
         __.dl();
      }});___.ln();
      __.dl();___.out("}");ln();
      __.dl();_it1.index++;
      _it1.first = false;
   }
   __.dl();___.ln();

   __.dl();___.ln();
   __.dl();
};

org.immutables.generator.Templates.Invokable convertToBuilderType() { return convertToBuilderType; }
private final org.immutables.generator.Templates.Invokable convertToBuilderType = new FragmentDispatch(1, 70);
void _t70__convertToBuilderType(org.immutables.generator.Templates.Invokation __) {
   __.dl();final org.immutables.value.processor.meta.AttributeBuilderDescriptor n = $cast(__.param(0));
   __.out("convertToBuilderType");
   $(__, n.getQualifiedValueTypeNameWithUnderscores());
   __.dl();
};

org.immutables.generator.Templates.Invokable convertToValueType() { return convertToValueType; }
private final org.immutables.generator.Templates.Invokable convertToValueType = new FragmentDispatch(1, 71);
void _t71__convertToValueType(org.immutables.generator.Templates.Invokation __) {
   __.dl();final org.immutables.value.processor.meta.AttributeBuilderDescriptor n = $cast(__.param(0));
   __.out("convertToValueType");
   $(__, n.getQualifiedValueTypeNameWithUnderscores());
   __.dl();
};

org.immutables.generator.Templates.Invokable copyBuilderListBody() { return copyBuilderListBody; }
private final org.immutables.generator.Templates.Invokable copyBuilderListBody = new FragmentDispatch(4, 72);
void _t72__copyBuilderListBody(org.immutables.generator.Templates.Invokation __) {
   __.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(__.param(0));
   final java.lang.Boolean toValueType = $if(__.param(1));
final java.lang.Boolean vargs = __.param(2);
final java.lang.String listToTransform = __.param(3).toString();
__ln();
final org.immutables.generator.Templates.Invokable listType = new 
org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
   __dl();final org.immutables.generator.Templates.Invokable listType = this;
   __dl();
   if ($if(toValueType)) {
      __dl();__dl();
      if ($if(v.hasAttributeValue())) {
         __dl();$__ v.attributeValueType.typeAbstract().absolute());
      } else {
         __dl();$(__, v.getAttributeBuilderDescriptor().getQualifiedValueTypeName());
      }
   } else {
      __dl();$(__, v.getAttributeBuilderDescriptor().getQualifiedBuilderTypeName());
   }
   __dl();__dl();
} });__dl();__ln();
__out("  ");
__dl();
if ($if(v.isGenerateJdkOnly())) {
   __dl();__ln();
   __out(" java.util.ArrayList<");
$(__, listType);
   __out(" list;">).ln();
   __out("  ");
   __dl();
   if ($if(vargs)) {
      __dl();__ln();
      __out("  if (\n");
$(__, listToTransform);
      __out(".length == 0) return java.util.Collections.emptyList();\n");
      __out("  ");
   } else {
      __dl();__ln();
      __out("  if (\n");
$(__, listToTransform);
      __out(" instanceof java.util.Collection<?>) {\n");
      __out("    int size = ((java.util.Collection<?>) ");
$(__, listToTransform);
      __out(").size();\n");
   }
if (size == 0) return java.util.Collections.emptyList();

list = new java.util.ArrayList();

if (listToTransform != null) {
  for (element : listToTransform) {
    list.add(element.build());
  }
} else {
  list = Guava.immutableListBuilder();

  for (element : listToTransform) {
    list.add(element.build());
  }
}

if ($if(toValueType)) {
  v.getAttributeBuilderDescriptor().getQualifiedBuilderTypeName();
} else {
  v.getAttributeBuilderDescriptor().getQualifiedValueTypeName();
}

if ($if(toValueType)) {
  v.getBuildMethod();
} else {

  for (element : listToTransform) {
    v.getBuildMethod();
  }
}
else {
    __dl();__ln();
    __out("    list.add(");
    final org.immutables.value.processor.meta.AttributeBuilderDescriptor n_valueToBuilder_1442539515 = $cast(v.getAttributeBuilderDescriptor());
    final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 = new org.immutables.generator.Templates.Fragment(0) {
        @Override public void run(org.immutables.generator.Templates.Invokation __) {
            __dl();final org.immutables.generator.Templates.Invokable expression_valueToBuilder_1442539515 = this;
            __out("element");
            __dl();
        }};__dl();__dl();
    if ($if(n_valueToBuilder_1442539515.isCopyMethodOnValueInstance())) {
        __dl();$___.expression_valueToBuilder_1442539515();
        __out(".");
        $___.n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod();
        __out("()");
    } else {
        __dl();$___.n_valueToBuilder_1442539515.getQualifiedValueToBuilderMethod();
        __out("()");
    }
    __dl();
}
__out(";").ln();
__out(" ");

__dl();__ln();
__out("  ");
__out("  ");
__dl();__ln();
__out("  ");
__out("  ");
__dl();__ln();
__out("  ");
__out("  ");
__dl();__ln();
__out("  ");
__out("  ");
__dl();__ln();
__out("  ");
__out("  ");
__dl();

if ($if(v.isGenerateJdkOnly())) {
    __dl();__ln();
    __out(" return list;").ln();
    __out(" ");
} else {
    __dl();__ln();
    __out(" return list.build;").ln();
    __out(" ");
}
__dl();__ln();
public org.immutables.generator.Templates.Invokable collectionUtility() { return collectionUtility; }
private final org.immutables.generator.Templates.Invokable collectionUtility = new FragmentDispatch(1, 73);
void _t73__collectionUtility(org.immutables.generator.Templates.Invocation __) {
  __dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __ln();
  __dl();
  if ($if($type.isUseListUtility(), or, $type.isUseSetUtility(), or, $type.isUseEnumSetUtility(), or,
    type.isUseSortedSetUtility()))
    __dl();__ln();
    __out("private static <T> java.util.List<T> createSafeList(Iterable<? extends T> iterable, boolean checkNulls,
      boolean skipNulls) {").ln();
    __out(" java.util.ArrayList<T> list;").ln();
    __out(" if (iterable instanceof java.util.Collection<?>) {").ln();
    __out(" int size = ((java.util.Collection<?>) iterable).size();").ln();
    __out(" if (size == 0) return java.util.Collections.emptyList();").ln();
    __out(" list = new java.util.ArrayList");
    $(___.asDiamond, "T");
    __out("();").ln();
    __out(" } else {").ln();
    __out(" list = new java.util.ArrayList");
    $(____.asDiamond, "T");
    __out("();").ln();
    __out(" for (T element : iterable) {").ln();
    __out(" if (skipNulls && element == null) continue;").ln();
    __out(" if (checkNulls )");
    $(____.requireNonNull, type);
    __out("element, \"element\";").ln();
    __out(" list.add(element);").ln();
    __out(" ;").ln();
    __out(" return list;").ln();
    __out(";").ln();
  }
  __out("};
  __dl();
  __dl();
  if ($if($type.isUseListUtility()))
    __dl();__ln();
    __ln();
    __out("private static <T> java.util.List<T> createUnmodifiableList(boolean clone, java.util.List<T> list) {").ln();
    __out(" switch(list.size()) {").ln();
    __out(" case 0: return java.util.Collections.emptyList();").ln();
    __out(" case 1: return java.util.Collections.singletonList(list.get(0));").ln();
    __out(" default:=").ln();
```java
    if (clone) {
      return java.util.Collections.unmodifiableList(new java.util.ArrayList
       )
    } else {
      if (list instanceof java.util.ArrayList<?>) {
        ((java.util.ArrayList<?>) list).trimToSize();
      }
      return java.util.Collections.unmodifiableList(list);
    }
  }
}

if ($if(type.isUseSetUtility())) {
  ...
/* Unmodifiable set constructed from list to avoid rehashing. */
private static <T> java.util.Set<T> createUnmodifiableSet(java.util.List<T> list) {
  switch(list.size()) {
  case 0: return java.util.Collections.emptySet();
  case 1: return java.util.Collections.singleton(list.get(0));
  default:
    java.util.Set<T> set = new java.util.LinkedHashSet
     
    set.addAll(list);
    return java.util.Collections.unmodifiableSet(set);
  };
}

if ($if(type.isUseEnumSetUtility())) {
  ...
  @SuppressWarnings("unchecked")
  private static <T extends Enum<T>> java.util.Set<T> createUnmodifiableEnumSet(Iterable<T> iterable) {
    if (iterable instanceof java.util.EnumSet<?>) {
      return java.util.Collections.unmodifiableSet(java.util.EnumSet.copyOf((java.util.EnumSet<T>)
    iterable));
  }
    java.util.List<T> list = createSafeList(iterable, true, false);
    switch(list.size()) {
  };
```

```java
__out(" case 0: return java.util.Collections.emptySet();").ln();
__out(" case 1: return java.util.Collections.singleton(list.get(0));").ln();
__out(" default: return java.util.Collections.unmodifiableSet(java.util.EnumSet.copyOf(list));").ln();
__out(" 1"').ln();
__out(" 1").ln();
}
__dl();__ln();
__dl();
if ($if(type.isUseSortedSetUtility()) {
__dl();__ln();
final org.immutables.generator.Templates.Invokable unmodifiableSortedSetInterface = new org.immutables.generator.Templates.Fragment(0) {
  @Override public void run(org.immutables.generator.Templates.Invokation __) {
    __dl();__ln();
    __dl();
    if ($if($(classpath.available, "java.lang.FunctionalInterface"))) {
      __dl();__ln();
      __out("  NavigableSet").ln();
    } else {
      __dl();__ln();
      __out("  SortedSet").ln();
    }
    __dl();__ln();
  }
}).run();
__ln();
__ln();
__out("private static <T extends Comparable<T>> java.util.").ln();
$(__ unmodifiableSortedSetInterface);
__out("<T> createUnmodifiableSortedSet(boolean reverse, java.util.List<T> list) {").ln();
__out("  java.util.TreeSet<T> set = reverse").ln();
__out("    ? new java.util.TreeSet()");
$(__ asDiamond, "T");
__out("(java.util.Collections.reverseOrder())").ln();
__out("  : new java.util.TreeSet()");
$(__ asDiamond, "T");
__out("();").ln();
__out("  set.addAll(list);").ln();
__out("  return java.util.Collections.unmodifiable");
$(__ unmodifiableSortedSetInterface);
__out("(set);").ln();
```
```java
  switch (map.size()) {
  case 0: return java.util.Collections.emptyMap();
  case 1: {
    java.util.Map.Entry<? extends K, ? extends V> e = map.entrySet().iterator().next();
    K k = e.getKey();
    V v = e.getValue();
    if (checkNulls) {
      $__().requireNonNull(type);
      ($__, requireNonNull, type);
      __().ln();
    }
    if (skipNulls && (k == null || v == null)) {
      return java.util.Collections.emptyMap();
    } else if (checkNulls) {
      __().ln();
      __().ln();
    }
    return java.util.Collections.singletonMap(k, v);
  }
  default: {
    java.util.Map<K, V> linkedMap = new java.util.LinkedHashMap
      asDiamond("K, V");
    if (skipNulls || checkNulls) {
        K k = e.getKey();
        V v = e.getValue();
        if (skipNulls) {
          if (k == null || v == null) continue;
        } else if (checkNulls) {
          __().ln();
          __().ln();
        }
        linkedMap.put(k, v);
      }
    }
    default: {
      __().ln();
    }
    return java.util.Collections.singletonMap(k, v);
  }
  }

default: { "");
```
if ($if($classpath.available, "java.lang.FunctionalInterface")) {
    __dl(); __ln();
    __out(" NavigableMap").ln();
} else {
    __dl(); __ln();
    __out(" SortedMap").ln();
}
__dl(); __ln();
}};
__dl();
__ln();
__out("private static <K extends Comparable<K>, V> java.util.");
$__(__, unmodifiableSortedMapInterface);
__out("<K, V> createUnmodifiableSortedMap(boolean reverse, boolean checkNulls, boolean skipNulls,
java.util.Map<? extends K, ? extends V> map) {").ln();
__out("  java.util.TreeMap<K, V> sortedMap = reverse").ln();
$__(__, asDiamond, "K, V");
__out("  ? new java.util.TreeMap");
$__(__, asDiamond, "K, V");
__out(" : new java.util.TreeMap");
$__(__, asDiamond, "K, V");
__out("()").ln();
__ln();
__out("  if (checkNulls || skipNulls) {").ln();
__out("      K k = e.getKey();").ln();
__out("      V v = e.getValue();").ln();
__out("      if (skipNulls) {".ln();
__out("        if (k == null || v == null) continue;").ln();
__out("      } else if (checkNulls) {").ln();
__out("      }");
$__(__, requireNonNull, type);
__out("(k, v'key\'\');").ln();
__out("  } else if (checkNulls) {").ln();
__out("  ");
$__(__, requireNonNull, type);
__out("(v, v'value\');").ln();
__out("  } ");.ln();
__out("   sortedMap.put(k, v);").ln();
__out("   ");.ln();
__out("   ");.ln();
__out("   ");.ln();
__out("   ");.ln();
__out("return java.util.Collections.unmodifiable");
$___.unmodifiableSortedMapInterface;
__out("(sortedMap);").ln();
__out("}"").ln();
}
___.dl();___.ln();
___.dl();
;

public org.immutables.generator.Templates.Invokable javadocGenerics() { return javadocGenerics; }
private final org.immutables.generator.Templates.Invokable javadocGenerics = new FragmentDispatch(1, 74);
void _t74__javadocGenerics(org.immutables.generator.Templates.Invocation __) {
___.dl();final org.immutables.value.processor.meta.ValueType type = $cast(___.param(0));
___.ln();
{final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
for (final java.lang.String p : $in(type.generics().vars())) {
___.dl();___.ln();
___.out(" * @param <");
$___.p);
___.ln();
___.dl();_it1.index++;
_it1.first = false;)
}
___.dl();___.ln();
___.dl();
}
org.immutables.generator.Templates.Invokable defineOrResetBuildingField() { return defineOrResetBuildingField; }
private final org.immutables.generator.Templates.Invokable defineOrResetBuildingField = new FragmentDispatch(2, 75);
void _t75__defineOrResetBuildingField(org.immutables.generator.Templates.Invokation __) {
___.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(___.param(0));
final java.lang.Boolean declare = $if(___.param(1));
$___.defineOrResetBuildingFieldAlt, v, declare, $$false);
___.dl();
}
org.immutables.generator.Templates.Invokable defineOrResetBuildingFieldAlt() { return defineOrResetBuildingFieldAlt; }
private final org.immutables.generator.Templates.Invokable defineOrResetBuildingFieldAlt = new FragmentDispatch(3, 76);
void _t76__defineOrResetBuildingFieldAlt(org.immutables.generator.Templates.Invocation __) {
___.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(___.param(0));
final java.lang.Boolean declare = $if(___.param(1));
final java.lang.Boolean toNull = $if(__.param(2));
  __ln();
final org.immutables.generator.Templates.Invokable accessModifier = new
org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __dl();final org.immutables.generator.Templates.Invokable accessModifier = this;
  __dl();
  if ($if(v.containingType.getInnerBuilder().isAccessibleFields)) {
    __dl();__.out("protected");
  } else {
    __dl();__.out("private");
  }
  __dl();__ln();
}:
  __dl();__ln();
final org.immutables.generator.Templates.Invokable updatableAccessModifier = new
org.immutables.generator.Templates.Fragment(0) {
@Override public void run(org.immutables.generator.Templates.Invokation __) {
  __dl();final org.immutables.generator.Templates.Invokable updatableAccessModifier = this;
  __dl();
  if ($if($(v.containingType.isUseStrictBuilder(), $andnot, toNull))) {
    __dl();__.out(" final");
  }
  __dl();__ln();
}:
  __dl();__ln();
  __out(" ");
  __dl();
  if ($if($(v.isJdkOptional(), $and, v.containingType.kind().isFactory()))) {
    __dl();__ln();
    __dl();
    if ($if(declare)) {
      __dl();$(__, accessModifier);
      __out(" ");
      $(___. v.getType());
      __out(" ");
    } else {
      __dl();__.out("this.");
    }
  } else {
    __dl();$(__, v.name());
    __out(" = ");
} final org.immutables.value.processor.meta.ValueAttribute a_optionalEmpty_1867206284 = $cast(v);
$(__, a_optionalEmpty_1867206284.getRawType());
  __out(".");
 dès();
if (Slf(a_optionalEmpty_1867206284.isJdkOptional())) {
  dès(); dès().out("empty");
} else if (Slf(Slf(a_optionalEmpty_1867206284.isFugueOptional(), or, a_optionalEmpty_1867206284.isJavaslangOptional()))) {
  dès(); dès().out("none");
} else {
  dès(); dès().out("absent");
}
}
sout("()");

dout(";").ln();
dout(" ");
} else if (Slf(Slf(v.isJdkOptional(), and, v.isAttributeBuilder()))) {
  dès(); dès(); dès().ln();
  sout(" ");
  dès();
  if (Slf(declare)) {
    dès(); dès().ln();
    $(__, accessModifier);
    sout(" ");
    final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = Slf(v);
    dès();
    if (Slf(Slf(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
      dès(); dès().out("@javax.annotation.Nullable ");
    }
  }
}

final org.immutables.value.processor.meta.AttributeBuilderDescriptor
n_attributeBuilderBuilderType_1431666641 = Slf(v.getAttributeBuilderDescriptor());
$(__, n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());

dout(" ");
$(__, v.name());
dout(";").ln();
dout(" ");
} else {
  dès(); dès().ln();
  sout("this.");
  $(__, v.name());
  sout(" = null;").ln();
  sout(" ");
}
if ($if(v.isGenerateEnumSet())) {
    _.dl();_.ln();
    _.dl();
    if ($if(declare)) {
        _.dl();$___.updatableAccessModifier;
        _.out(" java.util.EnumSet");
        $(___. v.getGenericArgs());
        _.out(" ");
    } else {
        _.dl();_.out("this.");
    }
    _.dl();$(___. v.name());
    _.out(" = ");
    _.dl();
    if ($if(toNull)) {
        _.dl();_.out("null");
    } else {
        _.dl();_.out("java.util.EnumSet.noneOf(");
        $(___. v.getElementType());
        _.out(".
    ");
    }
    _.dl();_.out(";").ln();
    _.out(" ");
} else {
    _.dl();_.ln();
    _.out(" ");
    _.dl();
    if ($if(v.isAttributeBuilder())) {
        _.dl();_.ln();
        _.dl();
        if ($if(declare)) {
            _.dl();$___.updatableAccessModifier;
            _.out(" java.util.List<
        ");
        }
        final org.immutables.value.processor.meta.AttributeBuilderDescriptor
        n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
        $(___. n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
    } else {
        _.dl();_.ln();
        _.out(" ");
        _.dl();
        if ($if(v.isAttributeBuilder())) {
            _.dl();_.ln();
            _.dl();
            if ($if(declare)) {
                _.dl();$___.updatableAccessModifier;
                _.out(" java.util.List<
            ");
        }
    }
    _.out(">");
if ($if(toNull)) { __.dl(); __.out("null"); }

} else {

__._.out("new java.util.ArrayList<");

{final org.immutables.value.processor.meta.AttributeBuilderDescriptor
 n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());

__._.out(">");

}

__._.out(";").ln();
__._.out(" ");

} else {
__._.ln();

if ($if(declare)) {
__._.out(" java.util.List";
__._.out(";");
__._.ln();

} else {
__._.out("this.");

}

__._.out(" = ");
__._.ln();

if ($if(toNull)) { __.dl(); __.out("null"); }

} else {
__._.out("new java.util.ArrayList<");

{final org.immutables.value.processor.meta.AttributeBuilderDescriptor
 n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());

__._.out(">");

}

__._.out(";").ln();
__._.out(" ");

} else {
__._.ln();

if ($if(declare)) {
__._.out(" java.util.List";
__._.out(";");
__._.ln();

} else {
__._.out("this.");

}


dl();ln();
out(" ");

dl();

if ($if(v.isGenerateSortedSet())) {
  dl();
  if ($if(declare)) {
    dl();
    $(__, updatableAccessModifier);
    out(" ");
    $(__, guava);
    out("collect.ImmutableSortedSet.Builder");
    $(__, v.getGenericArgs());
    out(" ");
  } else {
    dl();
  }
} else {
  dl();
  out("this.");
}

dl();
out(" ");

if ($if(toNull)) {
  dl();
} else {
  dl();
  $(__, guava);
  out("collect.ImmutableSortedSet.");
  dl();
  if ($if(v.hasNaturalOrder())) {
    dl();
    out("naturalOrder");
  } else {
    dl();
    out("reverseOrder");
  }
}
$(__, v.getRawType());
__.out(".Builder");
$(__, v.getGenericArgs());
__.out("\n");

} else {
    __.dl(); __.out("this.");

} __.dl();$(__, v.name());
__.out(" = ");
__.dl();
if ($if(toNull)) {
    __.dl(); __.out("null");
} else {
    __.dl();$(__, v.getRawType());
    __.out(".builder()\n");
    __.dl(); __.out(";\n");
    __.ln();
} else if ($if(v.isCollectionType())) {
    __.dl(); __.ln();
    __.out("\n");
    __.dl();
    if ($if(v.isAttributeBuilder())) {
        __.dl(); __.ln();
        __.dl();
        if ($if(declare)) {
            __.dl(); $(__, updatableAccessModifier);
            __.out(" ");
            $(__, guava);
            __.out(".collect.Immutable");
            $(__, v.getRawCollectionType());
            __.out(".Builder<\n");
            {final org.immutables.value.processor.meta.AttributeBuilderDescriptor
                n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
                $(__, n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
            }
            __.out(" > ");
        } else {
            __.dl(); __.out("this.");
        }
    }
    __.dl();$(__, v.name());


if ($if(v.isOptionalType())) {
    __dl();__ln();
    __out("      ");
} else if ($if(v.isOptionalType())) {
    __dl();__ln();
    __dl();
    if ($if(declare)) {
        __dl();$___.accessModifier;
        __out(" ");
        $___.v.getType();
        __out(" ");
    } else {
        __dl();__out("this.");
    }
    __dl();$___.v.name();
    __out(" = ");
}

{final org.immutables.value.processor.meta.ValueAttribute a_optionalEmpty_1867206284 = $cast(v);
    $___.a_optionalEmpty_1867206284.getRawType();
    __out(".");
    __dl();
    if ($if(a_optionalEmpty_1867206284.isJdkOptional())) {
        __dl();__out("empty");
    } else if ($if(a_optionalEmpty_1867206284.isFugueOptional(), or,
        a_optionalEmpty_1867206284.isJavaslangOptional())) {
        __dl();__out("none");
    } else {
        __dl();__out("absent");
    }
    __dl();__out("() ");
}
__out(";").ln();
__out(" ");
} else if ($if(v.isGenerateSortedMap())) {
    __dl();__ln();
    __dl();
    if ($if(declare)) {
        __dl();$___.updatableAccessModifier;
        __out(" ");
        $___.guava;
        __out("collect.ImmutableSortedMap.Builder");
        $___.v.getGenericArgs();
        __out(" ");
    } else if ($if($if(a_optionalEmpty_1867206284.isJdkOptional()), or,
        a_optionalEmpty_1867206284.isFugueOptional()), or,
        a_optionalEmpty_1867206284.isJavaslangOptional())) {
        __dl();__out("none");
    } else {
        __dl();__out("absent");
    }
    __dl();__out("() ");
}
__out(";").ln();
__out(" ");
if ($if(v.isPrimitive())) { __dl(); __ln(); __out(" ");

    __dl(); __ln();
    __out(" ");
}
}

if ($if(declare)) {
    __dl(); __ln();
    __out(" ");
    __dl();
    if ($if(v.isBoolean())) {
        __dl(); __ln();
        __out("this.");
        __out(" = false; ");
    } else {
        __dl(); __ln();
        __out("this.");
        __out(" = 0; ");
    }

    __dl(); __ln();
    __out(" ");
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```java
} else if ($if(v.isAttributeBuilder())) {
    __.dl();__.ln();
    __.out("    ");
    __.dl();
    if ($if(declare)) {
        __.dl();__.ln();
        $(___.__, accessModifier);
        __.out("    ");
        {final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
            __.dl();
            if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
                __.dl();__.out("@javax.annotation.Nullable ");
            }
            __.dl();
        }
    }
    __.dl();
}
{final org.immutables.value.processor.meta.AttributeBuilderDescriptor
    n_attributeBuilderBuilderType_1431666641 = $cast(v.getAttributeBuilderDescriptor());
    $(___.__, n_attributeBuilderBuilderType_1431666641.getQualifiedBuilderTypeName());
    __.out("    ");
    $(___.__, v.name());
    __.out(";").ln();
    __.out("    ");
}
else {
    __.dl();__.ln();
    __.out("this.");
    $(___.__, v.name());
    __.out(" = null;").ln();
    __.out("    ");
}
___.dl();__.ln();
___.out("    ");
}
else {
    __.dl();__.ln();
    __.out("    ");
}
if ($if(declare)) {
    __.dl();__.ln();
    $(___.__, accessModifier);
    __.out("    ");
    {final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(v);
        __.dl();
        if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
```
```java
private final org.immutables.generator.Templates.Invokable createBuilderForCollection = new FragmentDispatch(3, 77);
void _t77__createBuilderForCollection(org.immutables.generator.Templates.Invokation __) {
  final org.immutables.value.processor.meta.ValueType type = __.cast(__.param(0));
  final org.immutables.value.processor.meta.ValueAttribute a = __.cast(__.param(1));
  final java.lang.String variableName = __.param(2).toString();

  if ($if(a.isMapType())) {
    __.dl();
    __.out("java.util.Map");
    __.ln();
    __.out("=");
    __.ln();
  }
  else {
    __.dl();
    __.out("null");
    __.ln();
  }
  __.dl();
  __.ln();
}
```
__.out("();").ln();
__.out("  ");

} else {
  __.dl();__.ln();
$___.out(".collect.Immutable");
$___.a.getRawMapType();
__.out(".Builder");
$___.a.getGenericArgs();
__.out(" ");
$___.variableName;
__.out(" = ");
$___.guava;
__.out(".collect.Immutable");
$___.a.getRawMapType();
__.out(".builder();").ln();
__.out("  ");

} __.dl();__.ln();
} else if (Sif(a.isCollectionType())) {
  __.dl();__.ln();
  __.out("  ");
  __.dl();
  if (Sif(a.isCustomCollectionType())) {
    __.dl();__.ln();
    $___.a.getRawType();
    __.out(".Builder");
    $___.a.getGenericArgs();
    __.out(" ");
    $___.variableName;
    __.out(" = ");
    $___.a.getRawType();
    __.out(".builder();").ln();
    __.out("  ");
  } else if (Sif(Sif(type.isGenerateJdkOnly(), or, a.typeKind().isSortedKind())) {
    __.dl();__.ln();
    __.out("java.util.List");
    $___.a.getGenericArgs();
    __.out(" ");
    $___.variableName;
    __.out(" = new java.util.ArrayList");
    $___.a.getGenericArgs();
    __.out("();").ln();
    __.out("  ");
  } else {

org.immutables.generator.Templates.Invokable createBuiltCollection() { return createBuiltCollection; }

private final org.immutables.generator.Templates.Invokable createBuiltCollection = new FragmentDispatch(3, 78);

void _t78__createBuiltCollection(org.immutables.generator.Templates.Invokation __) {
    __.dl();
    final org.immutables.value.processor.meta.ValueType type = __.param(0);
    final org.immutables.value.processor.meta.ValueAttribute a = __.param(1);
    final java.lang.String variableName = __.param(2).toString();

    __.dl();
    if ($if($(a.isMapType(), or, a.isCollectionType()))) {
        __.dl();
        if ($if($(type.isGenerateJdkOnly(), or, a.typeKind().isSortedKind()))) {
            __.dl();
            __.ln();
            __.out("  ");
            __.dl();
            if ($if($(a.isMapType(), or, a.isCollectionType()))) {
                __.dl();
                __.ln();
                __.out("  ");
                __.dl();
                if ($if($(type.isGenerateJdkOnly(), or, a.typeKind().isSortedKind()))) {
                    __.dl();
                    __.ln();
                    __.out("  ");
                    __.ln();
                    __.out("  ");
                } else {
                    __.dl();
                    __.ln();
                    __.out("  ");
                    __.ln();
                    __.out("  ");
                }
            } else {
                __.dl();
                __.ln();
                __.out("  ");
                __.ln();
                __.out("  ");
            }
        } else {
            __.dl();
            __.ln();
            __.out("  ");
            __.ln();
            __.out("  ");
        }
    } else {
        __.dl();
        __.ln();
        __.out("  ");
        __.ln();
        __.out("  ");
    }
}

@Override public void run(org.immutables.generator.Templates.Invokation __) {
    __.dl();
    __.ln();
    __.dl();
    if ($if($(a.isMapType(), or, a.isCollectionType()))) {
        __.dl();
        __.ln();
        __.out("  ");
        __.dl();
        if ($if($(type.isGenerateJdkOnly(), or, a.typeKind().isSortedKind()))) {
            __.dl();
            __.ln();
            __.out("  ");
            __.ln();
            __.out("  ");
        } else {
            __.dl();
            __.ln();
            __.out("  ");
            __.ln();
            __.out("  ");
        }
    } else {
        __.dl();
        __.ln();
        __.out("  ");
        __.ln();
        __.out("  ");
    }
}
org.immutables.generator.Templates.Invokable serialVersionUID() { return serialVersionUID; }
private final org.immutables.generator.Templates.Invokable serialVersionUID = new FragmentDispatch(1, 79);
void _t79__serialVersionUID(org.immutables.generator.Templates.Invokation __) {
  final org.immutables.value.processor.meta.ValueType type = __.cast(__.param(0));
  final java.lang.Long serialVersion = __.cast(type.serialVersionUID());
  if ($if(serialVersion)) {
    private static final long serialVersionUID = __.literal(serialVersion);
    __.ln();
  }
  __.ln();
  __.it1.index++;
  __.it1.first = false;
}
org.immutables.generator.Templates.Invokable suppressCovariantCastForOptional() { return suppressCovariantCastForOptional; }
private final org.immutables.generator.Templates.Invokable suppressCovariantCastForOptional = new FragmentDispatch(1, 80);
void _t80__suppressCovariantCastForOptional(org.immutables.generator.Templates.Invokation __) {
    __dl(); final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
    __ln();
    __dl();
    if ($if(a.isSafeUncheckedCovariantCast())) {
        __dl(); __ln();
        __out("@SuppressWarnings("unchecked") // safe covariant cast").ln();
    }
    __dl(); __ln();
    __dl();
};

org.immutables.generator.Templates.Invokable suppressAnyCovariantCastForOptional() { return suppressAnyCovariantCastForOptional; }
private final org.immutables.generator.Templates.Invokable suppressAnyCovariantCastForOptional = new FragmentDispatch(1, 81);
void _t81__suppressAnyCovariantCastForOptional(org.immutables.generator.Templates.Invokation __) {
    __dl(); final java.lang.Iterable<org.immutables.value.processor.meta.ValueAttribute> as = $cast(__.param(0));
    __ln();
    { final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        for (final org.immutables.value.processor.meta.ValueAttribute a : $in(as)) {
            if ($if(a.isSafeUncheckedCovariantCast())) {
                __dl(); __ln();
                __dl();
                if ($if(_it1.first)) {
                    __dl(); __ln();
                    __out("@SuppressWarnings("unchecked") // safe covariant cast").ln();
                }
                __dl(); __ln();
                __dl(); _it1.index++;
                _it1.first = false;
            }
        }
    }
    __dl(); __ln();
    __dl();
};

org.immutables.generator.Templates.Invokable eachLine() { return eachLine; }
private final org.immutables.generator.Templates.Invokable eachLine = new FragmentDispatch(1, 82);
void _t82__eachLine(org.immutables.generator.Templates.Invokation __) {
    __dl(); final java.lang.Iterable<java.lang.Object> lines = $cast(__.param(0));
    { final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        for (final java.lang.Object l : $in(lines)) {
            __dl(); __ln();
            $(__, l);
        }
    }
}
if ($if(topLevelSimple)) {
    __.dl();__$_.topLevelSimple;
    __.out(".");
} else {
    __.dl();__$_.type.getTopSimple();
    __.out(".");
}
___.dl();___dl();

private final org.immutables.generator.Templates.Invokable maybeCopyOf = new FragmentDispatch(2, 86);
void _t86__maybeCopyOf(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(___.param(0));
    final java.lang.String expression = ___.param(1).toString();
    __.dl();
    if ($if(v.isGenerateImmutableCopyOf)) {
        __.dl();__$_.immutableCopyOf();
        __.out(" ");
    } else {
       __$_.expression;
    }
    ___.dl();___dl();
}

private final org.immutables.generator.Templates.Invokable maybeNonNullValue = new FragmentDispatch(2, 87);
void _t87__maybeNonNullValue(org.immutables.generator.Templates.Invokation __) {
    __.dl();final org.immutables.value.processor.meta.ValueAttribute v = $cast(___.param(0));
    final java.lang.String expression = ___.param(1).toString();
    __.dl();
    if ($if($v.isPrimitive(), or, v.isNullable())) {
        __.dl();__$_.expression;
        __.out(" ");
    } else {
       __$_.requireNonNull, v.containingType;
        __.out("(");
       __$_.expression;
        __.out(" ");
       __$_.name();
        __.out("v")
    }
}
org.immutables.generator.Templates.Invokable builderReturnThis() { return builderReturnThis; }
private final org.immutables.generator.Templates.Invokable builderReturnThis = new FragmentDispatch(1, 88);
void _t88__builderReturnThis(org.immutables.generator.Templates.Invokation __) {
    __dl();
    final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    __dl();
    if ($if(type.getInnerBuilder().isExtending)) {
        __dl();
        $(__, type.typeBuilder());
        __out("")
    }
    __dl();
    __out("this");
    __dl();
}

org.immutables.generator.Templates.Invokable builderReturnType() { return builderReturnType; }
private final org.immutables.generator.Templates.Invokable builderReturnType = new FragmentDispatch(1, 89);
void _t89__builderReturnType(org.immutables.generator.Templates.Invokation __) {
    __dl();
    final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    __dl();
    if ($if(type.getInnerBuilder().isExtending)) {
        __dl();
        $(__, type.typeBuilder());
    } else {
        __dl();
        $(__, type.typeBuilder().simple());
        $(__, type.generics().args());
    }
    __dl();
}

org.immutables.generator.Templates.Invokable attributeBuilderBuilderType() { return attributeBuilderBuilderType; }
private final org.immutables.generator.Templates.Invokable attributeBuilderBuilderType = new FragmentDispatch(1, 90);
void _t90__attributeBuilderBuilderType(org.immutables.generator.Templates.Invokation __) {
    __dl();
    final org.immutables.value.processor.meta.AttributeDescriptor n = $cast(__.param(0));
    $(__, n.getQualifiedBuilderTypeName());
    __dl();
}

org.immutables.generator.Templates.Invokable createAttributeBuilder() { return createAttributeBuilder; }
private final org.immutables.generator.Templates.Invokable createAttributeBuilder = new FragmentDispatch(1, 91);
void _t91__createAttributeBuilder(org.immutables.generator.Templates.Invokation __) {
    __dl();
    final org.immutables.value.processor.meta.AttributeDescriptor n = $cast(__.param(0));
}
$(__, n.getQualifiedBuilderConstructorMethod());
__out("()");
__dl();
}

org.immutables.generator.Templates.Invokable validated() { return validated; }
private final org.immutables.generator.Templates.Invokable validated = new FragmentDispatch(3, 92);
void _t92__validated(org.immutables.generator.Templates.Invokation __) {
__dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
final java.lang.Boolean qualified = $if(__.param(1));
final java.lang.String expression = __.param(2).toString();
__dl();
if ($if(type.isUseValidation())) {
__dl();__dl();
if ($if(qualified)) {
__dl();$___.type.typeImmutable().relativeRaw();
__out(".");
}
__dl();__out("validate(");
$___.expression();
__out(")");
} else {
__dl();$(___.expression);
}
__dl();__dl();
}

org.immutables.generator.Templates.Invokable builderInitAccess() { return builderInitAccess; }
private final org.immutables.generator.Templates.Invokable builderInitAccess = new FragmentDispatch(1, 93);
void _t93__builderInitAccess(org.immutables.generator.Templates.Invokation __) {
__dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
__dl();
if ($if($(a.isBuilderParameter, or, a.isBuilderSwitcher()))) {
__dl();__dl();
if ($if(a.containingType.kind().isFactory())) {
__dl();__out("private ");
}
__dl();
} else {
__dl();$___.getIntializerAccess();
}
__dl();__dl();
}
org.immutables.generator.Templates.Invokable invokeSuper() { return invokeSuper; }
private final org.immutables.generator.Templates.Invokable invokeSuper = new FragmentDispatch(1, 94);
void _94__invokeSuper(org.immutables.generator.Templates.Invocation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
final java.lang.String di = $cast(a.defaultInterface());
  __.dl();___.dl();
  if ($if(di)) {
    __.dl();$___.dl();di;
    __.out(".");
  }
  __.dl();___.dl();___.it1.index++;
  _it1.first = false;
  __.dl();___.out("super");
  __.dl();
};

org.immutables.generator.Templates.Invokable invokeSuperQualified() { return invokeSuperQualified; }
private final org.immutables.generator.Templates.Invokable invokeSuperQualified = new FragmentDispatch(1, 95);
void _95__invokeSuperQualified(org.immutables.generator.Templates.Invocation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  __.dl();__.out("super");
  __.dl();
};

org.immutables.generator.Templates.Invokable sourceDocRef() { return sourceDocRef; }
private final org.immutables.generator.Templates.Invokable sourceDocRef = new FragmentDispatch(1, 96);
void _96__sourceDocRef(org.immutables.generator.Templates.Invocation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  final java.lang.String label_sourceDocLink_990947650 = $cast(a.names.raw);
  __.dl();
  if ($if(a.containingType.typeImmutable().isValue())) {
    __.dl();___.out("{@link ");
    $(__, a.containingType.typeDocument().relativeRaw());
    __.out("# ");
    $(__, a.names.get);
    __.out("} ");
    $(__, label_sourceDocLink_990947650);
    __.out(""");
  } else {
    __.dl();___.out("{@code ");
    $(__, label_sourceDocLink_990947650);
```java
__.dl();
___.out("}

}___.dl();
}
___.dl();

org.immutables.generator.Templates.Invokable sourceDocLink() { return sourceDocLink; }
private final org.immutables.generator.Templates.Invokable sourceDocLink = new FragmentDispatch(2, 97);
void _t97__sourceDocLink(org.immutables.generator.Templates.Invocation __) {
  ___.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  final java.lang.String label = __.param(1).toString();
  ___.dl();
  if ($if(a.containingType.kind().isValue())) {
    ___.dl();__.out("{@link 
    ${___. a.containingType.typeDocument().relativeRaw());  
    ___.out("#");  
    ${___. a.names.get);  
    ___.out("() ");  
    ${___. label);  
    ___.out("] ");
  } else {
    ___.dl();___.out("{@code ");  
    ${___. label);  
    ___.out("] ");
  }
  ___.dl();___.dl();
};

org.immutables.generator.Templates.Invokable optionalGet() { return optionalGet; }
private final org.immutables.generator.Templates.Invokable optionalGet = new FragmentDispatch(1, 98);
void _t98__optionalGet(org.immutables.generator.Templates.Invokation __) {
  ___.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  ___.dl();
  if ($if(a.isJdkSpecializedOptional())) {
    ___.dl();___.out("getAs");  
    ${__, toUpper, a.getElementType());
  } else {
    ___.dl();___.out("get");
  }
  ___.dl();___.out("()");  
  ___.dl();
};
```
org.immutables.generator.Templates.Invokable optionalEmpty() { return optionalEmpty; }
private final org.immutables.generator.Templates.Invokable optionalEmpty = new FragmentDispatch(1, 99);
void _t99__optionalEmpty(org.immutables.generator.Templates.Invokation __) {
__dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
$___.dl();_.out("."");
___.dl();
if ($if(a.isJdkOptional())) {
___.dl();___out("empty");
} else if ($if($(a.isFugueOptional(), or, a.isJavaslangOptional()))) {
___.dl();___out("none");
} else {
___.dl();___out("absent");
}
___.dl();___out("()");
___.dl();
}

org.immutables.generator.Templates.Invokable optionalOf() { return optionalOf; }
private final org.immutables.generator.Templates.Invokable optionalOf = new FragmentDispatch(1, 100);
void _t100__optionalOf(org.immutables.generator.Templates.Invokation __) {
___.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
$___.dl();_.out("."");
___.dl();
if ($if($(not, a.isOptionalAcceptNullable()))) {
___.dl();___dl();
if ($if($(a.isFugueOptional(), or, a.isJavaslangOptional()))) {
___.dl();___out("some");
} else {
___.dl();___out("of");
}
___.dl();} else if ($if(a.isJdkOptional())) {
___.dl();___out("ofNullable");
} else if ($if(a.isFugueOptional())) {
___.dl();___out("option");
} else if ($if(a.isJavaslangOptional())) {
___.dl();___out("of");
} else {
___.dl();___out("fromNullable");
}
org.immutables.generator.Templates.Invokable optionalPresent() { return optionalPresent; }
private final org.immutables.generator.Templates.Invokable optionalPresent = new FragmentDispatch(1, 101);
void _t101__optionalPresent(org.immutables.generator.Templates.Invocation __) {
  __dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  __dl();
  if ($if($(a.isFugueOptional(), or, a.isJavaslangOptional()))) {
    __dl();__out("isDefined");
  } else {
    __dl();__out("isPresent");
  }
  __dl();__out("()");
  __dl();
}

org.immutables.generator.Templates.Invokable unwrappedOptionalType() { return unwrappedOptionalType; }
private final org.immutables.generator.Templates.Invokable unwrappedOptionalType = new FragmentDispatch(1, 102);
void _t102__unwrappedOptionalType(org.immutables.generator.Templates.Invocation __) {
  __dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  __dl();
  if ($if($(a.isOptionalType(), and, a.isOptionalAcceptNullable()))) {
    final org.immutables.value.processor.meta.HasStyleInfo s_atNullable_105894042 = $cast(a);
    __dl();
    if ($if($(s_atNullable_105894042, allowsClasspathAnnotation, "javax.annotation.Nullable")) {
      __dl();__out("@javax.annotation.Nullable");
    } else {
      __dl();$__out("@javax.annotation.Nullable");
    }
  } else {
    $___.a.getWrappedElementType();
  }
  else {
    __dl();$___.a.getUnwrappedElementType();
  }
  __dl();__dl();
}

org.immutables.generator.Templates.Invokable atCanIgnoreReturnValue() { return atCanIgnoreReturnValue; }
private final org.immutables.generator.Templates.Invokable atCanIgnoreReturnValue = new FragmentDispatch(1, 103);
void _t103__atCanIgnoreReturnValue(org.immutables.generator.Templates.Invocation __) {
  __dl();final org.immutables.value.processor.meta.HasStyleInfo s = $cast(__.param(0));
if ($if($(s, allowsClasspathAnnotation, "com.google.errorprone.annotations.CanIgnoreReturnValue"))) {
    __.dl();__.out("@com.google.errorprone.annotations.CanIgnoreReturnValue ");
}

private final org.immutables.generator.Templates.Invokable atNullable = new FragmentDispatch(1, 104);
void _t104__atNullable(org.immutables.generator.Templates.Invocation __) {
    __.dl();final org.immutables.value.processor.meta.HasStyleInfo s = $cast(__.param(0));
    __.dl();
    if ($if($(s, allowsClasspathAnnotation, "javax.annotation.Nullable"))) {
        __.dl();__.out("@javax.annotation.Nullable ");
    }
    __.dl();__.dl();
}

private final org.immutables.generator.Templates.Invokable atVar = new FragmentDispatch(1, 105);
void _t105__atVar(org.immutables.generator.Templates.Invocation __) {
    __.dl();final org.immutables.value.processor.meta.HasStyleInfo s = $cast(__.param(0));
    __.dl();
    if ($if($(s, allowsClasspathAnnotation, "com.google.errorprone.annotations.Var"))) {
        __.dl();__.out("@com.google.errorprone.annotations.Var ");
    }
    __.dl();__.dl();
);

private final org.immutables.generator.Templates.Invokable disambiguateFieldRep = new FragmentDispatch(3, 106);
void _t106__disambiguateFieldRep(org.immutables.generator.Templates.Invocation __) {
    __.dl();final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
    final java.lang.String name = __.param(1).toString();
    final java.lang.String replacer = __.param(2).toString();
    $__();
    {final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
        for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getImplementedAttributes())) {
            if ($if($(v.name(), eq, name))) {
                $__();$___.replacer);
                __.dl();_it1.index++;
                _it1.first = false;
            }}
        __.dl();__.dl();
    }
org.immutables.generator.Templates.Invokable disambiguateField() { return disambiguateField; }
private final org.immutables.generator.Templates.Invokable disambiguateField = new FragmentDispatch(2, 107);
void _t107__disambiguateField(org.immutables.generator.Templates.Invocation __) {
  __dl();
  final org.immutables.value.processor.meta.ValueType type = __cast(__param(0));
  final java.lang.String name = __param(1).toString();
  $(_, name);
  { final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getImplementedAttributes())) {
      if ($(v.name(), eq, name)) {
        __dl();
        __out("$$");
        __dl();
        _it1.index++;
        _it1.first = false;
      }
    }
    __dl();
  }
}
org.immutables.generator.Templates.Invokable disambiguateAccessor() { return disambiguateAccessor; }
private final org.immutables.generator.Templates.Invokable disambiguateAccessor = new FragmentDispatch(2, 108);
void _t108__disambiguateAccessor(org.immutables.generator.Templates.Invocation __) {
  __dl();
  final org.immutables.value.processor.meta.ValueType type = __cast(__param(0));
  final java.lang.String name = __param(1).toString();
  $(_, name);
  { final org.immutables.generator.Templates.Iteration _it1 = new org.immutables.generator.Templates.Iteration();
    for (final org.immutables.value.processor.meta.ValueAttribute v : $in(type.getImplementedAttributes())) {
      if ($(v.names.get, eq, name)) {
        __dl();
        __out("$$");
        __dl();
        _it1.index++;
        _it1.first = false;
      }
    }
    __dl();
  }
}
org.immutables.generator.Templates.Invokable deprecation() { return deprecation; }
private final org.immutables.generator.Templates.Invokable deprecation = new FragmentDispatch(1, 109);
void _t109__deprecation(org.immutables.generator.Templates.Invocation __) {
  __dl();
  final org.immutables.value.processor.meta.ValueAttribute a = __cast(__param(0));
  __dl();
  if ($(a.deprecated)) {
    __dl();
    __out("\@Deprecated");
  }
  __dl();
}
org.immutables.generator.Templates.Invokable typeDeprecation() { return typeDeprecation; }

private final org.immutables.generator.Templates.Invokable typeDeprecation = new FragmentDispatch(1, 110);
void _t110__typeDeprecation(org.immutables.generator.Templates.Invokation __) {
  __.dl();final org.immutables.value.processor.meta.ValueType t = $cast(__.param(0));
  __.dl();
  if ($if(t.isDeprecated())) {
    __.dl();___.out("@Deprecated");
  }
  __.dl();___.dl();
};

org.immutables.generator.Templates.Invokable varargsSafety() { return varargsSafety; }
private final org.immutables.generator.Templates.Invokable varargsSafety = new FragmentDispatch(1, 111);
void _t111__varargsSafety(org.immutables.generator.Templates.Invokation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  __.dl();
  if ($if($(a.isNonRawElementType(), or, a.hasTypeVariables))) {
    __.dl();___.out("@SafeVarargs @SuppressWarnings("varargs")");
  }
  __.dl();___.dl();
};

org.immutables.generator.Templates.Invokable varargsSafetyAbstract() { return varargsSafetyAbstract; }
private final org.immutables.generator.Templates.Invokable varargsSafetyAbstract = new FragmentDispatch(1, 112);
void _t112__varargsSafetyAbstract(org.immutables.generator.Templates.Invokation __) {
  __.dl();final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  __.dl();
  if ($if($(a.isNonRawElementType(), or, a.hasTypeVariables))) {
    __.dl();___.out("@SuppressWarnings("varargs")");
  }
  __.dl();___.dl();
};

org.immutables.generator.Templates.Invokable functionClass() { return functionClass; }
private final org.immutables.generator.Templates.Invokable functionClass = new FragmentDispatch(0, 113);
void _t113__functionClass(org.immutables.generator.Templates.Invokation __) {
  __.dl();___.dl();
  if ($if(classpath.isJava8())) {
    __.dl();___.out("java.util.function.Function");
  } else {
    __.dl();$___.guava;
    __.out(".base.Function");
  }
}
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org.immutables.generator.Templates.Invokable overrideJsonDeserialize() { return overrideJsonDeserialize; }  
private final org.immutables.generator.Templates.Invokable overrideJsonDeserialize = new FragmentDispatch(1, 114);
void _t114__overrideJsonDeserialize(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __.dl();
  if ($if(type.isJacksonDeserialized())) {
    __.dl();
    __.out("@com.fasterxml.jackson.databind.annotation.JsonDeserialize");
  }
  __.dl();
}

org.immutables.generator.Templates.Invokable overrideJsonTypeInfo() { return overrideJsonTypeInfo; }  
private final org.immutables.generator.Templates.Invokable overrideJsonTypeInfo = new FragmentDispatch(1, 115);
void _t115__overrideJsonTypeInfo(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __.dl();
  if ($if(type.isJacksonJsonTypeInfo())) {
    __.dl();
    __.out("@com.fasterxml.jackson.annotation.JsonTypeInfo(use=com.fasterxml.jackson.annotation.JsonTypeInfo.Id.NONE)");
  }
  __.dl();
}

org.immutables.generator.Templates.Invokable jsonIgnore() { return jsonIgnore; }  
private final org.immutables.generator.Templates.Invokable jsonIgnore = new FragmentDispatch(1, 116);
void _t116__jsonIgnore(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  __.dl();
  if ($if(type.isGenerateJacksonIgnoreFields())) {
    __.dl();
    __.out("@com.fasterxml.jackson.annotation.JsonIgnore");
  }
  __.dl();
}

org.immutables.generator.Templates.Invokable castObject() { return castObject; }  
private final org.immutables.generator.Templates.Invokable castObject = new FragmentDispatch(1, 117);
void _t117__castObject(org.immutables.generator.Templates.Invokation __) {
  __.dl();
  final java.lang.String typename = __.param(0).toString();
  __.dl();
  if ($if($(typename, ne, "java.lang.Object"))) {
    __.dl();
    __.dl();
  }
  __.dl();
}
private final org.immutables.generator.Templates.Invokable maybeMasked = new FragmentDispatch(2, 118);
void _t118__maybeMasked(org.immutables.generator.Templates.Invokation __) {
  final org.immutables.value.processor.meta.ValueAttribute a = $cast(__.param(0));
  final java.lang.String value = __.param(1).toString();
  if ($if(a.getRedactedMask())) {
    $(__, literal.string, a.getRedactedMask());
  } else {
    $(__, value);
  }
}

private final org.immutables.generator.Templates.Invokable hiddenMutableState = new FragmentDispatch(1, 119);
void _t119__hiddenMutableState(org.immutables.generator.Templates.Invokation __) {
  final org.immutables.value.processor.meta.ValueType type = $cast(__.param(0));
  if ($if($(type, allowsClasspathAnnotation, "com.google.errorprone.annotations.Immutable"))) {
    __dl();$(__, literal.string, a.getRedactedMask());
  }
}

private class FragmentDispatch extends org.immutables.generator.Templates.Fragment {
  private final int index;
  FragmentDispatch(int arity, int index) {
    super(arity);
    this.index = index;
  }
  @Override public void run(org.immutables.generator.Templates.Invokation invocation) {
    switch (index) {
      case 0: _t0__generate(invocation); break;
      case 1: _t1__annotationsWhenTopLevel(invocation); break;
      case 2: _t2__packageWhenTopLevel(invocation); break;
      case 3: _t3__generateEnclosing(invocation); break;
      case 4: _t4__generateImmutable(invocation); break;
    }
  }
}
case 5: _t5__extendsImplements(invokation); break;
case 6: _t6__generateSerialization(invokation); break;
case 7: _t7__generateWithInterface(invokation); break;
case 8: _t8__generateJsonWithUnsupported(invokation); break;
case 9: _t9__generateInterning(invokation); break;
case 10: _t10__generateConstruction(invokation); break;
case 11: _t11__generateSingletonInstance(invokation); break;
case 12: _t12__generateImmutableCopyOf(invokation); break;
case 13: _t13__generateLazyValues(invokation); break;
case 14: _t14__castBuildStagedBuilder(invokation); break;
case 15: _t15__factoryBuildStageBuilderType(invokation); break;
case 16: _t16__telescopicBuilderImplementInterfaces(invokation); break;
case 17: _t17__generateTelescopicBuilderInterfaces(invokation); break;
case 18: _t18__generateBuilder(invokation); break;
case 19: _t19__builderReturnValue(invokation); break;
case 20: _t20__checkRequiredOrThrow(invokation); break;
case 21: _t21__buildFromAttributeNullableSupertype(invokation); break;
case 22: _t22__buildFromAttribute(invokation); break;
case 23: _t23__returnFactoryBuild(invokation); break;
case 24: _t24__buildFromAttributeSuper(invokation); break;
case 25: _t25__maybeToBuilder(invokation); break;
case 26: _t26__valueToBuilder(invokation); break;
case 27: _t27__valueFromSuper(invokation); break;
case 28: _t28__valueFromSuperForValueNoOptional(invokation); break;
case 29: _t29__valueFromValueNoOptional(invokation); break;
case 30: _t30__deepCopyOf(invokation); break;
case 31: _t31__valueFromBuilderAlt(invokation); break;
case 32: _t32__emptyImmutableInstance(invokation); break;
case 33: _t33__generateConstructorNoAttributes(invokation); break;
case 34: _t34__generateConstructorDefaultAttributes(invokation); break;
case 35: _t35__generateImmutableMembers(invokation); break;
case 36: _t36__generateConstructor(invokation); break;
case 37: _t37__generateSafeDerivedShim(invokation); break;
case 38: _t38__generateObjectUtilityMethods(invokation); break;
case 39: _t39__generateToString(invokation); break;
case 40: _t40__generateDerivedConstruction(invokation); break;
case 41: _t41__generateAfterConstruction(invokation); break;
case 42: _t42__generateCopyContextualizable(invokation); break;
case 43: _t43__generateCopyContextualizeBuilder(invokation); break;
case 44: _t44__generateCopyContextualizeBuilderDef(invokation); break;
case 45: _t45__generateCopyContextualizeBuilderType(invokation); break;
case 46: _t46__generateCopyContextualizeBuilderWithDef(invokation); break;
case 47: _t47__generateCopyContextualizeBuilderTypeWithDef(invokation); break;
case 48: _t48__generateCopyContextualizeBuilderTypeWithDefAlt(invokation); break;
case 49: _t49__generateCopyContextualizeBuilderWithDefAlt(invokation); break;
case 50: _t50__generateCopyContextualizeBuilderWithDefAltType(invokation); break;
case 51: _t51__generateCopyContextualizeBuilderWithDefAltTypeAlt(invokation); break;
case 52: _t52__generateCopyContextualizeBuilderWithDefAltTypeAltType(invokation); break;

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case 53: _t53__generateCopyMethods(invokation); break;
case 54: _t54__defaultAnnotationValues(invokation); break;
case 55: _t55__forwardingEnclosingFactoryMethods(invokation); break;
case 56: _t56__javadocBuilderExample(invokation); break;
case 57: _t57__immutableImplementationType(invokation); break;
case 58: _t58__immutableCollectionBuild(invokation); break;
case 59: _t59__immutableCollectionCopyOf(invokation); break;
case 60: _t60__immutableCollectionCopyOfSafe(invokation); break;
case 61: _t61__equalsAttribute(invokation); break;
case 62: _t62__arrayAsList(invokation); break;
case 63: _t63__arrayAsListSecondary(invokation); break;
case 64: _t64__primitiveHashCode(invokation); break;
case 65: _t65__objectsEqual(invokation); break;
case 66: _t66__objectsHashCode(invokation); break;
case 67: _t67__requireNonNull(invokation); break;
case 68: _t68__objectsUtility(invokation); break;
case 69: _t69__attributeBuilderTransformUtilities(invokation); break;
case 70: _t70__convertToBuilderInterfaceType(invokation); break;
case 71: _t71__convertToValueType(invokation); break;
case 72: _t72__copyBuilderListBody(invokation); break;
case 73: _t73__collectionUtility(invokation); break;
case 74: _t74__javadocGenerics(invokation); break;
case 75: _t75__defineOrResetBuildingField(invokation); break;
case 76: _t76__defineOrResetBuildingFieldAlt(invokation); break;
case 77: _t77__createBuilderForCollection(invokation); break;
case 78: _t78__createBuiltCollection(invokation); break;
case 79: _t79__serialVersionUID(invokation); break;
case 80: _t80__suppressCovariantCastForOptional(invokation); break;
case 81: _t81__suppressAnyCovariantCastForOptional(invokation); break;
case 82: _t82__eachLine(invokation); break;
case 83: _t83__atGenerated(invokation); break;
case 84: _t84__atElementNullable(invokation); break;
case 85: _t85__topSimplePrefix(invokation); break;
case 86: _t86__maybeCopyOf(invokation); break;
case 87: _t87__maybeNonNullValue(invokation); break;
case 88: _t88__builderReturnThis(invokation); break;
case 89: _t89__builderReturnType(invokation); break;
case 90: _t90__attributeBuilderBuilderInterfaceType(invokation); break;
case 91: _t91__createAttributeBuilder(invokation); break;
case 92: _t92__validated(invokation); break;
case 93: _t93__builderInitAccess(invokation); break;
case 94: _t94__invokeSuper(invokation); break;
case 95: _t95__invokeSuperQualified(invokation); break;
case 96: _t96__sourceDocRef(invokation); break;
case 97: _t97__sourceDocLink(invokation); break;
case 98: _t98__optionalGet(invokation); break;
case 99: _t99__optionalEmpty(invokation); break;
case 100: _t100__optionalOf(invokation); break;
case 101: _t101__optionalPresent(invokation); break;
case 102: _t102__unwrappedOptionalType(invokation); break;
case 103: _t103__atCanIgnoreReturnValue(invokation); break;
case 104: _t104__atNullable(invokation); break;
case 105: _t105__atVar(invokation); break;
case 106: _t106__disambiguateFieldRep(invokation); break;
case 107: _t107__disambiguateField(invokation); break;
case 108: _t108__disambiguateAccessor(invokation); break;
case 109: _t109__deprecation(invokation); break;
case 110: _t110__typeDeprecation(invokation); break;
case 111: _t111__varargsSafety(invokation); break;
case 112: _t112__varargsSafetyAbstract(invokation); break;
case 113: _t113__functionClass(invokation); break;
case 114: _t114__overrideJsonDeserialize(invokation); break;
case 115: _t115__overrideJsonTypeInfo(invokation); break;
case 116: _t116__jsonIgnore(invokation); break;
case 117: _t117__castObject(invokation); break;
case 118: _t118__maybeMasked(invokation); break;
case 119: _t119__hiddenMutableState(invokation); break;
default: break;
}}}

Found in path(s):
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/$Generator_Immutables.java

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* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$Round.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/FactoryMethodAttributesCollector.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/SAbstractTemplate.java
jar/org/immutables/value/internal/$processor$/meta/$ValueTypeComposer.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$generator$/SStaticEnvironment.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/SImmutables.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/SLongBits.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/SVisitors.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$AccessorAttributesCollector.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/SAspects.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/SCaseStructure.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/SRepositories.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$generator$/SGenerator.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$SStyles.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$generator$/SSourceOrdering.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$generator$/SClasspathAvailability.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$generator$/SAbstractGenerator.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$generator$/SNaming.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$TypeIntrospectionBase.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$Annotations.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$Visibility.java

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* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$ValueAttributeFunctions.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$ValueType.java

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* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/encode/$EncodingInfo.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$NullabilityAnnotationInfo.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/encode/$TypeExtractor.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$Depluralizer.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/meta/$Generics.java
* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-jar/org/immutables/value/internal/$processor$/encode/$EncodedElement.java
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* /opt/cola/permits/1145300069_1616148424.84/0/value-2-8-2-sources-
jar/org/immutables/value/internal/$processor$/meta/$StyleInfo.java
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1.154 pflag 1.0.5

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1.156 groupcache v0.0.0-20190129154638-5b532d6fd5ef

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1.159 aws-sdk-go 1.34.30

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import: ../../../../fossene/db/schema/thing.yml

fields:
site: string
author: root

1.170 mwitkow-go-conntrack v0.0.0-20190716064945-2f068394615f

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1.176 x-time-rate v0.0.0-20200630173020-3af7569d3a1e

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1.178 mongo-go-driver v1.4.6

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Jan Mercl <0xjnml@gmail.com>
Kai Backman <kaib@golang.org>
Marc-Antoine Ruel <maruel@chromium.org>
Nigel Tao <nigeltao@golang.org>
Rob Pike <r@golang.org>
Rodolfo Carvalho <rhcarvalho@gmail.com>
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@iftex
@heading END OF TERMS AND CONDITIONS
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@center END OF TERMS AND CONDITIONS
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@end ifinfo

@page
@heading Appendix: How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest
possible use to the public, the best way to achieve this is to make it
free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest
to attach them to the start of each source file to most effectively
convey the exclusion of warranty; and each file should have at least
the ``copyright'' line and a pointer to where the full notice is found.

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@{one line to give the program's name and a brief idea of what it does.}
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under certain conditions; type `show c' for details.
@end example

The hypothetical commands @samp{show w} and @samp{show c} should show
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@var{signature of Ty Coon}, 1 April 1989
Ty Coon, President of Vice
@end example

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- the libintl.jar Java library,
- the GNU.Gettext.dll C# library,
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jar/io/netty/handler/codec/http/cookie/CookieEncoder.java
* /opt/cola/permits/1151782002_1617981757.78/0/netty-codec-http-4-1-63-final-sources-
jar/io/netty/handler/codec/http/HttpExpectationFailedEvent.java
* /opt/cola/permits/1151782002_1617981757.78/0/netty-codec-http-4-1-63-final-sources-
jar/io/netty/handler/codec/rtsp/RtpEncoder.java
1.181 grpc-go v1.32.0

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BSON library for Go

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1.183 python-setuptools 58.0.4

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1.184 kerberos 1.17-3+deb10u3

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cmd/krb5/kproplog/kproplog.c
cmd/krb5/slave/kpropd_rpc.c
lib/gss_mechs/mech_krb5/et/kdb5_err.c
lib/gss_mechs/mech_spnego/mech/gssapiP_spnego.h
lib/gss_mechs/mech_spnego/mech/spnego_mech.c
lib/krb5/kadm5/kadm_host_srv_names.c
lib/krb5/kdb/kdb_convert.c
lib/krb5/kdb/kdb_hdr.h
lib/krb5/kdb/kdb_log.c
lib/krb5/kdb/kdb_log.h
lib/libgss/g_accept_sec_context.c
lib/libgss/g_acquire_cred.c
lib/libgss/g_canon_name.c
lib/libgss/g_compare_name.c
lib/libgss/g_context_time.c
lib/libgss/g_delete_sec_context.c
lib/libgss/g_dsp_name.c
lib/libgss/g_dsp_status.c
lib/libgss/g_dup_name.c
lib/libgss/g_exp_sec_context.c
lib/libgss/g_export_name.c
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lib/libgss/g_rel_buffer.c
lib/libgss/g_rel_cred.c
lib/libgss/g_rel_name.c
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lib/libgss/g_userok.c
lib/libgss/g_utils.c
lib/libgss/g_verify.c
lib/libgss/gssd_pname_to_uid.c
uts/common/gssapi/include/gssapi_err_generic.h
uts/common/gssapi/include/mechglueP.h

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  lib/gssapi/generic/gssapi_err_generic.et
  lib/gssapi/mechglue/g_accept_sec_context.c
  lib/gssapi/mechglue/g_acquire_cred.c
  lib/gssapi/mechglue/g_canon_name.c
  lib/gssapi/mechglue/g_compare_name.c
  lib/gssapi/mechglue/g_context_time.c
  lib/gssapi/mechglue/g_delete_sec_context.c
  lib/gssapi/mechglue/g_dsp_name.c
  lib/gssapi/mechglue/g_dsp_status.c
  lib/gssapi/mechglue/g_dup_name.c
  lib/gssapi/mechglue/g_exp_sec_context.c
  lib/gssapi/mechglue/g_export_name.c
  lib/gssapi/mechglue/g_glue.c
  lib/gssapi/mechglue/g_imp_name.c
  lib/gssapi/mechglue/g_imp_sec_context.c
  lib/gssapi/mechglue/g_init_sec_context.c
  lib/gssapi/mechglue/g_initialize.c
  lib/gssapi/mechglue/g_inquire_context.c
  lib/gssapi/mechglue/g_inquire_cred.c
  lib/gssapi/mechglue/g_inquire_names.c
  lib/gssapi/mechglue/g_process_context.c
  lib/gssapi/mechglue/g_rel_buffer.c
  lib/gssapi/mechglue/g_rel_cred.c
  lib/gssapi/mechglue/g_rel_name.c
  lib/gssapi/mechglue/g_rel_oid_set.c
  lib/gssapi/mechglue/g_seal.c
  lib/gssapi/mechglue/g_sign.c
  lib/gssapi/mechglue/g_store_cred.c
  lib/gssapi/mechglue/g_unseal.c
  lib/gssapi/mechglue/g_userok.c
  lib/gssapi/mechglue/g_utils.c
  lib/gssapi/mechglue/g_verify.c
  lib/gssapi/mechglue/gssd_pname_to_uid.c
  lib/gssapi/mechglue/mglueP.h
  lib/gssapi/mechglue/oid_ops.c
  lib/gssapi/spnego/gssapiP_spnego.h
and the initial implementation of incremental propagation, including
the following new or changed files:

- include/iprop_hdr.h
- kadmin/server/ipropd_svc.c
- lib/kdb/iprop.x
- lib/kdb/kdb_convert.c
- lib/kdb/kdb_log.c
- lib/kdb/kdb_log.h
- lib/krb5/error_tables/kdb5_err.et
- kprop/kpropd_rpc.c
- kprop/kpropllog.c

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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wk@gnupg.org
Designed and implemented Libgcrypt.
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Disclaims changes.
mskala@ansuz.sooke.bc.ca
Wrote cipher/twofish.c.

GNUPG Natural Resources Canada 1998-08-11
Disclaims changes by Matthew Skala.

GNUPG Michael Roth Germany 1998-09-17
Assigns changes.
mroth@nessie.de
Wrote cipher/des.c.
Changes and bug fixes all over the place.

GNUPG Niklas Hernaeus 1998-09-18
Disclaims changes.
nh@df.lth.se
Weak key patches.

GNUPG Rémi Guyomarch 1999-05-25
Assigns past and future changes. (g10/compress.c, g10/encr-data.c,
g10/free-packet.c, g10/mdfilter.c, g10/plaintext.c, util/iobuf.c)
rguyom@mail.dotcom.fr

ANY g10 Code GmbH 2001-06-07
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LIBGCRYPT Timo Schulz 2001-08-31
Assigns past and future changes.
twoday@freakmail.de

LIBGCRYPT Simon Josefsson 2002-10-25
Assigns past and future changes to FSF (cipher/{md4,crc}.c, CTR mode,
CTS/MAC flags, self test improvements)
simon@josefsson.org

LIBGCRYPT Moritz Schulte 2003-04-17
Assigns past and future changes.
moritz@g10code.com

GNUTLS Nikolaos Mavrogiannopoulos 2003-11-22
nmav@gnutls.org
Original code for cipher/rfc2268.c.

LIBGCRYPT The Written Word 2005-04-15
Assigns past and future changes. (new: src/libgcrypt.pc.in,
src/Makefile.am, src/secmem.c, mpi/hppa1.1/mpih-mul3.S, mpi/hppa1.1/udiv-qrrnd.S, mpi/hppa1.1/mpih-mul2.S, mpi/hppa1.1/mpih-mul1.S, mpi/Makefile.am, tests/prime.c, tests/register.c, tests/ac.c, tests/basic.c, tests/tsexp.c, tests/keygen.c, tests/pubkey.c, configure.ac, acinclude.m4)

LIBGCRYPT   Brad Hards      2006-02-09
Assigns Past and Future Changes
bradh@frogmouth.net
(Added OFB mode. Changed cipher/cipher.c, test/basic.c doc/gcrypt.tex.
added SHA-224, changed cipher/sha256.c, added HMAC tests.)

LIBGCRYPT   Hye-Shik Chang   2006-09-07
Assigns Past and Future Changes
perky@freebsd.org
(SEED cipher)

LIBGCRYPT   Werner Dittmann 2009-05-20
Assigns Past and Future Changes
werner.dittmann@t-online.de
(mpi/amd64, tests/mpitests.c)

GNUPG       David Shaw
Assigns past and future changes.
dshaw@jabberwocky.com
(cipher/camellia-glue.c and related stuff)

LIBGCRYPT   Andrey Jivsov   2010-12-09
Assigns Past and Future Changes
openpgp@brainhub.org
(cipher/ecc.c and related files)

LIBGCRYPT   Ulrich MÄ¼ller   2012-02-15
Assigns Past and Future Changes
ulm@gentoo.org
(Changes to cipher/idea.c and related files)

LIBGCRYPT   Vladimir Serbinenko 2012-04-26
Assigns Past and Future Changes
phcoder@gmail.com
(cipher/serpent.c)

Authors with a DCO

======================

Andrei Scherer <andsch@inbox.com>
2014-08-22:BF7CEF794F9.000003F0andsch@inbox.com:
Christian Aistleitner <christian@quelltextlich.at>
2013-02-26:20130226110144.GA12678@quelltextlich.at:

Christian Grothoff <christian@grothoff.org>
2013-03-21:514B5D8A.6040705@grothoff.org:

Dmitry Eremin-Solenikov <dbaryshkov@gmail.com>
2013-07-13:20130713144407.GA27334@fangorn.rup.mentorg.com:

Dmitry Kasatkin <dmitry.kasatkin@intel.com>
2012-12-14:50CAE2DB.80302@intel.com:

JÄ©rÄ©mie CourrÄ‘ges-Anglas <jca@wxcvbn.org>
2016-05-26:87bn3ssqg0.fsf@ritchie.wxcvbn.org

Jussi Kivilinna <jussi.kivilinna@mbnet.fi>
2012-11-15:20121115172331.150537dzb5i6jmy8@www.dalek.fi:

Jussi Kivilinna <jussi.kivilinna@iki.fi>
2013-05-06:5186720A.4090101@iki.fi:

Markus Teich <markus dot teich at stusta dot mhn dot de>
2014-10-08:20141008180509.GA2770@trolle:

Mathias L. Baumann <mathias.baumann at sociomantic.com>
2017-01-30:07c06d79-0828-b564-d604-fd16c7c86ebe@sociomantic.com:

Milan Broz <gmazyland@gmail.com>
2014-01-13:52D44CC6.4050707@gmail.com:

Peter Wu <peter@lekensteyn.nl>
2015-07-22:20150722191325.GA8113@al:

RafaÄl CarrÄ© <funman@videolan.org>
2012-04-20:4F91988B.1080502@videolan.org:

Sergey V. <sftp.mtuci@gmail.com>
2013-11-07:2066221.5fYa7Yq760@darkstar:

Stephan Mueller <smueller@chronox.de>
2014-08-22:2008899.25OeoeVVA@myon.chronox.de:

TomÅ¡Å¡ MrÅ¡z <tm@t8m.info>
2012-04-16:1334571250.5056.52.camel@vespa.frost.loc:

Vitezslav Cizek <vcizek@suse.com>
2015-11-05:20151105131424.GA32700@kolac.suse.cz

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Werner Koch <wk@gnupg.org> (g10 Code GmbH)
2012-12-05:87obi8u4h2.fsf@vigenere.g10code.de:

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Libgcrypt used to be part of GnuPG but has been taken out into its own package on 2000-12-21.

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import: ../../..../fossene/db/schema/thing.yml
fields:
  site: string
  author: root

1.203 go-uber-org-multierr v1.6.0

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Manifest-Version: 1.0
Implementation-Title: Netty/Codec
Bundle-Description: Netty is an asynchronous event-driven network application framework for rapid development of maintainable high performance protocol servers and clients.
Automatic-Module-Name: io.netty.codec
Bundle-License: https://www.apache.org/licenses/LICENSE-2.0
Bundle-SymbolicName: io.netty.codec
Implementation-Version: 4.1.63.Final
Built-By: root
Bnd-LastModified: 1617274774525
Bundle-ManifestVersion: 2
Implementation-Vendor-Id: io.netty
Bundle-DocURL: https://netty.io/
Bundle-Vendor: The Netty Project
Require-Capability: osgi.ee;filter:="(&(osgi.ee=JavaSE)(version=1.6))"
Tool: Bnd-2.4.1.201501161923
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Go support for Protocol Buffers - Google's data interchange format

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1.217 jfreechart 1.0.12

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1.218 golang-mock v1.4.4
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//go:generate mockgen -package empty_interface -destination mock.go -source input.go -
copyright_file=mock_copyright_header

package empty_interface

type Empty interface{}

// This is a mock copyright header.

// Lorem ipsum dolor sit amet, consectetur adipiscing elit,
// sed do eiusmod tempor incididunt ut labore et dolore magna
// aliqua. Velit ut tortor pretium viverra suspendisse potenti.

// Code generated by MockGen. DO NOT EDIT.
// Source: input.go

// Package empty_interface is a generated GoMock package.
package empty_interface

import (
    gomock "github.com/golang/mock/gomock"
)

// MockEmpty is a mock of Empty interface
type MockEmpty struct {
    ctrl   *gomock.Controller
    recorder *MockEmptyMockRecorder
}

// MockEmptyMockRecorder is the mock recorder for MockEmpty
type MockEmptyMockRecorder struct {
    mock *MockEmpty
}

// NewMockEmpty creates a new mock instance
func NewMockEmpty(ctrl *gomock.Controller) *MockEmpty {
    mock := &MockEmpty{ctrl: ctrl}
    mock.recorder = &MockEmptyMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEmpty) EXPECT() *MockEmptyMockRecorder {
    return m.recorder
}

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* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/service/CorsService.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/converter/ConverterUtils.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/data/MediaType.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/util/ReferenceUtils.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/header/RecipientInfoReader.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/security/Enroler.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/header/ContentTypeReader.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/header/RangeWriter.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/security/AuthenticatorUtils.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/component/ServerRouter.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/header/TagReader.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/component/ComponentXmlParser.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/io/WakeupListener.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/connector/ConnectorHelper.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/header/CookieReader.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/ssl/DefaultSslContextFactory.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/representation/InputRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/representation/ChannelRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/security/MemoryRealm.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/routing/Variable.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/representation/InputRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/security/MemoryRealm.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/representation/ChannelRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/data/ChallengeScheme.java
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jar/org/restlet/engine/local/FileClientHelper.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/data/Encoding.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/util/StringReadingListener.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/ssl/SslContextFactory.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/header/WarningWriter.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/component/ClientRoute.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/log/LogUtils.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/util/Pool.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/header/ProductWriter.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/application/DecodeRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/local/RiapClientHelper.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/application/RangeRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/application/FlexibleConneg.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/application/DispositionWriter.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/service/RangeService.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/resource/ClientResource.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/service/BufferingRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/representation/BufferingRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/engine/connector/ProtocolHelper.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/resource/ClientResource.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources.jar/org/restlet/representation/WriterRepresentation.java
jar/org/restlet/representation/FileRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/application/StatusFilter.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/connection/WebDavProtocolHelper.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/application/StrictConneg.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/log/SimplerFormatter.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/Connector.java
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* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/resource/MethodAnnotationInfo.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/util/StringUtils.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/representation/DigesterRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/representation/AppendableRepresentation.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/local/ZipClientHelper.java

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*/
/** The confidentiality. */
* Constructor.

* @param schemeName
  * The scheme name.
* @param name
  * The unique name.
* @param description
  * The description.
* @param defaultPort
  * The default port.
* @param confidential
  * The confidentiality.
*/

/**
 * Indicates if the protocol guarantees the confidentiality of the messages
 * exchanged, for example via a SSL-secured connection.
 *
 * @return True if the protocol is confidential.
 */

Found in path(s):
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/data/Protocol.java
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 */
/**
* Indicates if the call came over a confidential channel such as an
* SSL-secured connection.
*
* @return True if the call came over a confidential channel.
*/

Found in path(s):
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/util/WrapperRequest.java
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/util/WrapperResponse.java

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 */
/** Indicates if the call is confidential. */
/**
 * Indicates if the confidentiality of the call is ensured (ex: via SSL).
 * *
 * @return True if the confidentiality of the call is ensured (ex: via SSL).
 */
/**
 * Indicates if the confidentiality of the call is ensured (ex: via SSL).
 * *
 * @param confidential
 * True if the confidentiality of the call is ensured (ex: via SSL).
 */
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Found in path(s):
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/engine/adapter/Call.java

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 */

/**
 * Sets the reference comparator based on the more friendly "Alphanum
 * Algorithm" created by David Koelle. The internal implementation used is
 * based on an optimized public domain implementation provided by Rob
 * Heittman from the Solertium Corporation.
 *
 * @see <a href="http://www.davekoelle.com/alphanum.html">The original
 * Alphanumeric Algorithm from David Koelle</a>
 * @see #setComparator(Comparator)
 */

Found in path(s):
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/resource/Directory.java

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/**
/** Application service capable of running and scheduling tasks asynchronously.
* The service instance returned will not invoke the runnable task in the
* current thread.<br>
* <br>
* In addition to allowing pooling, this method will ensure that the threads
* executing the tasks will have the thread local variables copied from the
* calling thread. This will ensure that call to static methods like
* [ @link Application#getCurrent()] still work.<br>
* <br>
* Also, note that this executor service will be shared among all Restlets and
* Resources that are part of your context. In general this context corresponds
* to a parent Application's context. If you want to have your own service
* instance, you can use the [ @link TaskService#wrap(ScheduledExecutorService)]
* method to ensure that thread local variables are correctly set.
*
* @author Jerome Louvel
* @author Doug Lea (docs of ExecutorService in public domain)
* @author Tim Peierls
*/

Found in path(s):
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/service/TaskService.java

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*/
/**
* Optimized public-domain implementation of a Java alphanumeric sort.
* <p>
* 
* This implementation uses a single comparison pass over the characters in a
* CharSequence, and returns as soon as a differing character is found, unless
* the difference occurs in a series of numeric characters, in which case that
* series is followed to its end. Numeric series of equal length are compared
* numerically, that is, according to the most significant (leftmost) differing
* digit. Series of unequal length are compared by their length.
* <p>
* 
* This implementation appears to be 2-5 times faster than alphanumeric
* comparators based based on substring analysis, with a lighter memory
* footprint.
* <p>
* 
* This alphanumeric comparator has approximately 20%-50% the performance of the
* lexical String.compareTo() operation. Character sequences without numeric
* data are compared more quickly.
* <p>
* 
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* 
* @author Rob Heittman, <a href="http://www.solertium.com">Solertium
* Corporation</a>
*/

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 */
/**
 * Implemented based on the [@link Protocol#isConfidential()] method for the
 * request's protocol returned by [@link #getProtocol()];
 */

Found in path(s):
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-jar/org/restlet/Request.java
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*/
/**
 * Indicates if this service is acting in HTTP or HTTPS mode.
 *
 * @param confidential
 *  True if this service is acting in HTTP or HTTPS mode.
 */

Found in path(s):
* /opt/cola/permits/1122075426_1629910343.42/0/org-restlet-2-4-3-sources-
jar/org/restlet/engine/connector/NetServerHelper.java
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*/

/**
 * Indicates if the message was or will be exchanged confidentially, for
 * example via a SSL-secured connection.
 *
 * @return True if the message is confidential.
 * @see Request#isConfidential()
 */

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 * Indicates if the message was or will be exchanged confidentially, for
 * example via a SSL-secured connection.
 *
 * @return True if the message is confidential.
 */

Found in path(s):
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```java
/**
 * Resolves a name into a value. By default, the { @link #createResolver(Map) }
 * static method can adapt a Java map into a resolver. Another useful method is
 * { @link #createResolver(Request, Response) }, which can expose a Restlet call
 * into a compact data model, with the following variables:
 *
 * <table>
 * <tr>
 * <th>Model property</th>
 * <th>Variable name</th>
 * <th>Content type</th>
 * </tr>
 * <tr>
 * <td>request.confidential</td>
 * <td>c</td>
 * <td>boolean (true|false)</td>
 * </tr>
 * <tr>
 * <td>request.clientInfo.address</td>
 * <td>cia</td>
 * <td>String</td>
 * </tr>
 * <tr>
 * <td>request.clientInfo.upstreamAddress</td>
 * <td>ciua</td>
 * <td>String</td>
 * </tr>
 * <tr>
 * <td>request.clientInfo.agent</td>
 * <td>cig</td>
 * <td>String</td>
 * </tr>
 * <tr>
 * <td>request.challengeResponse.identifier</td>
 * <td>cri</td>
 * <td>String</td>
 * </tr>
 * <tr>
 * <td>request.challengeResponse.scheme</td>
 * <td>crs</td>
 * <td>String</td>
 * </tr>
 * <tr>
 * <td>request.date</td>
 * <td>d</td>
 * <td>Date (HTTP format)</td>
 * </tr>
 */
```
<table>
<thead>
<tr>
<th>Request Entity Field</th>
<th>Value</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>request.entity.characterSet</td>
<td>ecs</td>
<td>String</td>
</tr>
<tr>
<td>response.entity.characterSet</td>
<td>ECS</td>
<td>String</td>
</tr>
<tr>
<td>request.entity.encoding</td>
<td>ee</td>
<td>String</td>
</tr>
<tr>
<td>response.entity.encoding</td>
<td>EE</td>
<td>String</td>
</tr>
<tr>
<td>request.entity.expirationDate</td>
<td>eed</td>
<td>Date (HTTP format)</td>
</tr>
<tr>
<td>response.entity.expirationDate</td>
<td>EED</td>
<td>Date (HTTP format)</td>
</tr>
<tr>
<td>request.entity.language</td>
<td>el</td>
<td>String</td>
</tr>
<tr>
<td>response.entity.language</td>
<td>EL</td>
<td>String</td>
</tr>
<tr>
<td>request.entity.modificationDate</td>
<td>emd</td>
<td>Date (HTTP format)</td>
</tr>
<tr>
<td>response.entity.modificationDate</td>
<td>EMD</td>
<td>Date (HTTP format)</td>
</tr>
</tbody>
</table>
* <td>EMD</td>
* <td>Date (HTTP format)</td>
* </tr>
* <tr>
* <td>request.entity.mediaType</td>
* <td>emt</td>
* <td>String</td>
* </tr>
* <tr>
* <td>response.entity.mediaType</td>
* <td>EMT</td>
* <td>String</td>
* </tr>
* <tr>
* <td>request.entity.size</td>
* <td>es</td>
* <td>Integer</td>
* </tr>
* <tr>
* <td>response.entity.size</td>
* <td>ES</td>
* <td>Integer</td>
* </tr>
* <tr>
* <td>request.entity.tag</td>
* <td>et</td>
* <td>String</td>
* </tr>
* <tr>
* <td>response.entity.tag</td>
* <td>ET</td>
* <td>String</td>
* </tr>
* <tr>
* <td>request.referrerRef</td>
* <td>f*</td>
* <td>Reference (see table below variable name sub-parts)</td>
* </tr>
* <tr>
* <td>request.hostRef</td>
* <td>h*</td>
* <td>Reference (see table below variable name sub-parts)</td>
* </tr>
* <tr>
* <td>request.method</td>
* <td>m</td>
* <td>String</td>
* </tr>
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>request.rootRef</td>
<td>o*</td>
</tr>
<tr>
<td>request.protocol</td>
<td>p</td>
</tr>
<tr>
<td>request.resourceRef</td>
<td>r*</td>
</tr>
<tr>
<td>response.redirectRef</td>
<td>R*</td>
</tr>
<tr>
<td>response.status</td>
<td>S</td>
</tr>
<tr>
<td>response.serverInfo.address</td>
<td>SIA</td>
</tr>
<tr>
<td>response.serverInfo.agent</td>
<td>SIG</td>
</tr>
<tr>
<td>response.serverInfo.port</td>
<td>SIP</td>
</tr>
</tbody>
</table>

Below is the list of name sub-parts, for Reference variables, that can replace the asterix in the variable names above:
<table>
<thead>
<tr>
<th>Reference property</th>
<th>Sub-part name</th>
<th>Content type</th>
</tr>
</thead>
<tbody>
<tr>
<td>authority</td>
<td>a</td>
<td>String</td>
</tr>
<tr>
<td>baseRef</td>
<td>b*</td>
<td>Reference</td>
</tr>
<tr>
<td>targetRef</td>
<td>t*</td>
<td>Reference</td>
</tr>
<tr>
<td>relativePart</td>
<td>e</td>
<td>String</td>
</tr>
<tr>
<td>fragment</td>
<td>f</td>
<td>String</td>
</tr>
<tr>
<td>hostIdentifier</td>
<td>h</td>
<td>String</td>
</tr>
<tr>
<td>identifier</td>
<td>i</td>
<td>String</td>
</tr>
<tr>
<td>path</td>
<td>p</td>
<td>String</td>
</tr>
<tr>
<td>query</td>
<td>q</td>
<td></td>
</tr>
</tbody>
</table>
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Found in path(s):
* /opt/cola/permits/1153055919_1618392508.54/0/netty-handler-proxy-4-1-61-final-sources-jar/io/netty/handler/proxy/package-info.java
* /opt/cola/permits/1153055919_1618392508.54/0/netty-handler-proxy-4-1-61-final-sources-jar/io/netty/handler/proxy/ProxyConnectionEvent.java
* /opt/cola/permits/1153055919_1618392508.54/0/netty-handler-proxy-4-1-61-final-sources-jar/io/netty/handler/proxy/HttpProxyHandler.java
* /opt/cola/permits/1153055919_1618392508.54/0/netty-handler-proxy-4-1-61-final-sources-jar/io/netty/handler/proxy/Socks5ProxyHandler.java
* /opt/cola/permits/1153055919_1618392508.54/0/netty-handler-proxy-4-1-61-final-sources-jar/io/netty/handler/proxy/ProxyHandler.java
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Found in path(s):
* /opt/cola/permits/1153055919_1618392508.54/0/netty-handler-proxy-4-1-61-final-sources-jar/META-INF/maven/io.netty/netty-handler-proxy/pom.xml

1.225 curl 7.78.0-r0
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1.226 jackson-mapper-asl 1.9.13

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 */

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1078286973_1597285663.32/0/jackson-mapper-asl-1-9-13-sources-2-
jar/org/codehaus/jackson/map/MappingJsonFactory.java

1.227 opentracing-go-stdlib v1.0.0

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1.228 miekg-dns v1.1.41
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1.233 armon-go-metrics v0.0.0-20180917152333-f0300d1749da

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1.234 p11-kit 0.23.15-2+deb10u1

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1.235 alpine-keys 2.2-r0
1.236 musl 1.2.2-r1

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Authors/contributors include:

A. Wilcox
Ada Worcester
Alex Dowad
Alex Suykov
Alexander Monakov
Andre McCurdy
Andrew Kelley
Anthony G. Basile
Aric Belsito
Arvid Picciani
Bartosz Brachaczek
Benjamin Peterson
Bobby Bingham
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Drew DeVault
Emil Renner Berthing
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Felix Fietkau
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Gianluca Anzolin
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1.237 zap v1.16.0

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1.238 x-net v0.0.0-20200625001655-4c5254603344

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# A grammar to describe tree matching patterns.
# Not shown here:
# - 'TOKEN' stands for any token (leaf node)
# - 'any' stands for any node (leaf or interior)
# With 'any' we can still specify the sub-structure.

# The start symbol is 'Matcher'.
Matcher: Alternatives ENDMARKER

Alternatives: Alternative ('|' Alternative)*

Alternative: (Unit | NegatedUnit)+

Unit: [NAME '='] ( STRING [Repeater]
  | NAME [Details] [Repeater]
  | '(' Alternatives ')' [Repeater]
  | '[' Alternatives ']
 )

NegatedUnit: 'not' (STRING | NAME [Details] | '(' Alternatives ')

Repeater: '*' | '+' | 'NUMBER [' NUMBER ']

Details: '<' Alternatives '>

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*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/distutils/command/bdist_wininst.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/distutils/command/bdist_msi.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/driver.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/grammar.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/literals.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/driver.py

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*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/distutils/cygwinccompiler.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/distutils/command/bdist_wininst.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/distutils/command/bdist_msi.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/driver.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/grammar.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/literals.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/driver.py

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*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/grammar.py
*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/literals.py
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*/opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3-7-3-orig-1-tar-xz/python3-stdlib-extensions-3.7.3/3.7/Lib/lib2to3/pgen2/driver.py

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Found in path(s):
* /opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3.7/3-orig-1-tar-xz/python3-stdlib-
  extensions-3.7.3/3.7/Modules/_tkinter.c
* /opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3.7-3-orig-1-tar-xz/python3-stdlib-
  extensions-3.7.3/3.6/Modules/_tkinter.c

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('binary-only', None,
"cannot supply both '--source-only' and '--binary-only'"
)'License: ' + self.distribution.get_license(),

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* /opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3.7-3-orig-1-tar-xz/python3-stdlib-
  extensions-3.7.3/3.6/Lib/distutils/command/bdist_rpm.py
* /opt/cola/permits/1127087901_1611776830.58/0/python3-stdlib-extensions-3.7-3-orig-1-tar-xz/python3-stdlib-
  extensions-3.7.3/3.7/Lib/distutils/command/bdist_rpm.py

1.240 xz 5.2.5-r0
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1.241 lua 2.66.8-r0

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1.242 gophercloud v0.16.0
1.242.1 Available under license :
package RESOURCE

    import (  
    "github.com/gophercloud/gophercloud"  
    "github.com/gophercloud/gophercloud/pagination"
    )

    // RESOURCE represents...
    type Resource struct {
    }

    type commonResult struct {
    gophercloud.Result
    }

    // GetResult is the response from a Get operation. Call its Extract method
    // to interpret it as a RESOURCE.
    type GetResult struct {
    commonResult
    }

    // CreateResult is the response from a Create operation. Call its Extract method
    // to interpret it as a RESOURCE.
    type CreateResult struct {
    commonResult
    }

    // DeleteResult is the response from a Delete operation. Call its ExtractErr to
    // determine if the request succeeded or failed.
type DeleteResult struct {
gophercloud.ErrResult
}

// UpdateResult is the result of an Update request. Call its Extract method to  
// interpret it as a RESOURCE.
type UpdateResult struct {
    commonResult
}

// ResourcePage is a single page of RESOURCE results.
type ResourcePage struct {
    pagination.LinkedPageBase
}

// IsEmpty determines whether or not a page of RESOURCES contains any results.
func (r ResourcePage) IsEmpty() (bool, error) {
    resources, err := ExtractResources(r)
    return len(resources) == 0, err
}

// NextPageURL extracts the "next" link from the links section of the result.
func (r ResourcePage) NextPageURL() (string, error) {
    var s struct {
        Links struct {
            Next     string `json:"next"`
            Previous string `json:"previous"`
        } `json:"links"`
    }
    err := r.ExtractInto(&s)
    if err != nil {
        return "", err
    }
    return s.Links.Next, err
}

// ExtractResources returns a slice of Resources contained in a single page of
// results.
func ExtractResources(r pagination.Page) ([]Resource, error) {
    var s struct {
        Resources []Resource `json:"resources"`
    }
    err := (r.(ResourcePage)).ExtractInto(&s)
    return s.Resources, err
}

// Extract interprets any commonResult as a Resource.
func (r commonResult) Extract() (*Resource, error) {

Contributor Tutorial

This tutorial is to help new contributors become familiar with the processes used by the Gophercloud team when adding a new feature or fixing a bug.

While we have a defined process for working on Gophercloud, we're very mindful that everyone is new to this in the beginning. Please reach out for help or ask for clarification if needed. No question is ever "dumb" or not worth our time answering.

To begin, go to [Step 1](step-01-introduction.md).

Step 5: Writing the Code

At this point, you should have:

- [x] Identified a feature or bug fix
- [x] Opened an Issue about it
- [x] Located the project’s service code which validates the feature or fix
- [x] Have an OpenStack environment available to test with

Now it's time to write the actual code! We recommend reading over the [CONTRIBUTING](/.github/CONTRIBUTING.md) guide again as a refresh. Notably the [Getting Started](/.github/CONTRIBUTING.md#getting-started) section will help you set up a `git` repository correctly.

We encourage you to browse the existing Gophercloud code to find examples of similar implementations. It would be a _very_ rare occurrence for you to be implementing something that hasn't already been done.

Use the existing packages as templates and mirror the style, naming, and logic.

Types of Pull Requests

The amount of changes you plan to make will determine how much code you should submit as Pull Requests.

### A Single Bug Fix
If you're implementing a single bug fix, then creating one `git` branch and submitting one Pull Request is fine.

### Adding a Single Field

If you're adding a single field, then a single Pull Request is also fine. See [#662](https://github.com/gophercloud/gophercloud/pull/662) as an example of this.

If you plan to add more than one missing field, you will need to open a Pull Request for _each_ field.

### Adding a Single API Call

Single API calls can also be submitted as a single Pull Request. See [#722](https://github.com/gophercloud/gophercloud/pull/722) as an example of this.

### Adding a Suite of API Calls

If you're adding support for a "suite" of API calls (meaning: Create, Update, Delete, Get), then you will need to create one Pull Request for _each_ call.

The following Pull Requests are good examples of how to do this:

* https://github.com/gophercloud/gophercloud/pull/584
* https://github.com/gophercloud/gophercloud/pull/586
* https://github.com/gophercloud/gophercloud/pull/587
* https://github.com/gophercloud/gophercloud/pull/594

You can also use the provided [template](/docs/contributor-tutorial/template) as it contains a lot of the repeated boiler plate code seen in each resource. However, please make sure to thoroughly review and edit it as needed. Leaving templated portions in-place might be interpreted as rushing through the work and will require further rounds of review to fix.

### Adding an Entire OpenStack Project

To add an entire OpenStack project, you must break each set of API calls into individual Pull Requests. Implementing an entire project can be thought of as implementing multiple API suites.

An example of this can be seen from the Pull Requests referenced in [#723](https://github.com/gophercloud/gophercloud/issues/723).

What to Include in a Pull Request
----------------------------------

---
Each Pull Request should contain the following:

1. The actual Go code to implement the feature or bug fix
2. Unit tests
3. Acceptance tests
4. Documentation

Whether you want to bundle all of the above into a single commit or multiple commits is up to you. Use your preferred style.

### Unit Tests

Unit tests should provide basic validation that your code works as intended.

Please do not use JSON fixtures from the API reference documentation. Please generate your own fixtures using the OpenStack environment you're testing with.

### Acceptance Tests

Since unit tests are not run against an actual OpenStack environment, acceptance tests can arguably be more important. The acceptance tests that you include in your Pull Request should confirm that your implemented code works as intended with an actual OpenStack environment.

### Documentation

All documentation in Gophercloud is done through in-line `godoc`. Please make sure to document all fields, functions, and methods appropriately. In addition, each package has a `doc.go` file which should be created or amended with details of your Pull Request, where appropriate.

Dealing with Related Pull Requests

If you plan to open more than one Pull Request, it's only natural that code from one Pull Request will be dependent on code from the prior Pull Request.

There are two methods of handling this:

### Create Independent Pull Requests

With this method, each Pull Request has all of the code to fully implement the code in question. Each Pull Request can be merged in any order because it's self contained.

Use the following `git` workflow to implement this method:
```shell
$ git checkout master
$ git pull
$ git checkout -b identityv3-regions-create
$ (write your code)
$ git add .
$ git commit -m "Implementing Regions Create"

$ git checkout master
$ git checkout -b identityv3-regions-update
$ (write your code)
$ git add .
$ git commit -m "Implementing Regions Update"
```

Advantages of this Method:

* Pull Requests can be merged in any order
* Additional commits to one Pull Request are independent of other Pull Requests

Disadvantages of this Method:

* There will be _a lot_ of duplicate code in each Pull Request
* You will have to rebase all other Pull Requests and resolve a good amount of merge conflicts.

### Create a Chain of Pull Requests

With this method, each Pull Request is based off of a previous Pull Request. Pull Requests will have to be merged in a specific order since there is a defined relationship.

Use the following `git` workflow to implement this method:

```shell
$ git checkout master
$ git pull
$ git checkout -b identityv3-regions-create
$ (write your code)
$ git add .
$ git commit -m "Implementing Regions Create"

$ git checkout -b identityv3-regions-update
$ (write your code)
$ git add .
$ git commit -m "Implementing Regions Update"
```
Advantages of this Method:

* Each Pull Request becomes smaller since you are building off of the last

Disadvantages of this Method:

* If a Pull Request requires changes, you will have to rebase _all_ child
  Pull Requests based off of the parent.

The choice of method is up to you.

---

Once you have your code written, submit a Pull Request to Gophercloud and proceed to [Step 6](step-06-code-review.md).

**Step 6: Code Review**

```
Once you've submitted a Pull Request, three things will happen automatically:

1. Travis-CI will run a set of simple tests:
   a. Unit Tests
   b. Code Formatting checks
   c. `go vet` checks

2. Coveralls will run a coverage test.
3. [OpenLab](https://openlabtesting.org/) will run acceptance tests.

Depending on the results of the above, you might need to make additional changes to your code.

While you're working on the finishing touches to your code, it is helpful to add a `[wip]` tag to the title of your Pull Request.

You are most welcomed to take as much time as you need to work on your Pull Request. As well, take advantage of the automatic testing that is done to each commit.

### Travis-CI

If Travis reports code formatting issues, please make sure to run `gofmt` on all of your code. Travis will also report errors with unit tests, so you should ensure those are fixed, too.

### Coveralls
If Coveralls reports a decrease in test coverage, check and make sure you have provided unit tests. A decrease in test coverage is _sometimes_ unavoidable and ignorable.

### OpenLab

OpenLab does not yet run a full suite of acceptance tests, so it's possible that the acceptance tests you've included were not run. When this happens, a core member for Gophercloud will run the tests manually.

There are times when a core reviewer does not have access to the resources required to run the acceptance tests. When this happens, it is essential that you've run them yourself (See [Step 4](step-04.md)).

Request a Code Review
---------------------

When you feel your Pull Request is ready for review, please leave a comment requesting a code review. If you don't explicitly ask for a code review, a core member might not know the Pull Request is ready for review.

Additionally, if there are parts of your implementation that you are unsure about, please ask for help. We're more than happy to provide advice.

During the code review process, a core member will review the code you've submitted and either request changes or request additional information. Generally these requests fall under the following categories:

1. Code which needs to be reformatted (See our [Style Guide](/docs/STYLEGUIDE.md) for conventions used.)
2. Requests for additional information about the validity of something. This might happen because the included supporting service code URLs don't have enough information.
3. Missing unit tests or acceptance tests.

Submitting Changes
------------------

If a code review requires changes to be submitted, please do not squash your commits. Please only add new commits to the Pull Request. This is to help the code reviewer see only the changes that were made.

It's Never Personal
-------------------
Code review is a healthy exercise where a new set of eyes can sometimes spot items forgotten by the author.

Please don’t take change requests personally. Our intention is to ensure the code is correct before merging.

---

Once the code has been reviewed and approved, a core member will merge your Pull Request.

Please proceed to [Step 7](step-07-congratulations.md).

```go
package testing

import (
    "fmt"
    "net/http"
    "testing"

    "github.com/gophercloud/gophercloud/openstack/service/vN/resources"
    th "github.com/gophercloud/gophercloud/testhelper"
    "github.com/gophercloud/gophercloud/testhelper/client"
)

// ListResult provides a single page of RESOURCE results.
const ListResult = `{
}
`

// GetResult provides a Get result.
const GetResult = `{
}
`

// CreateRequest provides the input to a Create request.
const CreateRequest = `{
}
`

// UpdateRequest provides the input to an Update request.
const UpdateRequest = `{
}
`
```
// UpdateResult provides an update result.
const UpdateResult = `{`
    
// FirstResource is the first resource in the List request.
var FirstResource = resources.Resource{
}

// SecondResource is the second resource in the List request.
var SecondResource = resources.Resource{
}

// SecondResourceUpdated is how SecondResource should look after an Update.
var SecondResourceUpdated = resources.Resource{
}

// ExpectedResourcesSlice is the slice of resources expected to be returned from ListResult.
var ExpectedResourcesSlice = []resources.Resource{FirstResource, SecondResource}

// HandleListResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that responds with a list of two resources.
func HandleListResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc(`/resources`, func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "GET")
        th.TestHeader(t, r, "Accept", "application/json")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)

        w.Header().Set("Content-Type", "application/json")
        w.WriteHeader(http.StatusOK)
        fmt.Fprintf(w, ListResult)
    })
}

// HandleGetResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that responds with a single resource.
func HandleGetResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc(`/resources/9fe1d3`, func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "GET")
        th.TestHeader(t, r, "Accept", "application/json")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)

        w.Header().Set("Content-Type", "application/json")
        w.WriteHeader(http.StatusOK)
        fmt.Fprintf(w, GetResult)
    })
}

// HandleCreateResourceSuccessfully creates an HTTP handler at `/resources` on the
// test handler mux that tests resource creation.
func HandleCreateResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc("/resources", func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "POST")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)
        th.TestJSONRequest(t, r, CreateRequest)
        w.WriteHeader(http.StatusCreated)
        fmt.Fprintf(w, GetResult)
    })
}

func HandleDeleteResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc("/resources/9fe1d3", func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "DELETE")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)
        w.WriteHeader(http.StatusNoContent)
    })
}

func HandleUpdateResourceSuccessfully(t *testing.T) {
    th.Mux.HandleFunc("/resources/9fe1d3", func(w http.ResponseWriter, r *http.Request) {
        th.TestMethod(t, r, "PATCH")
        th.TestHeader(t, r, "X-Auth-Token", client.TokenID)
        w.WriteHeader(http.StatusOK)
        fmt.Fprintf(w, UpdateResult)
    })
}

package testing

import (
    "testing"
    "github.com/gophercloud/gophercloud/openstack/service/vN/resources"
    "github.com/gophercloud/gophercloud/pagination"
    th "github.com/gophercloud/gophercloud/testhelper"
    "github.com/gophercloud/gophercloud/testhelper/client"
)

func TestListResources(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
HandleListResourcesSuccessfully(t)

count := 0
    count++
    actual, err := resources.ExtractResources(page)
    th.AssertNoErr(t, err)
    th.AssertDeepEquals(t, ExpectedResourcesSlice, actual)
    return true, nil
})

th.AssertNoErr(t, err)
th.AssertEquals(t, count, 1)
}

func TestListResourcesAllPages(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
    HandleListResourcesSuccessfully(t)

    allPages, err := resources.List(client.ServiceClient(), nil).AllPages()
    th.AssertNoErr(t, err)
    actual, err := resources.ExtractResources(allPages)
    th.AssertNoErr(t, err)
    th.AssertDeepEquals(t, ExpectedResourcesSlice, actual)
}

func TestGetResource(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
    HandleGetResourceSuccessfully(t)

    actual, err := resources.Get(client.ServiceClient(), "9fe1d3").Extract()
    th.AssertNoErr(t, err)
}

func TestCreateResource(t *testing.T) {
    th.SetupHTTP()
    defer th.TeardownHTTP()
    HandleCreateResourceSuccessfully(t)

    createOpts := resources.CreateOpts{
        Name: "resource two",
    }
actual, err := resources.Create(client.ServiceClient(), createOpts).Extract()
th.AssertNoErr(t, err)
}

func TestDeleteResource(t *testing.T) {
th.SetupHTTP()
defert.H.TeardownHTTP()
HandleDeleteResourceSuccessfully(t)

res := resources.Delete(client.ServiceClient(), "9fe1d3")
th.AssertNoErr(t, res.Err)
}

func TestUpdateResource(t *testing.T) {
th.SetupHTTP()
defert.H.TeardownHTTP()
HandleUpdateResourceSuccessfully(t)

updateOpts := resources.UpdateOpts{
    Description: "Staging Resource",
}

actual, err := resources.Update(client.ServiceClient(), "9fe1d3", updateOpts).Extract()
th.AssertNoErr(t, err)
th.AssertDeepEquals(t, SecondResourceUpdated, *actual)
}

package RESOURCE

import (
    "github.com/gophercloud/gophercloud"
    "github.com/gophercloud/gophercloud/pagination"
)

// ListOptsBuilder allows extensions to add additional parameters to
// the List request
type ListOptsBuilder interface {
    ToResourceListQuery() (string, error)
}

// ListOpts provides options to filter the List results.
type ListOpts struct {
}

// ToResourceListQuery formats a ListOpts into a query string.
func (opts ListOpts) ToResourceListQuery() (string, error) {
    q, err := gophercloud.BuildQueryString(opts)
    return q.String(), err
}
// List retrieves a list of RESOURCES.
func List(client *gophercloud.ServiceClient, opts ListOptsBuilder) pagination.Pager {
    url := listURL(client)
    if opts != nil {
        query, err := opts.ToResourceListQuery()
        if err != nil {
            return pagination.Pager{Err: err}
        }
        url += query
    }
        return ResourcePage{pagination.LinkedPageBase{PageResult: r}}
    })
}

// Get retrieves details of a RESOURCE.
func Get(client *gophercloud.ServiceClient, id string) (r GetResult) {
    resp, err := client.Get(getURL(client, id), &r.Body, nil)
    _, r.Header, r.Err = gophercloud.ParseResponse(resp, err)
    return
}

// CreateOptsBuilder allows extensions to add additional parameters to
// the Create request.
type CreateOptsBuilder interface {
    ToResourceCreateMap() (map[string]interface{}, error)
}

// CreateOpts provides options used to create a RESOURCE.
type CreateOpts struct {
}

// ToResourceCreateMap formats a CreateOpts into a create request.
func (opts CreateOpts) ToResourceCreateMap() (map[string]interface{}, error) {
    return gophercloud.BuildRequestBody(opts, "resource")
}

// Create creates a new RESOURCE.
func Create(client *gophercloud.ServiceClient, opts CreateOptsBuilder) (r CreateResult) {
    b, err := opts.ToResourceCreateMap()
    if err != nil {
        r.Err = err
        return
    }
    resp, err := client.Post(createURL(client), &b, &r.Body, &gophercloud.RequestOpts{
        OkCodes: []int{201},
    })
    _
// Delete deletes a RESOURCE.
func Delete(client *gophercloud.ServiceClient, id string) (r DeleteResult) {
    resp, err := client.Delete(deleteURL(client, id), nil)
    _, r.Header, r.Err = gophercloud.ParseResponse(resp, err)
    return
}

// UpdateOptsBuilder allows extensions to add additional parameters to
// the Update request.
type UpdateOptsBuilder interface {
    ToResourceUpdateMap() (map[string]interface{}, error)
}

// UpdateOpts represents parameters to update a RESOURCE.
type UpdateOpts struct {
}

// ToUpdateCreateMap formats a UpdateOpts into an update request.
func (opts UpdateOpts) ToResourceUpdateMap() (map[string]interface{}, error) {
    return gophercloud.BuildRequestBody(opts, "resource")
}

// Update modifies the attributes of a RESOURCE.
func Update(client *gophercloud.ServiceClient, id string, opts UpdateOptsBuilder) (r UpdateResult) {
    b, err := opts.ToResourceUpdateMap()
    if err != nil {
        r.Err = err
        return
    }
    resp, err := client.Patch(updateURL(client, id), b, &r.Body, &gophercloud.RequestOpts{
        OkCodes: []int{200},
    })
    _, r.Header, r.Err = gophercloud.ParseResponse(resp, err)
    return
}

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package RESOURCE

import "github.com/gophercloud/gophercloud"

func listURL(client *gophercloud.ServiceClient) string {
    return client.ServiceURL("resource")
}

func getURL(client *gophercloud.ServiceClient, id string) string {
return client.ServiceURL("resource", id)
}

func createURL(client *gophercloud.ServiceClient) string {
    return client.ServiceURL("resource")
}

func deleteURL(client *gophercloud.ServiceClient, id string) string {
    return client.ServiceURL("resource", id)
}

func updateURL(client *gophercloud.ServiceClient, id string) string {
    return client.ServiceURL("resource", id)
}

Step 7: Congratulations!

At this point your code is merged and you've either fixed a bug or added a new feature to Gophercloud!

We completely understand that this has been a long process. We appreciate your patience as well as the time you have taken for working on this. You've made Gophercloud a better project with your work.

Step 4: Acceptance Testing

If we haven't started working on the feature or bug fix, why are we talking about Acceptance Testing now?

Before you implement a feature or bug fix, you _must_ be able to test your code in a working OpenStack environment. Please do not submit code which you have only tested with offline unit tests.

Blindly submitting code is dangerous to the Gophercloud project. Developers from all over the world use Gophercloud in many different projects. If you submit code which is untested, it can cause these projects to break or become unstable.

And, to be frank, submitting untested code will inevitably cause someone else to have to spend time fixing it.

If you don't have an OpenStack environment to test with, we have lots of documentation [here](/acceptance) to help you build your own small OpenStack environment for testing.

---

Once you've confirmed you are able to test your code, proceed to
Step 5 (step-05-pull-requests.md) to (finally!) start working on a Pull Request.

/*
Package NAME manages and retrieves RESOURCE in the OpenStack SERVICE Service.

Example to List RESOURCE

Example to Create a RESOURCE

Example to Update a RESOURCE

Example to Delete a RESOURCE

*/

package RESOURCE
Step 2: Create an Issue
========================

Every patch / Pull Request requires a corresponding issue. If you're fixing a bug for an existing issue, then there's no need to create a new issue.

However, if no prior issue exists, you must create an issue.

Reporting a Bug
--------------

When reporting a bug, please try to provide as much information as you can.

The following issues are good examples for reporting a bug:

* https://github.com/gophercloud/gophercloud/issues/108
* https://github.com/gophercloud/gophercloud/issues/212
* https://github.com/gophercloud/gophercloud/issues/424
* https://github.com/gophercloud/gophercloud/issues/588
* https://github.com/gophercloud/gophercloud/issues/629
* https://github.com/gophercloud/gophercloud/issues/647

Feature Request
--------------

If you've noticed that a feature is missing from Gophercloud, you'll also need to create an issue before doing any work. This is to start a discussion about whether or not the feature should be included in Gophercloud. We don't want to see you put in hours of work only to learn that the feature is out of scope of the project.

Feature requests can come in different forms:
### Adding a Feature to Gophercloud Core

The "core" of Gophercloud is the code which supports API requests and responses: pagination, error handling, building request bodies, and parsing response bodies are all examples of core code.

Modifications to core will usually have the most amount of discussion than other requests since a change to core will affect _all_ of Gophercloud.

The following issues are examples of core change discussions:

* https://github.com/gophercloud/gophercloud/issues/310
* https://github.com/gophercloud/gophercloud/issues/613
* https://github.com/gophercloud/gophercloud/issues/729
* https://github.com/gophercloud/gophercloud/issues/713

### Adding a Missing Field

If you've found a missing field in an existing struct, submit an issue to request having it added. These kinds of issues are pretty easy to report and resolve.

You should also provide a link to the actual service's Python code which defines the missing field.

The following issues are examples of missing fields:

* https://github.com/gophercloud/gophercloud/issues/620
* https://github.com/gophercloud/gophercloud/issues/621
* https://github.com/gophercloud/gophercloud/issues/658

There's one situation which can make adding fields more difficult: if the field is part of an API extension rather than the base API itself. An example of this can be seen in [this](https://github.com/gophercloud/gophercloud/issues/749) issue.

Here, a user reported fields missing in the `Get` function of `networking/v2/networks`. The fields reported missing weren't missing at all, they're just part of various Networking extensions located in `networking/v2/extensions`.

### Adding a Missing API Call

If you've found a missing API action, create an issue with details of the action. For example:

* https://github.com/gophercloud/gophercloud/issues/715
You'll want to make sure the API call is part of the upstream OpenStack project and not an extension created by a third-party or vendor. Gophercloud only supports the OpenStack projects proper.

### Adding a Missing API Suite

Adding support to a missing suite of API calls will require more than one Pull Request. However, you can use a single issue for all PRs.

Examples of issues which track the addition of a missing API suite are:

* https://github.com/gophercloud/gophercloud/issues/539
* https://github.com/gophercloud/gophercloud/issues/555
* https://github.com/gophercloud/gophercloud/issues/571
* https://github.com/gophercloud/gophercloud/issues/583
* https://github.com/gophercloud/gophercloud/issues/605

Note how the issue breaks down the implementation by request types (Create, Update, Delete, Get, List).

Also note how these issues provide links to the service's Python code. These links are not required for _issues_, but it's usually a good idea to provide them, anyway. These links _are required_ for PRs and that will be covered in detail in a later step of this tutorial.

### Adding a Missing OpenStack Project

These kinds of feature additions are large undertakings. Adding support for an entire OpenStack project is something the Gophercloud team very much appreciates, but you should be prepared for several weeks of work and interaction with the Gophercloud team.

An example of how to create an issue for an entire project can be seen here:

* https://github.com/gophercloud/gophercloud/issues/723

---

With all of the above in mind, proceed to [Step 3](step-03-code-hunting.md) to learn about Code Hunting.

Step 3: Code Hunting

If you plan to submit a feature or bug fix to Gophercloud, you must be able to prove your code correctly works with the OpenStack service in
question.

Let's use the following issue as an example: [https://github.com/gophercloud/gophercloud/issues/621](https://github.com/gophercloud/gophercloud/issues/621). In this issue, there's a request being made to add support for `availability_zone_hints` to the `networking/v2/networks` package. Meaning, we want to change:

```go
```
go
type Network struct {
    ID         string `json:"id"`
    Name       string `json:"name"`
    AdminStateUp bool `json:"admin_state_up"`
    Status     string `json:"status"`
    Subnets    []string `json:"subnets"`
    TenantID   string `json:"tenant_id"`
    Shared     bool `json:"shared"`
}
```

to look like

```go
```
go
type Network struct {
    ID         string `json:"id"`
    Name       string `json:"name"`
    AdminStateUp bool `json:"admin_state_up"`
    Status     string `json:"status"`
    Subnets    []string `json:"subnets"`
    TenantID   string `json:"tenant_id"`
    Shared     bool `json:"shared"`
    AvailabilityZoneHints []string `json:"availability_zone_hints"`
}
```

We need to be sure that `availability_zone_hints` is a field which really does exist in the OpenStack Neutron project and it's not a field which was added as a customization to a single OpenStack cloud.

In addition, we need to ensure that `availability_zone_hints` is really a `[]string` and not a different kind of type.

One way of verifying this is through the [OpenStack API reference documentation](https://developer.openstack.org/api-ref/network/v2/). However, the API docs might either be incorrect or they might not provide all of the details we need to know in order to ensure this field is added correctly.
> Note: when we say the API docs might be incorrect, we are _not_ implying
> that the API docs aren't useful or that the contributors who work on the API
> docs are wrong. OpenStack moves fast. Typos happen. Forgetting to update
> documentation happens.

Since the OpenStack service itself correctly accepts and processes the fields, the best source of information on how the field works is in the service code itself.

Continuing on with using #621 as an example, we can find the definition of `availability_zone_hints` in the following piece of code:

https://github.com/openstack/neutron/blob/8e9959725eda4063a318b4ba6af1e3494cad9e35/neutron/objects/network.py#L191

The above code confirms that `availability_zone_hints` is indeed part of the `Network` object and that its type is a list of strings (`[string]`).

This example is a best-case situation: the code is relatively easy to find and it's simple to understand. However, there will be times when proving the implementation in the service code is difficult. Make no mistake, this is _not_ fun work. This can sometimes be more difficult than writing the actual patch for Gophercloud. However, this is an essential step to ensuring the feature or bug fix is correctly added to Gophercloud.

Examples of good code hunting can be seen here:

* https://github.com/gophercloud/gophercloud/issues/539
* https://github.com/gophercloud/gophercloud/issues/555
* https://github.com/gophercloud/gophercloud/issues/571
* https://github.com/gophercloud/gophercloud/issues/583
* https://github.com/gophercloud/gophercloud/issues/605

Code Hunting Tips

OpenStack projects differ from one to another. Code is organized in different ways. However, the following tips should be useful across all projects.

* The logic which implements Create and Delete actions is usually either located in the "model" or "controller" portion of the code.

* Use Github's search box to search for the exact field you're working on. Review all results to gain a good understanding of everywhere the field is used.

* When adding a field, look for an object model or a schema of some sort.
Proceed to [Step 4](step-04-acceptance-testing.md) to learn about Acceptance Testing.

Step 1: Read Our Guides

There are two introductory guides you should read before proceeding:

* [CONTRIBUTING](/.github/CONTRIBUTING.md): The Contributing guide is a detailed document which describes the different ways you can contribute to Gophercloud and how to get started. This tutorial you're reading is very similar to that guide, but presented in a different way. We still recommend you read it over.

* [STYLE](/docs/STYLEGUIDE.md): The Style Guide documents coding conventions used in the Gophercloud project.

When you've finished reading those guides, proceed to [Step 2](step-02-issues.md).

---

1.243 jackson-xc 2.9.5

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1.251 postgresql 11.11-0+deb10u1

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1.254 inotify-tools 3.20.11.0-r0

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{

    public static String getVersion()
    {
        return getProduct() + " " + getImplementationLanguage() + " "
           + getMajorVersionNum() + "." + getReleaseVersionNum() + ".";
        +( getDevelopmentVersionNum() > 0 ) ?
           ("D" + getDevelopmentVersionNum() ) : ("" + getMaintenanceVersionNum() );
    }

    public static void main(String argv[])
    {
        System.out.println(getVersion());
    }
}
/**
 * Name of product: Xalan.
 */
public static String getProduct()
{
    return "Xalan";
}

/**
 * Implementation Language: Java.
 */
public static String getImplementationLanguage()
{
    return "Java";
}

/**
 * Major version number.
 * Version number. This changes only when there is a
 * significant, externally apparent enhancement from
 * the previous release. 'n' represents the n'th
 * version.
 *
 * Clients should carefully consider the implications
 * of new versions as external interfaces and behaviour
 * may have changed.
 */
public static int getMajorVersionNum()
{
    return @version.VERSION@;
}

/**
 * Release Number.
 * Release number. This changes when:
 * - a new set of functionality is to be added, eg,
 *   implementation of a new W3C specification.
 * - API or behaviour change.
 * - its designated as a reference release.
 */
public static int getReleaseVersionNum()
{
    return @version.RELEASE@;
}
/**
 * Maintenance Drop Number.
 * Optional identifier used to designate maintenance
 * drop applied to a specific release and contains
 * fixes for defects reported. It maintains compatibility
 * with the release and contains no API changes.
 * When missing, it designates the final and complete
 * development drop for a release.
 */

public static int getMaintenanceVersionNum()
{
    return @version.MINOR@;
}

/**
 * Development Drop Number.
 * Optional identifier designates development drop of
 * a specific release. D01 is the first development drop
 * of a new release.
 *
 * Development drops are works in progress towards a
 * completed, final release. A specific development drop
 * may not completely implement all aspects of a new
 * feature, which may take several development drops to
 * complete. At the point of the final drop for the
 * release, the D suffix will be omitted.
 *
 * Each 'D' drops can contain functional enhancements as
 * well as defect fixes. 'D' drops may not be as stable as
 * the final releases.
 */

public static int getDevelopmentVersionNum()
{
    try {
        if (((new String(@version.DEVELOPER@)).length() == 0)
            return 0;
        else
            return Integer.parseInt(@version.DEVELOPER@);
    } catch (NumberFormatException nfe) {
        return 0;
    }
}
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*/

/**
* This is a special exception that is used to stop parsing when
* search for an element. For instance, when searching for xml:stylesheet
* PIs, it is used to stop the parse once the document element is found.
* @see StylesheetPIHandler
* @xsl.usage internal
*/

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-
jar/org/apache/xml/utils/StopParseException.java

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*/
Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xslt/compiler/XPathLexer.java
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 */

/*
 * $Id: Version.src 468654 2006-10-28 07:09:23Z minchau $
 */
package org.apache.xml.serializer;

/**
 * Administrative class to keep track of the version number of
 * the Serializer release.
 * <P>This class implements the upcoming standard of having
 * org.apache.project-name.Version.getVersion() be a standard way
 * to get version information.</P>
 * @xsl.usage general
 */
public final class Version
{

/**
 * Get the basic version string for the current Serializer.
 * Version String formatted like
 * <CODE>"<B>Serializer</B> <B>Java</B> v.r[.dd] <B>D</B>nn"</CODE>
 * Futurework: have this read version info from jar manifest.
 *
 * @return String denoting our current version
 */
public static String getVersion()
{
    return getProduct() + " +getImplementationLanguage() + "
    +getMajorVersionNum() + "." +getReleaseVersionNum() + " ."
    +(getDevelopmentVersionNum() > 0) ?
        ("D" + getDevelopmentVersionNum()) : ("" + getMaintenanceVersionNum());
}

/**
 * Print the processor version to the command line.
 * @param argv command line arguments, unused.
 */
public static void main(String argv[])
{
    System.out.println(getVersion());
}

/**
 * Name of product: Serializer.
 */
public static String getProduct()
{
    return "Serializer";
}

/**
 * Implementation Language: Java.
 */
public static String getImplementationLanguage()
{
    return "Java";
}

/**
 * Major version number.
 * Version number. This changes only when there is a
 * significant, externally apparent enhancement from
 * the previous release. 'n' represents the n'th
 * version.
 * Clients should carefully consider the implications
 * of new versions as external interfaces and behaviour
 * may have changed.
 */
public static int getMajorVersionNum()
{
return @version.VERSION@;

/**
 * Release Number.
 * Release number. This changes when:
 * - a new set of functionality is to be added, eg,
 *   implementation of a new W3C specification.
 * - API or behaviour change.
 * - its designated as a reference release.
 */
public static int getReleaseVersionNum()
{
    return @version.RELEASE@;
}

/**
 * Maintenance Drop Number.
 * Optional identifier used to designate maintenance
 * drop applied to a specific release and contains
 * fixes for defects reported. It maintains compatibility
 * with the release and contains no API changes.
 * When missing, it designates the final and complete
 * development drop for a release.
 */
public static int getMaintenanceVersionNum()
{
    return @version.MINOR@;
}

/**
 * Development Drop Number.
 * Optional identifier designates development drop of
 * a specific release. D01 is the first development drop
 * of a new release.
 * Development drops are works in progress towards a
 * completed, final release. A specific development drop
 * may not completely implement all aspects of a new
 * feature, which may take several development drops to
 * complete. At the point of the final drop for the
 * release, the D suffix will be omitted.
 * Each 'D' drops can contain functional enhancements as
 * well as defect fixes. 'D' drops may not be as stable as
 * the final releases.
 */
public static int getDevelopmentVersionNum()
{
try {
    if ((new String("@version.DEVELOPER@")).length() == 0)
        return 0;
    else
        return Integer.parseInt("@version.DEVELOPER@");
} catch (NumberFormatException nfe) {
    return 0;
}
}

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/serializer/Version.src

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 */

/**
 * Major version number.
 * Version number. This changes only when there is a
 * significant, externally apparent enhancement from
 * the previous release. 'n' represents the n'th
 * version.
 *
 * Clients should carefully consider the implications
 * of new versions as external interfaces and behaviour
 * may have changed.
 */

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/serializer/Version.java
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// Attribution to: "Voytenko, Dimitry" <DVoytenko@SECTORBASE.COM>

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 */

// Proprietary
/** The 'document-location()' id (Proprietary). */
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 */
package org.apache.xalan.xslt.compiler;

import java.util.Stack;
import java.util.Vector;
import java.io.StringReader;
import java_cup.runtime.*;
import org.apache.xml.dtm.DTM;
import org.apache.xalan.xslt.DOM;
import org.apache.xml.dtm.Axis;
import org.apache.xalan.xslt.runtime.Operators;
import org.apache.xalan.xslt.compiler.util.ErrorMsg;

parser code {:
  /**
   * Used by function calls with no args.
   */
  static public final Vector EmptyArgs = new Vector(0);

  /**
   * Reference to non-existing variable.
   */
  static public final VariableRef DummyVarRef = null;

  /**
   * Reference to the Parser class.
   */
  private Parser _parser;
  private XSLTC _xslt;

  /**
   * String representation of the expression being parsed.
   */
  private String _expression;
/**
 * Line number where this expression/pattern was declared.
 */
private int _lineNumber = 0;

/**
 * Reference to the symbol table.
 */
public SymbolTable _symbolTable;

public XPathParser(Parser parser) {
    _parser = parser;
    _xsltc = parser.getXSLTC();
    _symbolTable = parser.getSymbolTable();
}

public int getLineNumber() {
    return _lineNumber;
}

public QName getQNameIgnoreDefaultNs(String name) {
    return _parser.getQNameIgnoreDefaultNs(name);
}

public QName getQName(String namespace, String prefix, String localname) {
    return _parser.getQName(namespace, prefix, localname);
}

public void setMultiDocument(boolean flag) {
    _xsltc.setMultiDocument(flag);
}

public void setCallsNodeset(boolean flag) {
    _xsltc.setCallsNodeset(flag);
}

public void setHasIdCall(boolean flag) {
    _xsltc.setHasIdCall(flag);
}

/**
 * This method is similar to findNodeType(int, Object) except that it
 * creates a StepPattern instead of just returning a node type. It also
 * differs in the way it handles "[uri]:*" and "[uri]:@*". The last two
 * patterns are expanded as "*[namespace-uri() = 'uri']" and
 * "[@*namespace-uri() = 'uri']", respectively. This expansion considerably
 * simplifies the grouping of patterns in the Mode class. For this
* expansion to be correct, the priority of the pattern/template must be
* set to -0.25 (when no other predicates are present).
*
public StepPattern createStepPattern(int axis, Object test, Vector predicates) {
  int nodeType;

  if (test == null) { // "*"
    nodeType = (axis == Axis.ATTRIBUTE) ? NodeTest.ATTRIBUTE :
         (axis == Axis.NAMESPACE) ? -1 : NodeTest.ELEMENT;

    return new StepPattern(axis, nodeType, predicates);
  }
  else if (test instanceof Integer) {
    nodeType = ((Integer) test).intValue();

    return new StepPattern(axis, nodeType, predicates);
  }
  else {
    QName name = (QName)test;
    boolean setPriority = false;

    if (axis == Axis.NAMESPACE) {
      nodeType = (name.toString().equals("*")) ? -1 :
           _xsltc.registerNamespacePrefix(name);;
    }
    else {
      final String uri = name.getNamespace();
      final String local = name.getLocalPart();
      final QName namespace_uri =
           _parser.getQNameIgnoreDefaultNs("namespace-uri");

      // Expand {uri}:* to *[namespace-uri() = 'uri'] - same for @*
      if (uri != null && (local.equals("*") || local.equals("@*")) ) {
        if (predicates == null) {
          predicates = new Vector(2);
        }

        // Priority is set by hand if no other predicates exist
        setPriority = (predicates.size() == 0);

        predicates.add(
            new Predicate(
                new EqualityExpr(Operators.EQ,
                 new NamespaceUriCall(namespace_uri),
                 new LiteralExpr(uri))));
      }

      if (local.equals("*")) {

nodeType = (axis == Axis.ATTRIBUTE) ? NodeTest.ATTRIBUTE
: NodeTest.ELEMENT;
}
else if (local.equals("@*")) {
    nodeType = NodeTest.ATTRIBUTE;
}
else {
    nodeType = (axis == Axis.ATTRIBUTE) ? _xsltc.registerAttribute(name)
: _xsltc.registerElement(name);
}
}

final StepPattern result = new StepPattern(axis, nodeType, predicates);

// Set priority for case prefix:* and prefix:@* (no predicates)
if (setPriority) {
    result.setPriority(-0.25);
}
return result;
}

public int findNodeType(int axis, Object test) {
if (test == null) { // *
    return (axis == Axis.ATTRIBUTE) ?
           NodeTest.ATTRIBUTE :
            (axis == Axis.NAMESPACE) ? -1 : NodeTest.ELEMENT;
}
else if (test instanceof Integer) {
    return ((Integer)test).intValue();
}
else {
    QName name = (QName)test;
    if (axis == Axis.NAMESPACE) {
        return (name.toString().equals("*")) ? -1
            : _xsltc.registerNamespacePrefix(name);
    }
    if (name.getNamespace() == null) {
        final String local = name.getLocalPart();
        if (axis == Axis.NAMESPACE) {
            return (name.toString().equals("*")) ? -1
                : _xsltc.registerNamespacePrefix(name);
        }
        if (local.equals("*")) {
            return (axis == Axis.ATTRIBUTE) ? NodeTest.ATTRIBUTE
                : NodeTest.ELEMENT;
        }
        else if (local.equals("@*")) {
return NodeTest.ATTRIBUTE;
}

return (axis == Axis.ATTRIBUTE) ? _xslt.registerAttribute(name) :
    _xslt.registerElement(name);
}

/**
 * Parse the expression passed to the current scanner. If this
 * expression contains references to local variables and it will be
 * compiled in an external module (not in the main class) request
 * the current template to create a new variable stack frame.
 *
 * @param lineNumber Line where the current expression is defined.
 * @param external   Set to <tt>true</tt> if this expression is
 *                   compiled in a separate module.
 *
 */

public Symbol parse(String expression, int lineNumber) throws Exception {
    try {
        _expression = expression;
        _lineNumber = lineNumber;
        return super.parse();
    }
    catch (IllegalCharException e) {
        ErrorMsg err = new ErrorMsg(ErrorMsg.ILLEGAL_CHAR_ERR,
                                    lineNumber, e.getMessage());
        _parser.reportError(Constants.FATAL, err);
    }
    return null;
}

/**
 * Lookup a variable or parameter in the symbol table given its name.
 *
 * @param name Name of the symbol being looked up.
 *
 */

final SyntaxTreeNode lookupName(QName name) {
    // Is it a local var or param ?
    final SyntaxTreeNode result = _parser.lookupVariable(name);
    if (result != null)
        return(result);
    else
        return(_symbolTable.lookupName(name));
}
public final void addError(ErrorMsg error) {
    _parser.reportError(Constants.ERROR, error);
}

public void report_error(String message, Object info) {
    final ErrorMsg err = new ErrorMsg(ErrorMsg.SYNTAX_ERR, _lineNumber,
                                       _expression);
    _parser.reportError(Constants.FATAL, err);
}

public void report_fatal_error(String message, Object info) {
    // empty
}

public RelativeLocationPath insertStep(Step step, RelativeLocationPath rlp) {
    if (rlp instanceof Step) {
        return new ParentLocationPath(step, (Step) rlp);
    }
    else if (rlp instanceof ParentLocationPath) {
        final ParentLocationPath plp = (ParentLocationPath) rlp;
        final RelativeLocationPath newrlp = insertStep(step, plp.getPath());
        return new ParentLocationPath(newrlp, plp.getStep());
    }
    else {
        addError(new ErrorMsg(ErrorMsg.INTERNAL_ERR, "XPathParser.insertStep"));
        return rlp;
    }
}

/**
 * Returns true if the axis applies to elements only. The axes
 * child, attribute, namespace, descendant result in non-empty
 * nodesets only if the context node is of type element.
 * /
 * public boolean isElementAxis(int axis) {
 * return (axis == Axis.CHILD || axis == Axis.ATTRIBUTE ||
 *         axis == Axis.NAMESPACE || axis == Axis.DESCENDANT);
 * }
 */

terminal SLASH, DOT, LBRACK, RBRACK, VBAR, LPAREN, RPAREN, STAR, COMMA;
terminal DOLLAR, ATSIGN;
terminal DDOT, DCOLOM, DSLASH;
terminal EQ, NE;
terminal LT, GT, LE, GE;
terminal PLUS, MINUS, DIV, MOD, MULT;
terminal String Literal;
terminal String QNAME;
terminal ID, KEY, TEXT, NODE, OR, AND, COMMENT, PI, PIPARAM, PRECEDINGSIBLING;
terminal SELF, PARENT, CHILD, ATTRIBUTE, ANCESTOR, ANCESTORORSELF, DESCENDANT;
terminal DESCENDANTORSELF, FOLLOWING, FOLLOWINGSIBLING, NAMESPACE, PRECEDING;
terminal Double REAL;
terminal Long INT;
terminal PATTERN, EXPRESSION;

non terminal SyntaxTreeNode TopLevel;

non terminal Expression Expr, Argument, LocationPath;
non terminal Expression Predicate, FilterExpr, Step;
non terminal Expression OrExpr, AndExpr, EqualityExpr;
non terminal Expression RelationalExpr, AdditiveExpr;
non terminal Expression MultiplicativeExpr, UnaryExpr;
non terminal Expression VariableReference, FunctionCall;
non terminal Expression PrimaryExpr, UnionExpr, PathExpr, AbbreviatedStep;
non terminal Expression RelativeLocationPath, AbbreviatedRelativeLocationPath;
non terminal Expression AbsoluteLocationPath, AbbreviatedAbsoluteLocationPath;

non terminal Object NodeTest, NameTest;

non terminal IdKeyPattern IdKeyPattern;
non terminal Pattern Pattern;
non terminal Pattern LocationPathPattern;
non terminal StepPattern ProcessingInstructionPattern;
non terminal RelativePathPattern RelativePathPattern;
non terminal StepPattern StepPattern;
non terminal Object NodeTestPattern, NameTestPattern;

non terminal Vector Predicates, NonemptyArgumentList;
non terminal QName QName, FunctionName, VariableName;
non terminal Integer AxisName, AxisSpecifier;
non terminal Integer ChildOrAttributeAxisSpecifier;

precedence left VBAR;
precedence left OR;
precedence left AND;
precedence nonassoc EQ, NE;
precedence left LT, GT, LE, GE;

precedence left PLUS, MINUS;
precedence left DIV, MOD, MULT;
precedence left DOLLAR;
precedence left ATSIGN;
precedence right DCOLOM;

start with TopLevel;
TopLevel ::= PATTERN Pattern:pattern
   [: RESULT = pattern; :]
   | EXPRESSION Expr:expr
   [: RESULT = expr; :];

/* --------------------------- Patterns ----------------------------- */

Pattern ::= LocationPathPattern:lpp
   [: RESULT = lpp; :]
   | LocationPathPattern:lpp VBAR Pattern:p
   [: RESULT = new AlternativePattern(lpp, p); :];

LocationPathPattern ::= SLASH
   [: RESULT = new AbsolutePathPattern(null); :]
   | SLASH RelativePathPattern:rpp
   [: RESULT = new AbsolutePathPattern(rpp); :]

   | IdKeyPattern:ikp
   [: RESULT = ikp; :]

   | IdKeyPattern:ikp SLASH RelativePathPattern:rpp
   [: RESULT = new ParentPattern(ikp, rpp); :]

   | IdKeyPattern:ikp DSLASH RelativePathPattern:rpp
   [: RESULT = new AncestorPattern(ikp, rpp); :]

   | DSLASH RelativePathPattern:rpp
   [: RESULT = new AncestorPattern(rpp); :]

   | RelativePathPattern:rpp
   [: RESULT = rpp; :];

IdKeyPattern ::= ID LPAREN Literal:l RPAREN
   [: RESULT = new IdPattern(l);
      parser.setHasIdCall(true);
   :]
   | KEY LPAREN Literal:l1 COMMA Literal:l2 RPAREN
   [: RESULT = new KeyPattern(l1, l2); :];

ProcessingInstructionPattern ::= PIPARAM LPAREN Literal:l RPAREN
   [: RESULT = new ProcessingInstructionPattern(l); :];

RelativePathPattern ::= StepPattern:sp
   [: RESULT = sp; :]
StepPattern ::= NodeTestPattern:nt
   {:
      RESULT = parser.createStepPattern(Axis.CHILD, nt, null);
   }

   | NodeTestPattern:nt Predicates:pp
   {:
      RESULT = parser.createStepPattern(Axis.CHILD, nt, pp);
   }

   | ProcessingInstructionPattern:pip
   {:
      RESULT = pip; }

   | ProcessingInstructionPattern:pip Predicates:pp
   {:
      RESULT = (ProcessingInstructionPattern)pip.setPredicates(pp); }

   | ChildOrAttributeAxisSpecifier:axis NodeTestPattern:nt
   {:
      RESULT = parser.createStepPattern(axis.intValue(), nt, null);
   }

   | ChildOrAttributeAxisSpecifier:axis NodeTestPattern:nt Predicates:pp
   {:
      RESULT = parser.createStepPattern(axis.intValue(), nt, pp);
   }

   | ChildOrAttributeAxisSpecifier:axis ProcessingInstructionPattern:pip
   {:
      RESULT = pip; // TODO: report error if axis is attribute
   }

   | ChildOrAttributeAxisSpecifier:axis ProcessingInstructionPattern:pip
   Predicates:pp
   {:
      // TODO: report error if axis is attribute
      RESULT = (ProcessingInstructionPattern)pip.setPredicates(pp);
   }

   NodeTestPattern ::= NameTestPattern:nt
   { : RESULT = nt; }
| NODE
{: RESULT = new Integer(NodeTest.ANODE); :}

| TEXT
{: RESULT = new Integer(NodeTest.TEXT); :}

| COMMENT
{: RESULT = new Integer(NodeTest.COMMENT); :}

| PI
{: RESULT = new Integer(NodeTest.PI); :};

NameTestPattern ::= STAR
{: RESULT = null; :}

| QName:qn
{: RESULT = qn; :};

ChildOrAttributeAxisSpecifier ::= ATSIGN
{: RESULT = new Integer(Axis.ATTRIBUTE); :}

| CHILD DCOLON
{: RESULT = new Integer(Axis.CHILD); :}

| ATTRIBUTE DCOLON
{: RESULT = new Integer(Axis.ATTRIBUTE); :};

Predicates ::= Predicate:p
{: Vector temp = new Vector(); temp.addElement(p); RESULT = temp; :}

| Predicate:p Predicates:pp
{: pp.insertElementAt(p, 0); RESULT = pp; :};

Predicate ::= LBRACK Expr:e RBRACK
{: RESULT = new Predicate(e); :};

/* --------------------------- Expressions --------------------------------- */

Expr ::= OrExpr:ex
{: RESULT = ex; :}
OrExpr ::= AndExpr:ae
{: RESULT = ae; :}

| OrExpr:oe OR AndExpr:ae
{: RESULT = new LogicalExpr(LogicalExpr.OR, oe, ae); :};

AndExpr ::= EqualityExpr:e
{: RESULT = e; :}

| AndExpr:ae AND EqualityExpr:ee
{: RESULT = new LogicalExpr(LogicalExpr.AND, ae, ee); :};

EqualityExpr ::= RelationalExpr:re
{: RESULT = re; :}

| EqualityExpr:ee EQ RelationalExpr:re
{: RESULT = new EqualityExpr(Operators.EQ, ee, re); :}

| EqualityExpr:ee NE RelationalExpr:re
{: RESULT = new EqualityExpr(Operators.NE, ee, re); :};

RelationalExpr ::= AdditiveExpr:ae
{: RESULT = ae; :}

| RelationalExpr:re LT AdditiveExpr:ae
{: RESULT = new RelationalExpr(Operators.LT, re, ae); :}

| RelationalExpr:re GT AdditiveExpr:ae
{: RESULT = new RelationalExpr(Operators.GT, re, ae); :}

| RelationalExpr:re LE AdditiveExpr:ae
{: RESULT = new RelationalExpr(Operators.LE, re, ae); :}

| RelationalExpr:re GE AdditiveExpr:ae
{: RESULT = new RelationalExpr(Operators.GE, re, ae); :};

AdditiveExpr ::= MultiplicativeExpr:me
{: RESULT = me; :}

| AdditiveExpr:ae PLUS MultiplicativeExpr:me
{: RESULT = new BinOpExpr(BinOpExpr.PLUS, ae, me); :}

| AdditiveExpr:ae MINUS MultiplicativeExpr:me
{: RESULT = new BinOpExpr(BinOpExpr.MINUS, ae, me); :};

MultiplicativeExpr ::= UnaryExpr:ue
{: RESULT = ue; :}
| MultiplicativeExpr:me MULT UnaryExpr:ue  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = \text{new BinOpExpr(BinOpExpr.TIMES, me, ue);} \hspace{1cm} \}

| MultiplicativeExpr:me DIV UnaryExpr:ue  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = \text{new BinOpExpr(BinOpExpr.DIV, me, ue);} \hspace{1cm} \}

| MultiplicativeExpr:me MOD UnaryExpr:ue  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = \text{new BinOpExpr(BinOpExpr.MOD, me, ue);} \hspace{1cm} \};

UnaryExpr ::= UnionExpr:ue  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = ue; \hspace{1cm} \}

| MINUS UnaryExpr:ue  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = \text{new UnaryOpExpr(ue);} \hspace{1cm} \};

UnionExpr ::= PathExpr:pe  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = pe; \hspace{1cm} \}

| PathExpr:pe VBAR UnionExpr:rest  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = \text{new UnionPathExpr(pe, rest);} \hspace{1cm} \};

PathExpr ::= LocationPath:lp  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = lp; \hspace{1cm} \}

| FilterExpr:fexp  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = fexp; \hspace{1cm} \}

| FilterExpr:fexp SLASH RelativeLocationPath:rlp  
| \hspace{1cm} \{ \hspace{1cm} \text{RESULT} = \text{new FilterParentPath(fexp, rlp);} \hspace{1cm} \}

| FilterExpr:fexp DSLASH RelativeLocationPath:rlp  
| \hspace{1cm} \{ \hspace{1cm} // \hspace{1cm} // Expand '//' into '/descendant-or-self::node()/' or 
| \hspace{1cm} // into /descendant-or-self::*/* 
| \hspace{1cm} // \hspace{1cm} int nodeType = DOM.NO_TYPE; 
| \hspace{1cm} if (rlp instanceof Step && 
| \hspace{1cm} \hspace{1cm} parser.isElementAxis(((Step) rlp).getAxis())) 
| \hspace{1cm} \hspace{1cm} \{ 
| \hspace{1cm} \hspace{1cm} nodeType = DTM.ELEMENT_NODE; 
| \hspace{1cm} \hspace{1cm} \}
| \hspace{1cm} \hspace{1cm} final Step step = new Step(Axis.DESCENDANTORSELF, nodeType, null); 
| \hspace{1cm} \hspace{1cm} FilterParentPath fpp = new FilterParentPath(fexp, step); 
| \hspace{1cm} \hspace{1cm} fpp = new FilterParentPath(fpp, rlp); 
| \hspace{1cm} \hspace{1cm} if (fexp instanceof KeyCall == false) { 
| \hspace{1cm} \hspace{1cm} fpp.setDescendantAxis(); 
| \hspace{1cm} \hspace{1cm} } 
| \hspace{1cm} \};
RESULT = fpp;
;
LocationPath ::= RelativeLocationPath:rlp
    {: RESULT = rlp; :}

    | AbsoluteLocationPath:alp
      {: RESULT = alp; :};

RelativeLocationPath ::= Step:step
    {: RESULT = step; :}

    | RelativeLocationPath:rlp SLASH Step:step
      {:
        if (rlp instanceof Step && ((Step) rlp).isAbbreviatedDot()) {
          RESULT = step;       // Remove '.' from the middle
        }
        else if (((Step) step).isAbbreviatedDot()) {
          RESULT = rlp;        // Remove '/.' from the end
        }
        else {
          RESULT =
            new ParentLocationPath((RelativeLocationPath) rlp, step);
        }
      :}

    | AbbreviatedRelativeLocationPath:arlp
      {: RESULT = arlp; :};

AbsoluteLocationPath ::= SLASH
    {: RESULT = new AbsoluteLocationPath(); :}

    | SLASH RelativeLocationPath:rlp
      {: RESULT = new AbsoluteLocationPath(rlp); :}

    | AbbreviatedAbsoluteLocationPath:aalp
      {: RESULT = aalp; :};

AbbreviatedRelativeLocationPath ::= RelativeLocationPath:rlp DSLASH Step:step
    {:
      final Step right  = (Step)step;
      final int  axis   = right.getAxis();
      final int  type   = right.getNodeType();
      final Vector predicates = right.getPredicates();

      if ((axis == Axis.CHILD) && (type != NodeTest.ATTRIBUTE)) {
        // Compress '/child:E' into 'descendant::E' - if possible
        if (predicates == null) {
right.setAxis(Axis.DESCENDANT);
if (rlp instanceof Step && ((Step)rlp).isAbbreviatedDot()) {
RESULT = right;
} else {
// Expand 'rlp//child::E' into 'rlp/descendant::E'
RelativeLocationPath left = (RelativeLocationPath)rlp;
RESULT = new ParentLocationPath(left, right);
}
else {
// Expand './/step' -> 'descendant-or-self::*/step'
if (rlp instanceof Step && ((Step)rlp).isAbbreviatedDot()) {
Step left = new Step(Axis.DESCENDANTORSELF,
DTM.ELEMENT_NODE, null);
RESULT = new ParentLocationPath(left, right);
} else {
// Expand 'rlp//step' -> 'rlp/descendant-or-self::*/step'
RelativeLocationPath left = (RelativeLocationPath)rlp;
Step mid = new Step(Axis.DESCENDANTORSELF,
DTM.ELEMENT_NODE, null);
ParentLocationPath ppl = new ParentLocationPath(mid, right);
RESULT = new ParentLocationPath(left, ppl);
}
}

else if ((axis == Axis.ATTRIBUTE) || (type == NodeTest.ATTRIBUTE)) {
// Expand 'rlp//step' -> 'rlp/descendant-or-self::*/step'
RelativeLocationPath left = (RelativeLocationPath)rlp;
Step middle = new Step(Axis.DESCENDANTORSELF,
DTM.ELEMENT_NODE, null);
ParentLocationPath ppl = new ParentLocationPath(middle, right);
RESULT = new ParentLocationPath(left, ppl);
}
else {
// Expand 'rlp//step' -> 'rlp/descendant-or-self::node()/step'
RelativeLocationPath left = (RelativeLocationPath)rlp;
Step middle = new Step(Axis.DESCENDANTORSELF,
DOM.NO_TYPE, null);
ParentLocationPath ppl = new ParentLocationPath(middle, right);
RESULT = new ParentLocationPath(left, ppl);
}
);

AbbreviatedAbsoluteLocationPath ::= DSLASH RelativeLocationPath:rlp
{:
int nodeType = DOM.NO_TYPE;
if (rlp instanceof Step &&
    parser.isElementAxis(((Step) rlp).getAxis()))
{
    nodeType = DTM.ELEMENT_NODE;
}
final Step step = new Step(Axis.DESCENDANTORSELF, nodeType, null);
RESULT = new AbsoluteLocationPath(parser.insertStep(step, (RelativeLocationPath) rlp));

Step ::= NodeTest:ntest
{:
    if (ntest instanceof Step) {
        RESULT = (Step)ntest;
    }
    else {
        RESULT = new Step(Axis.CHILD, parser.findNodeType(Axis.CHILD, ntest), null);
    }
}

| NodeTest:ntest Predicates:pp
{: if (ntest instanceof Step) {
    Step step = (Step)ntest;
    step.addPredicates(pp);
    RESULT = (Step)ntest;
}
else {
    RESULT = new Step(Axis.CHILD, parser.findNodeType(Axis.CHILD, ntest), pp);
}
}

| AxisSpecifier:axis NodeTest:ntest Predicates:pp
{: RESULT = new Step(axis.intValue(), parser.findNodeType(axis.intValue(), ntest), pp);
}

| AxisSpecifier:axis NodeTest:ntest
{: RESULT = new Step(axis.intValue(),
<table>
<thead>
<tr>
<th>AbbreviatedStep:abbrev</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : RESULT = abbrev; :};</td>
</tr>
</tbody>
</table>

**AxisSpecifier ::=** 
\[
\text{AxisName}:an \text{ DCOLON} \\
\{ : \text{RESULT} = an; :\}
\]

<table>
<thead>
<tr>
<th>ATSIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.ATTRIBUTE); :};</td>
</tr>
</tbody>
</table>

**AxisName ::=** 
\[
\text{ANCESTOR} \\
\{ : \text{RESULT} = \text{new Integer}(Axis.ANCESTOR); :\}
\]

<table>
<thead>
<tr>
<th>ANCESTORORSELF</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.ANCESTORORSELF); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTRIBUTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.ATTRIBUTE); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHILD</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.CHILD); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCENDANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.DESCENDANT); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCENDANTORSELF</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.DESCENDANTORSELF); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOLLOWING</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.FOLLOWING); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOLLOWINGSIBLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.FOLLOWINGSIBLING); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NAMESPACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.NAMESPACE); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.PARENT); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRECEDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.PRECEDING); :}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRECEDINGSIBLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ : \text{RESULT} = \text{new Integer}(Axis.PRECEDINGSIBLING); :}</td>
</tr>
</tbody>
</table>
SELF
{: RESULT = new Integer(Axis.SELF); :};

AbbreviatedStep ::= DOT
{: RESULT = new Step(Axis.SELF, NodeTest.ANODE, null); :}

DDOT
{: RESULT = new Step(Axis.PARENT, NodeTest.ANODE, null); :};

FilterExpr ::= PrimaryExpr:primary
{: RESULT = primary; :}

| PrimaryExpr:primary Predicates:pp
{: RESULT = new FilterExpr(primary, pp); :};

PrimaryExpr ::= VariableReference:vr
{: RESULT = vr; :}

| LPAREN Expr:ex RPAREN
{: RESULT = ex; :}

| Literal:string
{: /*
  * If the string appears to have the syntax of a QName, store
  * namespace info in the literal expression. This is used for
  * element-available and function-available functions, among
  * others. Also, the default namespace must be ignored.
  */
  String namespace = null;
  final int index = string.lastIndexOf(’:’);
  if (index > 0) {
    final String prefix = string.substring(0, index);
    namespace = parser._symbolTable.lookupNamespace(prefix);
  }
  RESULT = (namespace == null) ? new LiteralExpr(string)
    : new LiteralExpr(string, namespace);
  :}

| INT:num
{: long value = num.longValue();
  if (value < Integer.MIN_VALUE || value > Integer.MAX_VALUE) {
    RESULT = new RealExpr(value);
  } else {
if (num.doubleValue() == -0)
    RESULT = new RealExpr(num.doubleValue());
else if (num.intValue() == 0)
    RESULT = new IntExpr(num.intValue());
else if (num.doubleValue() == 0.0)
    RESULT = new RealExpr(num.doubleValue());
else
    RESULT = new IntExpr(num.intValue());

| REAL:num |
{ RESULT = new RealExpr(num.doubleValue()); |}

| FunctionCall:fc |
{ RESULT = fc; |};

VariableReference ::= DOLLAR VariableName:varName |
{ // An empty qname prefix for a variable or parameter reference
  // should map to the null namespace and not the default URI.
  SyntaxTreeNode node = parser.lookupName(varName);

  if (node != null) {
    if (node instanceof Variable) {
      RESULT = new VariableRef((Variable)node);
    }
    else if (node instanceof Param) {
      RESULT = new ParameterRef((Param)node);
    }
    else {
      RESULT = new UnresolvedRef(varName);
    }
  }
  else {
    RESULT = new UnresolvedRef(varName);
  }
  |

FunctionCall ::= FunctionName:fname LPAREN RPAREN |
{ if (parser.getQNameIgnoreDefaultNs("current").equals(fname)) {
    RESULT = new CurrentCall(fname);
  }
  else if (parser.getQNameIgnoreDefaultNs("number").equals(fname)) {
    RESULT = new NumberCall(fname, parser.EmptyArgs);
  }
  |

else if (parser.getQNameIgnoreDefaultNs("string").equals(fname)) {
    RESULT = new StringCall(fname, parser.EmptyArgs);
}

else if (parser.getQNameIgnoreDefaultNs("concat").equals(fname)) {
    RESULT = new ConcatCall(fname, parser.EmptyArgs);
}

else if (parser.getQNameIgnoreDefaultNs("true").equals(fname)) {
    RESULT = new BooleanExpr(true);
}

else if (parser.getQNameIgnoreDefaultNs("false").equals(fname)) {
    RESULT = new BooleanExpr(false);
}

else if (parser.getQNameIgnoreDefaultNs("name").equals(fname)) {
    RESULT = new NameCall(fname);
}

else if (parser.getQNameIgnoreDefaultNs("generate-id").equals(fname)) {
    RESULT = new GenerateIdCall(fname, parser.EmptyArgs);
}

else if (parser.getQNameIgnoreDefaultNs("string-length").equals(fname)) {
    RESULT = new StringLengthCall(fname, parser.EmptyArgs);
}

else if (parser.getQNameIgnoreDefaultNs("position").equals(fname)) {
    RESULT = new PositionCall(fname);
}

else if (parser.getQNameIgnoreDefaultNs("last").equals(fname)) {
    RESULT = new LastCall(fname);
}

else if (parser.getQNameIgnoreDefaultNs("local-name").equals(fname)) {
    RESULT = new LocalNameCall(fname);
}

else if (parser.getQNameIgnoreDefaultNs("namespace-uri").equals(fname)) {
    RESULT = new NamespaceUriCall(fname);
}

else {
    RESULT = new FunctionCall(fname, parser.EmptyArgs);
}

| FunctionName:fname LPAREN NonemptyArgumentList:argl RPAREN |
| {}: 
| if (parser.getQNameIgnoreDefaultNs("concat").equals(fname)) {
|     RESULT = new ConcatCall(fname, argl);
| }

else if (parser.getQNameIgnoreDefaultNs("number").equals(fname)) {
    RESULT = new NumberCall(fname, argl);
}

else if (parser.getQNameIgnoreDefaultNs("document").equals(fname)) {
parser.setMultiDocument(true);
    RESULT = new DocumentCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("string").equals(fname)) {
    RESULT = new StringCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("boolean").equals(fname)) {
    RESULT = new BooleanCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("name").equals(fname)) {
    RESULT = new NameCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("generate-id").equals(fname)) {
    RESULT = new GenerateIdCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("not").equals(fname)) {
    RESULT = new NotCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("format-number").equals(fname)) {
    RESULT = new FormatNumberCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("unparsed-entity-uri").equals(fname)) {
    RESULT = new UnparsedEntityUriCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("key").equals(fname)) {
    RESULT = new KeyCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("id").equals(fname)) {
    RESULT = new KeyCall(fname, arg1);
    parser.setHasIdCall(true);
}
else if (parser.getQNameIgnoreDefaultNs("ceiling").equals(fname)) {
    RESULT = new CeilingCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("round").equals(fname)) {
    RESULT = new RoundCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("floor").equals(fname)) {
    RESULT = new FloorCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("contains").equals(fname)) {
    RESULT = new ContainsCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("string-length").equals(fname)) {
    RESULT = new StringLengthCall(fname, arg1);
}
else if (parser.getQNameIgnoreDefaultNs("starts-with").equals(fname)) {
    RESULT = new StartsWithCall(fname, arg1);
else if (parser.getQNameIgnoreDefaultNs("function-available").equals(fname)) {
    RESULT = new FunctionAvailableCall(fname, argl);
}
else if (parser.getQNameIgnoreDefaultNs("element-available").equals(fname)) {
    RESULT = new ElementAvailableCall(fname, argl);
}
else if (parser.getQNameIgnoreDefaultNs("local-name").equals(fname)) {
    RESULT = new LocalNameCall(fname, argl);
}
else if (parser.getQNameIgnoreDefaultNs("lang").equals(fname)) {
    RESULT = new LangCall(fname, argl);
}
else if (parser.getQNameIgnoreDefaultNs("namespace-uri").equals(fname)) {
    RESULT = new NamespaceUriCall(fname, argl);
}
else if (parser.getQName(Translet.URI, "xsltc", "cast").equals(fname)) {
    RESULT = new CastCall(fname, argl);
}
// Special case for extension function nodeset()
else if (fname.getLocalPart().equals("nodeset") || fname.getLocalPart().equals("node-set")) {
    parser.setCallsNodeset(true); // implies MultiDOM
    RESULT = new FunctionCall(fname, argl);
}
else {
    RESULT = new FunctionCall(fname, argl);
}
);

NonemptyArgumentList ::= Argument:arg
{:
    Vector temp = new Vector();
    temp.addElement(arg);
    RESULT = temp;
:}

| Argument:arg COMMA NonemptyArgumentList:argl
{:
    argl.insertElementAt(arg, 0);
    RESULT = argl;
:}

FunctionName ::= QName:fname
{:
    RESULT = fname;
:}

VariableName ::= QName:vname
{:
    RESULT = vname;
:}
Argument ::= Expr:ex
   { : RESULT = ex; :};

NodeTest ::= NameTest:nt
   { : RESULT = nt; :}

   | NODE
   { : RESULT = new Integer(NodeTest.ANODE); :}

   | TEXT
   { : RESULT = new Integer(NodeTest.TEXT); :}

   | COMMENT
   { : RESULT = new Integer(NodeTest.COMMENT); :}

   | PIPARAM LPAREN Literal:l RPAREN
   { :
      QName name = parser.getQNameIgnoreDefaultNs("name");
      Expression exp = new EqualityExpr(Operators.EQ,
         new NameCall(name),
         new LiteralExpr(l));
      Vector predicates = new Vector();
      predicates.addElement(new Predicate(exp));
      RESULT = new Step(Axis.CHILD, NodeTest.PI, predicates);
   :}

   | PI
   { : RESULT = new Integer(NodeTest.PI); :};

NameTest ::= STAR
   { : RESULT = null; :}

   | QName:qn
   { : RESULT = qn; :};

QName ::= QNAME:qname
   { : RESULT = parser.getQNameIgnoreDefaultNs(qname); :}

   | DIV
   { : RESULT = parser.getQNameIgnoreDefaultNs("div"); :}

   | MOD
   { : RESULT = parser.getQNameIgnoreDefaultNs("mod"); :}

   | KEY
   { : RESULT = parser.getQNameIgnoreDefaultNs("key"); :}
ANCESTOR
{ : RESULT = parser.getQNameIgnoreDefaultNs("child"); : }

ANCESTORORSELF
{ : RESULT = parser.getQNameIgnoreDefaultNs("ancestor-or-self"); : }

ATTRIBUTE
{ : RESULT = parser.getQNameIgnoreDefaultNs("attribute"); : }

CHILD
{ : RESULT = parser.getQNameIgnoreDefaultNs("child"); : }

DESCENDANT
{ : RESULT = parser.getQNameIgnoreDefaultNs("descendant"); : }

DESCENDANTORSELF
{ : RESULT = parser.getQNameIgnoreDefaultNs("descendant-or-self"); : }

FOLLOWING
{ : RESULT = parser.getQNameIgnoreDefaultNs("following"); : }

FOLLOWINGSIBLING
{ : RESULT = parser.getQNameIgnoreDefaultNs("following-sibling"); : }

NAMESPACE
{ : RESULT = parser.getQNameIgnoreDefaultNs("namespace"); : }

PARENT
{ : RESULT = parser.getQNameIgnoreDefaultNs("parent"); : }

PRECEDING
{ : RESULT = parser.getQNameIgnoreDefaultNs("preceding"); : }

PRECEDINGSIBLING
{ : RESULT = parser.getQNameIgnoreDefaultNs("preceding-sibling"); : }

SELF
{ : RESULT = parser.getQNameIgnoreDefaultNs("self"); : }

ID
{ : RESULT = parser.getQNameIgnoreDefaultNs("id"); : }

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xslt/compiler/xpath.cup
No license file was found, but licenses were detected in source scan.

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* limitations under the License.
*/

// is found, then throw a special exception in order to terminate

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/processor/TransformerFactoryImpl.java
No license file was found, but licenses were detected in source scan.

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*/

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/domapi/XPathStylesheetDOM3Exception.java
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Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-
  jar/org/apache/xpath/functions/FuncDoclocation.java

No license file was found, but licenses were detected in source scan.

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  * distributed under the License is distributed on an "AS IS" BASIS,
  * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
  * See the License for the specific language governing permissions and
  * limitations under the License.
  */

package org.apache.xalan.xsltc.compiler;

/*
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 */

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* distributed under the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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* limitations under the License.
*/

/**
 * Execute the proprietary document-location() function, which returns
 * a node set of documents.
 *
 */

/*
 * @xsl.usage advanced
 */

* $Id: xpath.lex 1225752 2011-12-30 04:12:46Z mrglavas $
*/

/*
 * @author Jacek Ambroziak
 * @author Santiago Pericas-Geertsen
 * @author Morten Jorgensen
 */
import java_cup.runtime.Symbol;

%%
%cup
%unicode
%cclass XPathLexer
%yyeof

{%
  int last;

  void initialize() {
    last = -1;
  }

static boolean isWhitespace(int c) {
  return (c == ' ' || c == '	' || c == '' || c == '
' || c == '');
}

/**
 * If symbol is not followed by '::' or '(', then treat it as a
 * name instead of an axis or function (Jira-1912).
 */
Symbol disambiguateAxisOrFunction(int ss) throws Exception {
  // Peek in the input buffer without changing the internal state
  int index = yy_buffer_index;

  // Skip whitespace
  while (index < yy_buffer_read && isWhitespace(yy_buffer[index])) {
    index++;
  }

  // If end of buffer, can't disambiguate :
  if (index >= yy_buffer_read) {
    // Can't disambiguate, so return as symbol
    return new Symbol(ss);
  }

  // Return symbol if next token is '::' or '(
  return (yy_buffer[index] == ':' && yy_buffer[index+1] == ':') ||
         yy_buffer[index] == '(' ?
          newSymbol(ss) : newSymbol(sym.QNAME, yytext());
}

/**
 * If symbol is first token or if it follows any of the operators
 * listed in http://www.w3.org/TR/xpath#exprlex then treat as a
 * name instead of a keyword (Jira-1912).
 */
Symbol disambiguateOperator(int ss) throws Exception {
    switch (last) {
    case -1:   // first token
        case sym.ATSIGN:
        case sym.DCOLON:
        case sym.LPAREN:
        case sym.LBRACK:
        case sym.COMMA:
        case sym.AND:
        case sym.OR:
        case sym.MOD:
        case sym.DIV:
        case sym.MULT:
        case sym.SLASH:
        case sym.DSлаSH:
        case sym.VBAR:
        case sym.PLUS:
        case sym.MINUS:
        case sym.EQ:
        case sym.NE:
        case sym.LT:
        case sym.LE:
        case sym.GT:
        case sym.GE:
            return newSymbol(sym.QNAME, yytext());
    }
    return newSymbol(ss);
}

/**
 * If symbol is first token or if it follows any of the operators
 * listed in http://www.w3.org/TR/xpath#exprlex then treat as a
 * wildcard instead of a multiplication operator
 */
Symbol disambiguateStar() throws Exception {
    switch (last) {
    case -1:   // first token
        case sym.ATSIGN:
        case sym.DCOLON:
        case sym.LPAREN:
        case sym.LBRACK:
        case sym.COMMA:
        case sym.AND:
        case sym.OR:
        case sym.MOD:
        case sym.DIV:
        case sym.MULT:
        case sym.SLASH:
        case sym.DSлаSH:
        case sym.VBAR:
        case sym.PLUS:
        case sym.MINUS:
        case sym.EQ:
        case sym.NE:
        case sym.LT:
        case sym.LE:
        case sym.GT:
        case sym.GE:
            return newSymbol(sym.QNAME, yytext());
    }
    return newSymbol(ss);
}
case sym.SLASH:
case sym.DSLASH:
case sym.VBAR:
case sym.PLUS:
case sym.MINUS:
case sym.EQ:
case sym.NE:
case sym.LT:
case sym.LE:
case sym.GT:
case sym.GE:
    return newSymbol(sym.STAR);
}
return newSymbol(sym.MULT);
}

Symbol newSymbol(int ss) {
    last = ss;
    return new Symbol(ss);
}

Symbol newSymbol(int ss, String value) {
    last = ss;
    return new Symbol(ss, value);
}

Symbol newSymbol(int ss, Long value) {
    last = ss;
    return new Symbol(ss, value);
}

Symbol newSymbol(int ss, Double value) {
    last = ss;
    return new Symbol(ss, value);
}

%}
%eofval{
    return newSymbol(sym.EOF);
%eofval}

%yylexthrow{
    Exception
%yylexthrow}

Letter={BaseChar}|{Ideographic}
NCName=([{Letter}]|"_"|[{NCNameStartChar}]|[{NCNameChar}])*  
NCNameChar=([Letter]|[Digit]|"-"|"_"|[{CombiningChar}]|[{Extender}]|[{NCNameStartChar}]|\u00B7 |[\u0300-\u036F]| [\u203F-\u2040] | [\u0130-\u0136]  
NCNameStartChar=[\u0041-\u005A\u0061-\u007A\u00C0-\u00D6\u00D8-\u02FF\u0370-\u037D\u037F-\u039F\u0391-\u0398\u039A-\u039F\u0398-\u03A0\u03A3-\u03A8\u03BB-\u03CE\u03DE-\u03FF\u200C-‍\u2070-↏\u2C00-⿯\u3001-퟿\uF900-﷏\uFDF0-\uFFFD] | [\u005F] | [{HighSurrogate}] [{LowSurrogate}]  
HighSurrogate=[\uD800-\uDBFF]  
LowSurrogate=[\uDC00-\uDFFF]  

%%

"*"                      { return disambiguateStar(); }
"/"                      { return newSymbol(sym.SLASH); }
"+"                      { return newSymbol(sym.PLUS); }
"-"                      { return newSymbol(sym.MINUS); }
"div"                    { return disambiguateOperator(sym.DIV); }
"mod"                    { return disambiguateOperator(sym.MOD); }
":;"                     { return newSymbol(sym.DCOLON); }
",;"                     { return newSymbol(sym.COMMA); }
"@"                      { return newSymbol(sym.ATSIGN); }
".."                     { return newSymbol(sym.DDOT); }
"\"                      { return newSymbol(sym.VBAR); }
"$"                      { return newSymbol(sym.DOLLAR); }
"//"                     { return newSymbol(sym.DSLASH); }
"="                      { return newSymbol(sym.EQ); }
"!="                     { return newSymbol(sym.NE); }
"<"                      { return newSymbol(sym.LT); }
">"                      { return newSymbol(sym.GT); }
"<="                     { return newSymbol(sym.LE); }
">="                     { return newSymbol(sym.GE); }
"id"                     { return disambiguateAxisOrFunction(sym.ID); }
"key"                    { return disambiguateAxisOrFunction(sym.KEY); }
"text()"                 { return newSymbol(sym.TEXT); }
"text"+ [ \n\r\f\t]+"("  { return newSymbol(sym.TEXT); }
"node()"                 { return newSymbol(sym.NODE); }
"node"+ [ \n\r\f\t]+"()"  { return newSymbol(sym.NODE); }
"comment()"              { return newSymbol(sym.COMMENT); }
"comment"+ [ \n\r\f\t]+"("  { return newSymbol(sym.COMMENT); }
"processing-instruction" { return disambiguateAxisOrFunction(sym.PI); }
"processing-instruction"+ [ \n\r\f\t]+"(" { return newSymbol(sym.PI); }
"or"                     { return disambiguateOperator(sym.OR); }
"and"                    { return disambiguateOperator(sym.AND); }
"child"                  { return disambiguateAxisOrFunction(sym.CHILD); }
"attribute"  { return disambiguateAxisOrFunction(sym.ATTRIBUTE); }
"ancestor"  { return disambiguateAxisOrFunction(sym.ANCESTOR); }
"ancestor-or-self"  { return disambiguateAxisOrFunction(sym.ANCESTORORSELF); }
"descendant"  { return disambiguateAxisOrFunction(sym.DESCENDANT); }
"descendant-or-self"  { return disambiguateAxisOrFunction(sym.DESCENDANTORSELF); }
"following"  { return disambiguateAxisOrFunction(sym.FOLLOWING); }
"following-sibling"  { return disambiguateAxisOrFunction(sym.FOLLOWINGSIBLING); }
"namespace"  { return disambiguateAxisOrFunction(sym.NAMESPACE); }
"parent"  { return disambiguateAxisOrFunction(sym.PARENT); }
"preceding"  { return disambiguateAxisOrFunction(sym.PRECEDING); }
"preceding-sibling"  { return disambiguateAxisOrFunction(sym.PRECEDINGSIBLING); }
"self"  { return disambiguateAxisOrFunction(sym.SELF); }
"
{ return newSymbol(sym.LBRACK); }
"]"  { return newSymbol(sym.RBRACK); }
"("  { return newSymbol(sym.LPAREN); }
")"  { return newSymbol(sym.RPAREN); }
"<PATTERN>"  { initialize(); return new Symbol(sym.PATTERN); }
"<EXPRESSION>"  { initialize(); return new Symbol(sym.EXPRESSION); }
"\[\^"{\n"{Digit}+  { return newSymbol(sym.INT, new Long(yytext())); }
{Digit}+\.(\.[Digit]+)?  { return newSymbol(sym.REAL, new Double(yytext())); }
"."{Digit}+  { return newSymbol(sym.REAL, new Double(yytext())); }
"."  { return newSymbol(sym.DOT); }
({NCName}:)?([NCName]  { return newSymbol(sym.QNAME, yytext()); }
({NCName}:)?"@*  { return newSymbol(sym.QNAME, yytext()); }
[\w\n\v]  /* ignore white space. */
].  { throw new Exception(yytext()); }

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/xpath.lex
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*/
/*
$Id: XSLProcessorVersion.src 468640 2006-10-28 06:53:53Z minchau$
*/
package org.apache.xalan.processor;

/**
 * Administrative class to keep track of the version number of
 * the Xalan release.
 * <P>See also: org/apache/xalan/res/XSLTInfo.properties</P>
 * @deprecated To be replaced by org.apache.xalan.Version.getVersion()
 * @xsl.usage general
 */
public class XSLProcessorVersion
{

/**
 * Print the processor version to the command line.
 * *
 * @param argv command line arguments, unused.
 */
public static void main(String argv[])
{
    System.out.println(S_VERSION);
}

/**
 * Constant name of product.
 */
public static final String PRODUCT = "Xalan";

/**
 * Implementation Language.
 */
public static final String LANGUAGE = "Java";

/**
 * Major version number.
 * Version number. This changes only when there is a
 * significant, externally apparent enhancement from
 * the previous release. 'n' represents the n'th
 * version.
 *
Clients should carefully consider the implications of new versions as external interfaces and behaviour may have changed.

public static final int VERSION = @version.VERSION@;

/**
 * Release Number.
 * Release number. This changes when:
 * - a new set of functionality is to be added, eg,
 *   implementation of a new W3C specification.
 * - API or behaviour change.
 * - its designated as a reference release.
 */
public static final int RELEASE = @version.RELEASE@;

/**
 * Maintenance Drop Number.
 * Optional identifier used to designate maintenance drop applied to a specific release and contains fixes for defects reported. It maintains compatibility with the release and contains no API changes. When missing, it designates the final and complete development drop for a release.
 */
public static final int MAINTENANCE = @version.MINOR@;

/**
 * Development Drop Number.
 * Optional identifier designates development drop of a specific release. D01 is the first development drop of a new release.
 * Development drops are works in progress towards a completed, final release. A specific development drop may not completely implement all aspects of a new feature, which may take several development drops to complete. At the point of the final drop for the release, the D suffix will be omitted.
 * Each 'D' drops can contain functional enhancements as well as defect fixes. 'D' drops may not be as stable as the final releases.
 */
public static final int DEVELOPMENT = 0;

/**
 * Version String like <CODE>"<B>Xalan</B> <B>Language</B>
* v.r.[dd] <B>D</B><B>/</B><B>n</B>n"</CODE>.
* &lt;P&gt;Semantics of the version string are identical to the Xerces project.&lt;/P&gt; */

```java
public static final String S_VERSION = PRODUCT + " " + LANGUAGE + " " + VERSION + "." + RELEASE + "." + (DEVELOPMENT > 0 ? ("D" + DEVELOPMENT) : ("" + MAINTENANCE));
```

Found in path(s):
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/processor/XSLProcessorVersion.src

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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xalan/trace/package.html
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xpath/functions/package.html
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xalan/transformer/package.html
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xalan/client/package.html
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xpath/domapi/package.html
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xalan/templates/package.html
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xalan/extensions/package.html
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar.org/apache/xalan/extensions/package.html
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 * limitations under the License.
 */

// Proprietary, built in functions
/** current function string (Proprietary). */

Found in path(s):
   * /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/compiler/Keywords.java

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*/

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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/XslAttribute.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/dtm/ref/NodeLocator.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/serializer/ToStream.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/serializer/utils/SerializerMessages_ja.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/CurrentCall.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/When.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/util/NodeSetType.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/WhenHandlerImpl.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/axes/WalkingIteratorSorted.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/templates/ElemForEach.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/templates/ElemWhen.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/utils/StylesheetPIHandler.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/functions/FuncStringLength.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/functions/FuncGenerateId.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/serializer/OutputPropertiesFactory.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/processor/ProcessorStylesheetDoc.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/processor/XSLTElementProcessor.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/functions/FuncStartsWith.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/axes/ContextNodeList.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/FilteredAbsoluteLocationPath.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/NamespaceAlias.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/dtm/ref/DTMChildIterNodeList.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/FilteredAbsoluteLocationPath.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/FilteredAbsoluteLocationPath.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/NamespaceAlias.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/dtm/ref/DTMChildIterNodeList.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/DocumentCall.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/dom/FilterIterator.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/trax/SmartTransformerFactoryImpl.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/res/XMLErrorResources_es.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/runtime/ErrorMessages_hu.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/serialize/Serializer.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/LocationPathPattern.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/axes/BasicTestIterator.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xml/serializer/utils/SerializerMessages_zh.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/util/NodeSortRecordGenerator.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xsltc/compiler/FlowList.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/templates/XSLTVisitable.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/jaxp/XPathFactoryImpl.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/Arg.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/Arg.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/Arg.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xalan/trace/ExtensionEvent.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xml/serializer/ObjectFactory.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xpath/axes/UnionPathIterator.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xalan/templates/ElemUnknown.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xpath/objects/XRSTreeFragSelectWrapper.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xalan/util/xslt/compiler/util/ReferenceType.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xml/utils/XMLReaderManager.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xpath/domapi/XPathExpressionImpl.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xml/utils/UnImplNode.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xalan/res/XSLTErrorResources_cs.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xalan/serialize/SerializerFactory.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xalan/templates/ElemOtherwise.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xalan/xsltc/runtime/InternalRuntimeError.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xml/serializer/utils/XML11Char.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources.jar/org/apache/xpath/operations/Div.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/xslt/compiler/util/ResultTreeType.java
* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/jaxp/JAXPPrefixResolver.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/XPathException.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xalan/lib/ExsltDynamic.java
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* /opt/cola/permits/1134796662_1613422294.09/0/xalan-2-7-2-sources-jar/org/apache/xpath/patterns/NodeTest.java
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1.261 go-openapi-spec v0.20.3

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package spec

import {
    "encoding/json"
    "testing"
    "github.com/stretchr/testify/assert"
}

var license = License{
    LicenseProps: LicenseProps{Name: "the name", URL: "the url"},
    VendorExtensible: VendorExtensible{Extensions: map[string]interface{}{"x-license": "custom term"}}
}

const licenseJSON = `
    "name": "the name",
    "url": "the url",
    "x-license": "custom term"
`

func TestIntegrationLicense(t *testing.T) {

    // const licenseYAML = "name: the name\nurl: the url"

    b, err := json.MarshalIndent(license, "", "\t")
    if assert.NoError(t, err) {
        assert.Equal(t, licenseJSON, string(b))
    }
actual := License{
$err = json.Unmarshal([]byte(licenseJSON), &actual)
if assert.NoError(t, $err) {
assert.EqualValues(t, license, actual)
}
}$

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package spec

import (
    "encoding/json"
    "github.com/go-openapi/swag"
)

// License information for the exposed API.

// For more information: http://goo.gl/8us55a#licenseObject
type License struct {
    LicenseProps
    VendorExtensible
}

// LicenseProps holds the properties of a License object
type LicenseProps struct {
    Name string `json:"name,omitempty"`
    URL  string `json:"url,omitempty"`
}

// UnmarshalJSON hydrates License from json
func (l *License) UnmarshalJSON(data []byte) error {
    if err := json.Unmarshal(data, &l.LicenseProps); err != nil {
        return err
    }
}
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1.262 go-logr-zapr v0.2.0

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1.263 kubernetes-client v0.18.6

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@end smallexample

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when it starts in an interactive mode:

@end smallexample
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under certain conditions; type `show c' for details.
@end smallexample

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@end example
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`Gnomovision' (which makes passes at compilers) written by James Hacker.

@var{signature of Ty Coon}, 1 April 1989
Ty Coon, President of Vice
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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means
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1.273 commons-logging 1.1.

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* /opt/cola/permits/1098395378_1602741261.54/0/commons-logging-1-1-sources-4-
jar/org/apache/commons/logging/impl/ServletContextCleaner.java

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* /opt/cola/permits/1098395378_1602741261.54/0/commons-logging-1-1-sources-4-
jar/org/apache/commons/logging/impl/WeakHashtable.java

1.274 protobuf v1.24.0

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1.275 python 3.7.3 2+deb10u3

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This package was put together by Klee Dienes <klee@debian.org> from sources from ftp.python.org:/pub/python, based on the Debianization by the previous maintainers Bernd S. Breitrup <bsb@uni-muenster.de> and Bruce Perens.

Current maintainer is Matthias Klose <doko@debian.org> until the final 2.3 version is released.

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A. HISTORY OF THE SOFTWARE

Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see http://www.cwi.nl) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see http://www.cnri.reston.va.us) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see http://www.zope.com). In 2001, the Python Software Foundation (PSF, see http://www.python.org/psf/) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of
All Python releases are Open Source (see http://www.opensource.org for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

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py3compile, py3clean and debpython module:

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1.276 jaeger-lib v2.4.0+incompatible

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1.277 apiserver-builder-alpha v1.18.0

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1.278 jackson-annotations 2.9.8

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1.279 spf13-pflag v1.0.5

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1.280 checker-compat-qual 2.5.5

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* DateParser.java February 2001
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jar/org/simpleframework/http/parse/DateParser.java
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* KeyMap.java May 2007
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jar/org/simpleframework/util/KeyMap.java
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  jar/org/simpleframework/http/core/RequestMessage.java
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  jar/org/simpleframework/transport/reactor/ActionDistributor.java
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  jar/org/simpleframework/util/lease/Cleaner.java
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* Maintainer.java May 2004
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  jar/org/simpleframework/util/lease/Maintainer.java
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 * SocketTransport.java February 2007
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 * BufferAdapter.java February 2008
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   jar/org/simpleframework/transport/BufferAdapter.java
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 * ContainerProcessor.java February 2007
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   jar/org/simpleframework/http/core/ContainerProcessor.java
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* Negotiator.java February 2007
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  jar/org/simpleframework/transport/Negotiator.java
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 * ListParser.java September 2003
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  jar/org/simpleframework/http/message/Body.java
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  jar/org/simpleframework/http/message/Message.java
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  jar/org/simpleframework/http/message/MessageHeader.java
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  jar/org/simpleframework/transport/reactor/Action.java
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/ /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-jar/org/simpleframework/http/parse/ContentDispositionParser.java
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* Entity.java February 2007
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  jar/org/simpleframework/http/message/Entity.java
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 * Agent.java October 2012
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  jar/org/simpleframework/transport/trace/Agent.java
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 * BufferSegment.java February 2008
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1.jar/org/simpleframework/transport/BufferSegment.java
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 * SocketListenerManager.java February 2007
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1.jar/org/simpleframework/transport/connect/SocketListenerManager.java
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 * Status.java February 2007
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-jar/org/simpleframework/transport/Status.java
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* BufferWrapper.java February 2008
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 * Container.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-jar/org/simpleframework/http/core/Container.java

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 * RequestLine.java February 2001
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* RequestHeader.java February 2001
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jar/org/simpleframework/http/RequestHeader.java
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jar/org/simpleframework/transport/Scheduler.java
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 * ConnectionEvent.java October 2012
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 * EmptyProducer.java February 2007
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 * Expectation.java February 2007
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  jar/org/simpleframework/http/message/Expectation.java

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  jar/org/simpleframework/http/message/BodyConsumer.java

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* FlushMonitor.java February 2007
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  jar/org/simpleframework/http/core/FlushMonitor.java
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* TransportException.java February 2007
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  jar/org/simpleframework/transport/TransportException.java
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* AddressParser.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/http/parse/AddressParser.java
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* RequestCertificate.java June 2013
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  jar/org/simpleframework/http/core/RequestCertificate.java
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  jar/org/simpleframework/http/message/SegmentConsumer.java
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* QueryBuilder.java October 2002
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  jar/org/simpleframework/util/thread/Scheduler.java
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  jar/org/simpleframework/util/buffer/Allocator.java
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* ConnectionException.java February 2007
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jar/org/simpleframework/transport/connect/ConnectionException.java
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* SecureTransport.java February 2007
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jar/org/simpleframework/transport/SecureTransport.java
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  jar/org/simpleframework/transport/reactor/ActionMap.java
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/Channel.java
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/*
 * RequestEntity.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/http/core/RequestEntity.java
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 * PartSeriesConsumer.java February 2007
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 * /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-jar/org/simpleframework/http/message/PartSeriesConsumer.java
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 * PacketController.java February 2008
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 * /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-jar/org/simpleframework/transport/PacketController.java
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 * SocketWriter.java February 2008
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/SocketWriter.java
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 * Terminator.java February 2009
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Found in path(s):
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/Terminator.java
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 * ArrayAllocator.java February 2001
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Found in path(s):
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/util/buffer/ArrayAllocator.java
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* NegotiationCertificate.java June 2013
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/NegotiationState.java
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* PacketManager.java October 2007
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*/
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/PacketManager.java
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* Collector.java October 2002
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/http/core/Collector.java
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* PoolQueue.java February 2007
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Found in path(s):
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
jar/org/simpleframework/util/thread/PoolQueue.java
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* Notifier.java February 2009
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
jar/org/simpleframework/transport/Notifier.java
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/*
* TransportEvent.java October 2012
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Found in path(s):
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-jar/org/simpleframework/transport/TransportEvent.java
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* BufferPart.java February 2012
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Found in path(s):
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-jar/org/simpleframework/http/message/BufferPart.java
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* Handshake.java February 2007
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Found in path(s):
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/http/core/ProducerException.java
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* PoolExecutor.java February 2007
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/util/thread/PoolExecutor.java
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* ContentTypeParser.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/http/parse/ContentTypeParser.java
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* TransferException.java February 2007
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  jar/org/simpleframework/http/core/TransferException.java
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* ArrayBuffer.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
jar/org/simpleframework/util/buffer/ArrayBuffer.java
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* ArrayConsumer.java February 2007
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
jar/org/simpleframework/http/message/ArrayConsumer.java
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  jar/org/simpleframework/http/ContentType.java
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 * QueryCombiner.java May 2003
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  jar/org/simpleframework/http/core/QueryCombiner.java
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 * ValueParser.java September 2003
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jar/org/simpleframework/http/parse/ValueParser.java
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 * Certificate.java June 2013
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 * Acceptor.java October 2002
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/reactor/Distributor.java
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Found in path(s):
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/util/lease/Controller.java
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/*
* ConsumerFactory.java February 2007
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  jar/org/simpleframework/http/message/ConsumerFactory.java
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 * BufferAllocator.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/reactor/ExecuteAction.java
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* ActionSet.java February 2013
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  jar/org/simpleframework/transport/reactor/ActionSet.java
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* Processor.java February 2007
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  jar/org/simpleframework/transport/Processor.java
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  jar/org/simpleframework/http/message/ChunkedConsumer.java
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* Part.java February 2007
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 * Principal.java November 2002
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 * Allocator.java February 2001
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  jar/org/simpleframework/util/buffer/Allocator.java
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* NegotiationException.java February 2007
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  jar/org/simpleframework/transport/NegotiationException.java
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* Transfer.java February 2007
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* LeaseCleaner.java May 2004
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* TransportSender.java February 2007
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 * Reader.java February 2001
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* EmptyInputStream.java October 2002
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  jar/org/simpleframework/http/message/EmptyInputStream.java
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* Transport.java February 2007
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  jar/org/simpleframework/transport/Transport.java
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 * ChunkedProducer.java February 2007
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  jar/org/simpleframework/http/core/ChunkedProducer.java
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 * BufferBody.java February 2012
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  jar/org/simpleframework/http/message/BufferBody.java
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 * Selector.java February 2007
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* PartHeaderConsumer.java February 2007
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  jar/org/simpleframework/util/thread/PoolFactory.java
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jar/org/simpleframework/transport/reactor/PartitionDistributor.java
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* ProcessorServer.java February 2007
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/transport/OperationFactory.java
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* ParseBuffer.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/util/parse/ParseBuffer.java
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 * MapParser.java February 2005
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  jar/org/simpleframework/util/parse/MapParser.java
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 * Cookie.java February 2001
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jar/org/simpleframework/http/Cookie.java
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* ResponseMessage.java February 2001
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jar/org/simpleframework/http/core/ResponseMessage.java
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* Negotiation.java February 2007
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jar/org/simpleframework/transport/Negotiation.java

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* SocketAgent.java February 2012
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jar/org/simpleframework/transport/connect/SocketAgent.java

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jar/org/simpleframework/transport/SecureNegotiator.java
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 * TransportChannel.java February 2007
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 * ProducerFactory.java February 2007
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* Task.java February 2007
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  jar/org/simpleframework/transport/Task.java
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* SocketController.java February 2008
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  jar/org/simpleframework/transport/SocketController.java
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* Entry.java May 2004
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  jar/org/simpleframework/util/lease/Entry.java
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 * Monitor.java February 2007
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  jar/org/simpleframework/http/core/Monitor.java
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 * PartEntryConsumer.java February 2007
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  jar/org/simpleframework/http/message/PartEntryConsumer.java
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* StatusLine.java February 2001
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  jar/org/simpleframework/http/StatusLine.java
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* PacketException.java February 2008
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  jar/org/simpleframework/transport/PacketException.java
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* PartEntryFactory.java February 2007
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  jar/org/simpleframework/http/message/PartEntryFactory.java
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* LeaseManager.java May 2004
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  jar/org/simpleframework/util/lease/LeaseManager.java
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  jar/org/simpleframework/util/buffer/FilterAllocator.java
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* CertificateChallenge.java June 2013
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  jar/org/simpleframework/transport/CertificateChallenge.java
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* Protocol.java May 2012
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  jar/org/simpleframework/http/Protocol.java
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  jar/org/simpleframework/http/core/Timer.java

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  jar/org/simpleframework/http/message/TokenConsumer.java

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  jar/org/simpleframework/transport/Packet.java
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 */
jar/org/simpleframework/util/thread/DirectExecutor.java
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 * Response.java February 2001
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* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/http/ResponseHeader.java
* /opt/cola/permits/1144651729_1620196519.49/0/simple-5-1-6-sources-1-
  jar/org/simpleframework/http/Response.java
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 * CookieParser.java February 2001
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jar/org/simpleframework/http/parse/CookieParser.java

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 * BufferRecycler.java February 2008
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    jar/org/simpleframework/transport/BufferRecycler.java

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    jar/org/simpleframework/transport/reactor/Latch.java

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* PartSeries.java February 2007
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* Operation.java February 2007
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 * BufferException.java February 2001
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  jar/org/simpleframework/util/buffer/BufferException.java
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 * ContractLease.java May 2004
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  jar/org/simpleframework/util/lease/ContractLease.java
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 * DirectReactor.java February 2007
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jar/org/simpleframework/transport/TransportSource.java
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  jar/org/simpleframework/transport/Source.java
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  jar/org/simpleframework/http/message/FixedConsumer.java
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* LeaseException.java May 2004
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  jar/org/simpleframework/util/lease/LeaseException.java
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 * LeaseMap.java May 2004
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  jar/org/simpleframework/http/core/ContainerSelector.java
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 * ContainerEvent.java October 2012
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  jar/org/simpleframework/transport/PacketFlusher.java

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  jar/org/simpleframework/transport/Dispatcher.java
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  jar/org/simpleframework/http/parse/PathParser.java
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1.290 x-crypto v0.0.0-20201208171446-5f87f3452ae9

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1.292 tre 0.8.0

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Julian Seward, jseward@bzip.org
bzip2/libbzip2 version 1.0.6 of 6 September 2010

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If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a
work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

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That's all there is to it!
DRuntime: Runtime Library for the D Programming Language
==============================================

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GCC RUNTIME LIBRARY EXCEPTION

Version 3.1, 31 March 2009

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APPENDIX: How to apply the Apache License to your work.

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1.297 kasa-operator-deltacli v0.0.0

1.297.1 Available under license:

```yaml
{{- $global := default (dict ) $.Values.global -}}
{{- $dataPlaneNamespace := include "aegis.namespace.dataPlaneNamespace" (list $) -}}
{{- if ($global.platform | eq "azure") }}
{{ include "kasa.licensebroker.storageAzureDisk" (list $ "azure-disk-sc") }}
{{- else if ($global.platform | ne "aws") | and ($global.platform | ne "eks") }}
{{ include "kasa.licensebroker.storageLocal" (list $ "broker") }}
{{- end }}
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: {{ template "aegis.metadata.fullname" (list $ "server") }}
labels: {{ include "aegis.metadata.standardLabels" (list $) | nindent 4 }}
spec:
  accessModes:
    - ReadWriteOnce
```
volumeMode: Filesystem

{{- if ($global.platform | eq "aws") or ($global.platform | eq "eks") }}
storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */}}
{{- else if ($global.platform | eq "azure") }}
storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc") }} {{/* example yaml has 'managed-csi' as the name which is vague af */}}
{{- else if ($global.platform | eq "kind") }}
storageClassName: "standard" {{/* Kind has a default 'standard' StorageClass so reusing it here */}}
{{- else }}
storageClassName: {{ include "aegis.metadata.fullname" (list $ "broker") }}
{{- end }}

resources:
  requests:
    storage: {{ $.Values.licenseServerStorage }}

---

{{- define "kasa.licensebroker.storageLocal" -}}
  {{- $ := first . -}}
  {{- $storageName := last . -}}

apiVersion: storage.k8s.io/v1
kind: StorageClass

{{ template "aegis.metadata.standard" (list $ $storageName) }}
provisioner: kubernetes.io/no-provisioner
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer

{{- end -}}

---

{{- define "kasa.licensebroker.storageAzureDisk" -}}
  {{- $ := first . -}}
  {{- $storageName := last . -}}

apiVersion: storage.k8s.io/v1
kind: StorageClass

{{ template "aegis.metadata.standard" (list $ $storageName) }}
provisioner: disk.csi.azure.com
parameters:
  {{- /* TODO: parameterize the sku and other params https://github.com/kubernetes-sigs/azuredisk-csi-driver/blob/v1.2.0/docs/driver-parameters.md */}}
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer
allowVolumeExpansion: true

{{- end -}}

{{- define "kasa.validate.eula" -}}
  {{- $ := first . -}}
  {{ $acceptValues := list "yes" "agree" }}

  {{ if $.Release.IsInstall and (not ($acceptValues | has $.Values.global.acceptEULA)) -}}
    {{ $Files.Get "eula/EULA.txt" }}
  {{- end -}}
package services_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"
    
    
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    )

func TestControllers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})

package listeners_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "github.com/golang/mock/gomock"
    
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/api/ma/machinypkg/api/v1"
    "k8s.io/apimachine/pkg/apis/meta/v1" "k8s.io/apimachine/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    "sigs.k8s.io/controller-runtime/pkg/event"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var _ = Describe("Deregistration Listener Test", func() {
    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

    var listener licensing.DeregistrationListener
    var fakeClient client.Client

var mockCtrl *gomock.Controller
var recorder *record.FakeRecorder
var smartLicense *v1.SmartLicense
var notifier chan event.GenericEvent

BeforeEach(func() {
    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1.SmartLicenseSpec{
            Action:      v1.Register,
            LicenseType: licenseType,
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Registered,
            LicenseState:      v1.InCompliance,
            ErrorReason:       "",
        },
    }
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
    recorder = record.NewFakeRecorder(1024)
    notifier = make(chan event.GenericEvent, 10)
    listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger{}, recorder, notifier)
})

AfterEach(func() {
    mockCtrl.Finish()
})

It("should update SmartLicense status on deregistration event", func() {
    listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
    Reason: something happened"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response
    to out-of-band event from License Server")))
    Expect(notifier).Should(Receive(&event.GenericEvent{}})
import ("context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers"
  "css.cisco.com/kasa/license-broker/controllers/mocks"
  "github.com/golang/mock/gomock"
  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
 appsv1 "k8s.io/api/apps/v1"
 autoscalingv1 "k8s.io/api/autoscaling/v1"
 metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
 "k8s.io/apimachinery/pkg/types"
 "k8s.io/client-go/kubernetes/scheme"
 "k8s.io/client-go/tools/record"
 "k8s.io/utils/pointer"
 ctrl "sigs.k8s.io/controller-runtime"
 "sigs.k8s.io/controller-runtime/pkg/client"
 "sigs.k8s.io/controller-runtime/pkg/client/fake"
 logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (epHpaName                   = "epHPA"
  initialHPAMaxReplicas int32 = 3)

var _ = Describe("HPA License Controller Test", func() {

  hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}
  var (reconciler *controllers.HPALicenseReconciler
    fakeClient     client.Client
    mockCtrl       *gomock.Controller
    hpa            *autoscalingv1.HorizontalPodAutoscaler
    smartLicense   *v1.SmartLicense
    recorder       *record.FakeRecorder
    replicasCalculatorMock *mocks.MockReplicasCalculator
  )

 BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()

    reconciler = controllers.NewLicenseReconciler(hpaNsName, hpa)
    reconciler.SetSmartLicense(smartLicense)
    reconciler.SetReplicasCalculator(replicasCalculatorMock)
    reconciler.SetRecord(recorder)

    interactions := []interactions{interaction{hpa, hpaNsName}}
    reconciler.SetInteractions(interactions)

    reconciler.SetError("failed")
    reconciler.SetSynced(false)

    reconciler.Observe()
recorder = record.NewFakeRecorder(1024)
replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

reconciler = &controllers.HPALicenseReconciler{
    Client:     fakeClient,
    Log:        logf.NullLogger{ },
    Recorder:   recorder,
    ReplicasCalculator: replicasCalculatorMock,
}

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:          v1.Register,
        LicenseType:     licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor:   &scalingFactor,
    },
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

deployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:      "ep",
        Namespace: defaultNs,
    },
    Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

hpa = &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{
        Name:   epHpaName,
        Namespace: defaultNs,
    },
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: initialHPAMaxReplicas,
    },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

AfterEach(func() {

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It("should skip if HPA does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})

It("should skip if HPA SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})

It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(initialHPAMaxReplicas, nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(initialHPAMaxReplicas, nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})
gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Spec.MinReplicas).Should(BeNil())
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas to 2 ]")))
}

It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  hpa.Spec.MaxReplicas = 10
  hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
  Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
  Expect(*hpa.Spec.MinReplicas).Should(Equal(int32(2)))
  Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas MinReplicas] to 2 ")))
})

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  smartLicense2 := &v1.SmartLicense{
    Spec: smartLicense.Spec,
  }
  Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())
  smartLicense3 := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
Spec:    smartLicense.Spec,
Status:  v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
}
Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2")))
}
})
})
---
apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  annotations:
    controller-gen.kubebuilder.io/version: v0.4.1
creationTimestamp: null
name: smartlicenses.sfcn.cisco.com
spec:
group: sfcn.cisco.com
names:
  kind: SmartLicense
  listKind: SmartLicenseList
  plural: smartlicenses
  singular: smartlicense
scope: Namespaced
versions:
- additionalPrinterColumns:
  - jsonPath: .metadata.creationTimestamp
    name: Age
    type: date
  - jsonPath: .status.registrationState
    name: Registration State
    type: string
  - jsonPath: .status.licenseState
    name: License State
    type: string
  - jsonPath: .status.licenseNumber
    name: License Number
    type: integer

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- jsonPath: .status.accountDomain
  name: Domain
  priority: 1
  type: string

- jsonPath: .status.accountName
  name: Account
  priority: 1
  type: string

name: v1

schema:

openAPIV3Schema:
  description: SmartLicense is the Schema for the smartlicenses API
  properties:
    apiVersion:
      description: 'APIVersion defines the versioned schema of this representation
          of an object. Servers should convert recognized schemas to the latest
          internal value, and may reject unrecognized values. More info:
          https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#resources'
      type: string
    kind:
      description: 'Kind is a string value representing the REST resource this
          object represents. Servers may infer this from the endpoint the client
          submits requests to. Cannot be updated. In CamelCase. More info:
          https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'
      type: string
    metadata:
      type: object
    spec:
      description: SmartLicenseSpec defines the desired state of SmartLicense
      properties:
        action:
          description: Action is the desired state of the Smart Agent license
          registration.
          enum:
            - REGISTER
            - DEREGISTER
          type: string
        licenseType:
          description: LicenseType defines the type of license to request/release,
              usually the SKU of the license. The default value is a SFW license
              tag being able to handle 1vCPU.
          type: string
        maxLicenseCount:
          description: MaxLicenseCount is an optional value, the maximum number
              of licenses SFCN can reserve for the product. The default value
              is equal to MinLicenseCount.
          format: int32
          type: integer
minLicenseCount:
  description: MinLicenseCount is a minimum number of licenses SFCN reserves for the product. The default value is 1.
  format: int32
  type: integer

scalingFactor:
  description: ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down. The default value is 1.
  format: int32
  type: integer

scalingRef:
  description: ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
  properties:
    apiVersion:
      description: API version of the referent
      type: string
    kind:
      description: 'Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds”
      type: string
    name:
      description: 'Name of the referent; More info: http://kubernetes.io/docs/user-guide/identifiers#names'
      type: string

  required:
    - kind
    - name
  type: object

tokenSecret:
  description: TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
  properties:
    name:
      description: Name is unique within a namespace to reference a secret resource.
      type: string
    namespace:
      description: Namespace defines the space within which the secret name must be unique.
      type: string

  required:
    - tokenSecret
  type: object

status:
  description: SmartLicenseStatus defines the observed state of SmartLicense
  properties:
accountDomain:
  description: AccountDomain is the account domain in Cisco Software Central.
  type: string
accountName:
  description: AccountName is the name of the virtual account in Cisco Software Central.
  type: string
contextId:
  description: ContextId is an internal identifier uniquely defining platform registration.
  type: string
coresPerLicense:
  description: CoresPerLicense is number of cores per one requested LicenseType.
  format: int32
  type: integer
errorReason:
  description: ErrorReason specifies the error due to which the SFCN product was not registered in Cisco Software Central.
  type: string
estimatedMaxReplicas:
  description: EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
  format: int32
  type: integer
exportControlled:
  description: ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
  type: boolean
licenseNumber:
  description: LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
  format: int32
  type: integer
licenseState:
  description: LicenseState is the state of the reserved licenses.
  enum:
  - PENDING
  - UNLICENSED
  - IN_COMPLIANCE
  - OUT_OF_COMPLIANCE
  - OVERAGE
  type: string
registrationState:
  description: RegistrationState is the registration status of the SFCN
product in Cisco Software Central.

enum:
- PENDING
- REGISTERED
- REGISTRATION_FAILED
- Deregistered
- Deregistration_FAILED

type: string

served: true
storage: true

subresources:
status: {}

status:
acceptedNames:
kind: ""
plural: ""
conditions: []
storedVersions: []

FROM dockerhub.cisco.com/asac-dev-docker/css-golang:v1.16 as builder

WORKDIR /workspace
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"]
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates/"]

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ../pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api/ api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
# disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13
WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot
USER nonroot
ENTRYPOINT ["manager"]
---
title: "Monitoring Status"
weight: 3
description: >
Learn how to monitor the ASA operational status and critical license events
---

### Smart License Status

When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
tokenSecret:
    name: ccssm-token
    namespace: cisco-systems
licenseType: 
minLicenseCount: 1
maxLicenseCount: 10
scalingRef:
  kind: Deployment
  name: sfcn-enforcer
status:
  accountDomain: InternalTestDemoAccount8.cisco.com
  accountName: asac-dev
```
### ASA Licensing State

The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are

- `AwaitingLicense` (Warning)
- `LicenseCommunicationFailed` (Warning)
- `LicenseGranted` (Normal)
- `LicenseVerified` (Normal)
- `LicenseRevoked` (Warning)

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.

When the ASA comes up successfully, the Manager tries to obtain a license for the [number of cores](#core-calculation). During this period, the Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For instance, when the ASA came up for the first time and operating at reduced throughput, this event would read something like

```markdown
Warning     AwaitingLicense     ASA operating at reduced throughput because it was not licensed, requesting for a new license
```

And, if the ASA came up and operating at full potential, then

```markdown
Warning     AwaitingLicense     ASA operating at full potential but not licensed, requesting for a new license
```

The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could not communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a `LicenseCommunicationFailed` warning event with the reasoning behind the failure.

```markdown
```
Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the license granted to it and on successful verification, emits a `LicenseVerified` event.

```
Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure
```

```
When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the license granted to it and on successful verification, emits a `LicenseVerified` event.

```
Normal LicenseGranted successfully obtained a license from the server
Normal LicenseVerified ASA operating at full potential, license status verified
```

It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the licenses have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale down the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager emits a `LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be granted a license, or it will be removed by Kubernetes because the controller scaled down the cluster.

```
Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license, retrying to acquire
```

### Unauthorized Requests

License requests may be granted by the License Server to any pod capable of requesting a licensing, however the License Controller sees a grant as authorized only if that pod belonged to a Deployment/HPA specified in one of the Smart License resources otherwise it considers that pod as unauthorized and takes action to delete that pod and set the number of replicas to 0 on its owners to prevent the Kubernetes from creating such pods. The License Controller will emit an event on the pod that was deleted specifying the reason behind it. It then releases the license back to the License Server after the pod is killed.

```
Warning PodDeleted Deleted Pod as it requested a license but does not belong to any licensed EP deployment. Please, check SmartLicense resources to update licensing configuration.
```

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```
Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license, retrying to acquire
```

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```
Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license, retrying to acquire
```

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```
Warning PodDeleted Deleted Pod as it requested a license but does not belong to any licensed EP deployment. Please, check SmartLicense resources to update licensing configuration.
```
This might happen when you have an Enforcer deployment but did not specify that Deployment in a Smart License resource in the same namespace. To remedy that, simply add a Smart License resource with the desired configuration and specify the Deployment of the Enforcer in it.

### Identifying Licensed Pods

All licensed Deployments specified via the Smart License resources, and their Pods that have been granted a license will include a label `sfcn.cisco.com/license-holder=true`. You should be able to use `kubectl` to list all the pods in a namespace that are having this label to identify the pods currently holding a license.

```go
import (  "context"  "errors"  "fmt"  "strconv"

v1 "css.cisco.com/kasa/license-broker/api/v1"  "css.cisco.com/kasa/license-broker/controllers"  "css.cisco.com/kasa/license-broker/controllers/mocks" licensing "css.cisco.com/licensing/client-agent"  "github.com/golang/mock/gomock"  . "github.com/onsi/ginkgo"  . "github.com/onsi/gomega" appsv1 "k8s.io/api/apps/v1" autoscalingv1 "k8s.io/api/autoscaling/v1" corev1 "k8s.io/api/core/v1" apiErrors "k8s.io/apimachinery/pkg/api/errors" metav1 "k8s.io/apimachinery/pkg/apis/meta/v1" "k8s.io/apimachinery/pkg/types" "k8s.io/client-go/kubernetes/scheme" "k8s.io/client-go/tools/record" ctrl "sigs.k8s.io/controller-runtime" "sigs.k8s.io/controller-runtime/pkg/client" "sigs.k8s.io/controller-runtime/pkg/client/fake" logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService

const (  epPodName = "epPod"  redirectorEpPodName = "redirectorEpPod"
)
defaultServiceRole = "default"
vpnRedirectorServiceRole = "vpnredirector"
deploymentName2 = "test-deployment-2"
secondDefaultEpDeploymentName = "secondDefaultEpDeployment"
redirectorEpDeploymentName = "vpnRedirectorEpDeployment"
initialRedirectorDeploymentReplicas int32 = 2
)

var controllerTrue = true

var _ = Describe("Pod License Controller Test", func() {

}

podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}

redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}
deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpDeploymentName}

var reconciler *controllers.PodLicenseReconciler
var fakeClient client.Client
var mockCtrl *gomock.Controller
var recorder *record.FakeRecorder

var licensingClient *mocks.MockLicensingClient
var allotmentService *mocks.MockAllotmentService

var pod *corev1.Pod
var deployment *appsv1.Deployment
var redirectorPod *corev1.Pod
var redirectorDeployment *appsv1.Deployment
var smartLicense *v1.SmartLicense

BeforeEach(func() {

}

pod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name: epPodName,
        Namespace: defaultNs,
        OwnerReferences: []metav1.OwnerReference{ {Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue}}},
    },
}

replicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name: "epReplicaSet",
        Namespace: defaultNs,
        OwnerReferences: []metav1.OwnerReference{ {Kind: "Deployment", Name: epDeploymentName, Controller:}
replicas := initialDeploymentReplicas

deployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:         epDeploymentName,
        Namespace:    defaultNs,
        Labels:       map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations:  map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

secondDefaultDeployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:         secondDefaultEpDeploymentName,
        Namespace:    defaultNs,
        Labels:       map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations:  map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

redirectorPod := &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name:         redirectorEpPodName,
        Namespace:    defaultNs,
        OwnerReferences: []metav1.OwnerReference{
            metav1.OwnerReference{Kind: "ReplicaSet", Name: "redirectorEpReplicaSet", Controller: &controllerTrue},
        },
    },
}

redirectorReplicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:         "redirectorEpReplicaSet",
        Namespace:    defaultNs,
        OwnerReferences: []metav1.OwnerReference{
            metav1.OwnerReference{Kind: "Deployment", Name: redirectorEpDeploymentName, Controller: &controllerTrue},
        },
    },
}

redirectorReplicas := initialRedirectorDeploymentReplicas

redirectorDeployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:         redirectorEpDeploymentName,
        Namespace:    defaultNs,
        Labels:       map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}
Annotations: map[string]string{
    controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
},
Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Registered,
    },
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(
    deployment, replicaSet, pod, secondDefaultDeployment,
    redirectorDeployment, redirectorReplicaSet, redirectorPod,
    smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()

reconciler = &controllers.PodLicenseReconciler{
    Client: fakeClient,
    LicensingClient: licensingClient,
    Log: logf.NullLogger{},
    Recorder: recorder,
}

AfterEach(func() {
    mockCtrl.Finish()
})

It("should add the licensing label for licensed pod", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
    Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
})
It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
  Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

  smartLicense.Status.RegistrationState = v1.Deregistered
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name:
    epDeploymentName}, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
})

It("should ensure one replica per service role without SmartLicense", func() {
  // initiate reconcile for the pod which is part of deployment with vpnredirector service role and without smart license
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
  Expect(err).To(BeNil())

  // expect the deployment to be scaled to 1 and mark it as trial license holder
  redirDeployment := appsv1.Deployment{}
  Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
  Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))
  Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
  Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
  Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

  // create another deployment with vpnredirector role
  redirectorEpPodName2 := "redirectorEpPod2"
  redirectorEpDeploymentName2 := "redirectorEpDeployment2"
  replicaSetName2 := "redirectorEpReplicaSet2"
  redirectorPod2 := &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
      Name:            redirectorEpPodName2,
      Namespace:       defaultNs,
      OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller:
        &controllerTrue}},
    },
  }
  Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
  redirectorReplicaSet2 := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
      Name: redirectorEpPodName2,
      Namespace:   defaultNs,
      OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller:
        &controllerTrue}},
    },
  }
  Expect(fakeClient.Get(context.TODO(), redirectorReplicaSetName2, &redirectorReplicaSet2)).To(Succeed())
})
Name: replicaSetName2,
Namespace: defaultNs,
OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName2, Controller: &controllerTrue}}

Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
initialRedirector2Replicas := int32(3)
redirectorDeployment2 := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        redirectorEpDeploymentName2,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &initialRedirector2Replicas},
}
Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

// initiate reconcile for the pod which is part of another deployment with vpnredirector service role and without
// smart license
redirector2PodNsName := types.NamespacedName{Name: redirectorEpPodName2, Namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirector2PodNsName.String()}).Return(nil, nil)
_, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
Expect(err).To(BeNil())

// expect the second vpnredirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2, Namespace: defaultNs}, &redirDeployment2)).To(Succeed())
Expect(*redirDeployment2.Spec.Replicas).Should(Equal(int32(0)))
Expect(redirDeployment2.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(redirDeployment2.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment2.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirector2Replicas))))
}

Context("on pod removal", func() {

    It("should release licensing allotments", func() {
        Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    })
})
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

It("should requeue request if failed to release licensing allotments", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
    ContextId: "fooBar",
    Tenant:    &licensing.Tenant{Name: podNsName.String()},
  }).Return(errors.New("failed to release allotments"))

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(HaveOccurred())
})

It("should not release licensing allotments if tenant is not registered", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when NumCores is 0", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

Context("for pod without corresponding SmartLicense", func() {
It("should remove pod if not belong to any deployment", func() {
    pod.OwnerReferences = nil
    Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
}

err = fakeClient.Get(context.TODO(), podNsName, pod)
Expect(err).NotTo(BeNil())
Expect(apiErrors.IsNotFound(err)).To(BeTrue())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license but does not belong to any Deployment")))
})

It("should scale down pod's deployment", func() {
    smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})

Context("without SmartLicense resources", func() {
    BeforeEach(func() {
        Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    })

    It("should scale down Deployment to 1 Replica and mark as trial", func() {
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)
        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())
        Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    })
})
Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
}

It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func()
{
    var replicaCount int32 = 4
    var expectedInitialReplicasNumber int32 = 4

    createDeployment := func(name string, role string) *appsv1.Deployment {

        pod := &corev1.Pod{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("pod-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: fmt.Sprintf("rs-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

        replicaSet := &appsv1.ReplicaSet{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("rs-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

        deployment := &appsv1.Deployment{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("deployment-%s", name),
                Namespace: defaultNs,
                Labels: map[string]string{controllers.ServiceRoleLabel: role},
                Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
            },
            Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
        }
        Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

        podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
        allocationService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
Expect(err).To(BeNil())

return deployment
}

deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", "")

assertScaledDown := func(d *appsv1.Deployment) {
  Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: d.Namespace, Name: d.Name}, d)).To(Succeed())
  Expect(*d.Spec.Replicas).Should(Equal(int32(0)))
  Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
  Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
  Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(expectedInitialReplicasNumber))))
}
assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
}

It("should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist", func() {
  deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
  var replicaCount int32 = 1
  pod2 := &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
      Name: "deployment-test-2",
      Namespace: defaultNs,
      OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue}},
    },
  }
  Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())
replicaSet2 := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "epReplicaSet2",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: deploymentName2, Controller: &controllerTrue}}
    },
}
Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())

deployment2 := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        deploymentName2,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: "new-service-role"},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}
Expect(fakeClient.Create(context.TODO(), deployment2)).To(Succeed())

pod2NsName := types.NamespacedName{Namespace: defaultNs, Name: "deployment-test-2"}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: pod2NsName.String(), Attributes: pod.Labels}).Return(nil, nil)
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: pod2NsName})
Expect(err).To(BeNil())

deployment2Ns := types.NamespacedName{Namespace: defaultNs, Name: deploymentName2}
Expect(fakeClient.Get(context.TODO(), deployment2Ns, deployment2)).To(Succeed())
Expect(*deployment2.Spec.Replicas).Should(Equal(int32(1)))
Expect(deployment2.Labels).Should(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(recorder.Events).ShouldNot(HaveLen(1))
}
})
})
})
# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.
global:
    platform: $platform
    imageCredentials:
        # the url to the docker registry, for example dockerhub.cisco.com
        registry: $registry
        artifactoryRepo: $artifactoryRepo
        apiGroup: sfcn.cisco.com
        fullNamePrefix: sfcn-license-
# Docker image for the controller that manages licensing CRDs and their reconciliation
controllerImage: $controllerImage

# Docker image for the server-agent license server
licenseServerImage: $licenseServerImage

# licenseServerPort is the port where the server-agent license server is listening for requests
licenseServerPort: 17051

# licenseServerTransportUrl is the http transport to make use of to connect to CSSM
licenseServerTransportUrl: $licenseServerTransportUrl

# Default image policy that is used by all pod containers unless being explicitly overwritten
defaultImagePullPolicy: $defaultImagePullPolicy

# log verbosity
logLevel: $logLevel

# zap log encoder
# options: console, json
logFormat: $logFormat

# managerMemoryRequest specifies the amount of memory to allocate per request for manager container
managerMemoryRequest: "20Mi"

# managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
managerCoreRequest: "100m"

# managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
managerMemoryLimit: "100Mi"

# managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
managerCoreLimit: "100m"

# metricsPort is the port the metric endpoint binds to
metricsPort: 17080

# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"

# licenseServerXms specifies the amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory
licenseServerXms: "128M"

# licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container
licenseServerCoreRequest: "100m"

# licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container
licenseServerMemoryLimit: "768Mi"

# licenseServerXmx specifies the maximum amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory
licenseServerXmx: "512M"

# licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container
licenseServerCoreLimit: "300m"

# licenseServerStorage specifies the persistent volume size to use for storing licensing data
licenseServerStorage: "1Gi"

# disktype for dynamic azure disk storage on azure platform
# options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
azureDiskStorageAccountType: "Standard_LRS"
package listeners

import {
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  licensing "css.cisco.com/licensing/client-agent"
  licensingProto "css.cisco.com/licensing/client-agent/proto"
  "fmt"
  "github.com/go-logr/logr"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/types"
  "sigs.k8s.io/controller-runtime/pkg/client"
}

type EntitlementListener struct {
  Log      logr.Logger
  Client   client.Client
  LicenseNsName types.NamespacedName
}

func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
  log := l.Log.WithValues("smartlicense", l.LicenseNsName)
  log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)

  if err := l.processEvent(event); err != nil {
    log.Error(err, "failed to process entitlement event")
    return
  }
}
func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()

    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense", l.LicenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }

    originalLicense := license.DeepCopy()

    switch event.Type {
    case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
        license.Status.LicenseState = v1.OutOfCompliance
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
        license.Status.LicenseState = v1.Unlicensed
        license.Status.EstimatedMaxReplicas = 0
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
        license.Status.LicenseState = v1.InCompliance
    default:
        return fmt.Errorf("unknown event type: %s", event.Type.String())
    }

    license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
    license.Status.LicenseNumber = uint32(event.EntitlementNumber)

    // using patch to avoid conflict errors caused by version mismatch and optimistic lock
    // as events from the server have the latest data, it is admissible to overwrite status without version check
    if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
        return fmt.Errorf("failed to patch SmartLicense status: %w", err)
    }

    return nil
}

package handlers_test

import {
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
}
const (  
defaultNamespace = "default"  
smartLicenseName = "smart-license"  
deploymentName = "ep-deployment"  
deploymentName2 = "ep-deployment2"  
hpaName = "ep-hpa"  
hpaName2 = "ep-hpa2"  
)  

var _ = Describe("DeploymentHandler", func() {  
var handler EventHandler  
var mockCtrl *gomock.Controller  
var mockQueue *mocks.MockRateLimitingInterface  

BeforeEach(func() {  
mockCtrl = gomock.NewController(GinkgoT())  
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)  
handler = handlers.DeploymentHandler()  
})  

AfterEach(func() {  
mockCtrl.Finish()  
})  

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {  
mockQueue.EXPECT().Add(reconcile.Request{  
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},  
})  

handler.Create(event.CreateEvent{  
Object: &v1.SmartLicense{  
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},  
Spec: v1.SmartLicenseSpec{  
},  
},  
}, mockQueue)  
})  

It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {
handler.Create(event.CreateEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)
})

It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
    })
}
}

handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
    ObjectNew: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
}
}

handler.Delete(event.DeleteEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)
})
var _ = Describe("HPAHandler", func() {
    var handler EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface

   BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
        handler = handlers.HPAHandler()
    })

    AfterEach(func() {
        mockCtrl.Finish()
    })

    It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
        mockQueue.EXPECT().Add(reconcile.Request{
            NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
        },
        ),
        ],
        ], mockQueue)
    })

    It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
        handler.Create(event.CreateEvent{
            Object: &v1.SmartLicense{
                ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
                Spec: v1.SmartLicenseSpec{
                },
            },
        }, mockQueue)
    })

    It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
        mockQueue.EXPECT().Add(reconcile.Request{
            NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
        })
    })
})
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
}

handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
       .Spec: v1.SmartLicenseSpec{
        },
       .Spec: v1.SmartLicenseSpec{
        },
    },
   .mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with HPA kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
       .NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })

handler.Delete(event.DeleteEvent{
    Object: &v1.SmartLicense{
       .Spec: v1.SmartLicenseSpec{
        },
       .Spec: v1.SmartLicenseSpec{
        },
    },
   .mockQueue)
})

package handlers

import {
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "k8s.io/apimachinery/pkg/types"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/handler"
}

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface
var log = ctrl.Log.WithName("handlers").WithName("SmartLicense")

// DeploymentHandler handles SmartLicense changes and queues up events for the Deployment that the
// SmartLicense manages.
func DeploymentHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.DeploymentKind)
}

// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.HPAKind)
}

func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
    return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
        smartLicense, ok := obj.(*v1.SmartLicense)
        if !ok {
            log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
            return []ctrl.Request{}
        }
        if smartLicense.Spec.ScalingRef.Kind != scalingRefKind {
            return []ctrl.Request{}
        }
        return []ctrl.Request{{NamespacedName: types.NamespacedName{
            Namespace: smartLicense.Namespace,
            Name:      smartLicense.Spec.ScalingRef.Name,
        }}}
    })
}

package v1

import (
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
)
const (  
  RetryDuration = 15 * time.Second  
  MaxWaitingDuration = 5 * time.Minute  
  MaxRetryAttempts = int(MaxWaitingDuration / RetryDuration)  
  LicenseCmd = "show license feature"  
  UnlicensedResponse = "Licensing Status : Unlicensed"  
  LicensedResponse = "Licensing Status : Licensed"
)

type licenseEvent int

const (  
  Revoked licenseEvent = iota + 1  
  Awaiting  
  Granted  
  Verified  
  CommunicationFailed
)

func (l licenseEvent) reasonCode() string {  
  switch l {  
    case Revoked:  
      return "LicenseRevoked"  
    case Awaiting:  
      return "AwaitingLicense"  
    case Granted:  
      return "LicenseGranted"  
    case Verified:  
      return "LicenseVerified"  
    case CommunicationFailed:  
      return "LicenseCommunicationFailed"
  }  
  return "LicenseActivity"
}

func (l licenseEvent) eventType() string {  
  switch l {  
    case

case Awaiting, Revoked, CommunicationFailed:
    return coreV1.EventTypeWarning
default:
    return coreV1.EventTypeNormal
}
}

type SmartLicenseReconciler struct {
    Log                logr.Logger
    CoreClient         *coreV1Client.CoreV1Client
    Licenser           lca.LicensingClient
    Dispatcher         dispatcher.GatewayClient
    Recorder           record.EventRecorder
    tenant             *lca.Tenant
    numRetriedAttempts int
    allotment          *lca.AllotmentRequestStatus // needed to report the allotment held to server on request
    requiredNumCores   uint32
    isRegistered       bool
    lastRecordedEvent  licenseEvent // needed to avoid reporting the same event repeatedly
    notificationChan   chan event.GenericEvent
}

func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher) *SmartLicenseReconciler {
    s.notificationChan = make(chan event.GenericEvent)
    lsp.AddListener(s)
    return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
    pod := &coreV1.Pod{
    }
    s.Log.Info("lina (re)started, initiating license reconciliation")
    s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    podName := os.Getenv("POD_NAME")
    podNamespace := os.Getenv("POD_NAMESPACE")
    return ctrl.NewControllerManagedBy(mgr).
        Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{}).
        For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{
            Name:      podName,
            Namespace: podNamespace,
        })).Complete(s)
}
// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list

func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result, error) {
    s.Log.Info("reconciling license status", "pod", request)
    errResult := reconcile.Result{RequeueAfter: RetryDuration}
    pod, err := s.CoreClient.Pods().Get(request.NamespacedName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NamespacedName)
        return errResult, err
    }
    s.lastRecordedEvent = 0
    licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
    if err != nil {
        s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
        return errResult, nil
    }
    if strings.Contains(licenseResponse, LicensedResponse) {
        s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
        s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
    } else if strings.Contains(licenseResponse, UnlicensedResponse) {
        s.recordEvent(pod, Awaiting,
                "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
    }

    if pod.DeletionTimestamp == nil {
        s.computeRequiredNumCores(pod)
        // (re)register with the license server
        err := s.registerTenantWithLicenseServer(pod)
        if err != nil {
            return errResult, nil
        }
        // registration successful, fetch or request allotment of this tenant
        err = s.syncAllotmentStatus(pod)
        if err != nil {
            return errResult, nil
        }
        err = s.grantASAcLicenseToOperate(pod)
        if err != nil {
            return errResult, nil
        }
        } else {
        err := s.releaseAllotment()
        if err != nil {
            s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
            return errResult, nil
        }
    }
}
return reconcile.Result{}, nil
}

func (s *SmartLicenseReconciler) recordEvent(pod *corev1.Pod, event licenseEvent, description string) {
    if s.lastRecordedEvent != event || event == Verified { // always record verified events
        s.lastRecordedEvent = event
    }
    s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
}

func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *corev1.Pod) {
    requiredCoresQuantity := resource.MustParse("0")
    var containerCores = make(map[string]string)
    for _, container := range pod.Spec.Containers {
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container", container.Name)
            if err != nil {
                s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
                // continue further to compute other containers
                continue
            }
            // set the required core quantities directly to the capacity of the node
            requiredCoresQuantity = *node.Status.Capacity.Cpu()
            break
        }
        requiredCoresQuantity.Add(containerLimit)
    }
    s.requiredNumCores = uint32(requiredCoresQuantity.Value())
    if len(pod.Spec.Containers) == len(containerCores) {
        s.Log.Info("computed resources usage", "cpu", containerCores)
    }
    s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
}

func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *corev1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}.String(), Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            s.numRetriedAttempts = s.numRetriedAttempts + 1
        }
    }
}

---

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if s.numRetriedAttempts > MaxRetryAttempts {
    s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, " +
        "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
    s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
        communication failure (%s), " +
        "retrying communication", err.Error()))
    _ = s.revokeASAcLicenseAndRetry()
    return err
}

s.Log.Info(fmt.Sprintf("failed to register with licensing server, will retry (reason: %s)", err.Error()),
    "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
return err
}
s.recordEvent(pod, Awaiting, "successfully registered the ASA with license server, awaiting a license")
s.isRegistered = true
return nil
}

func (s *SmartLicenseReconciler) revokeASAcLicenseAndRetry() error {
    reason, err := s.Dispatcher.RevokeLicense()
    if err != nil {
        s.Log.Error(err, "failed to revoke license")
        return err
    }
    if reason != "" {
        err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
        return err
    }
    s.Log.Info("successfully revoked ASAc license")
    s.numRetriedAttempts = 0
    return nil
}

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *coreV1.Pod) error {
    allotmentStatus, err := s.Licenser.Allotment().Status(s.tenant)
    if err != nil {
        if errors.Is(err, lca.ErrLicenseServerUnavailable) {
            s.Log.Info("licensing server is unavailable, unregistering the tenant")
            s.isRegistered = false
        }
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, " +
                "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
                communication failure (%s), " +
                "retrying communication", err.Error()))
        }
        return err
    }
    return nil
}
if allotmentStatus == nil {
  s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
  // no allotment was made to this tenant, requesting one
  allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
    PoolName: pod.Namespace,
    Tenant:   s.tenant,
    NumCores: s.requiredNumCores,
  })
  if err != nil {
    s.numRetriedAttempts = s.numRetriedAttempts + 1
    if s.numRetriedAttempts > MaxRetryAttempts {
      s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
        "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
      s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to
        obtain a license (%s), "+
        "retrying the operation", err.Error()))
      _ = s.revokeASAcLicenseAndRetry()
      return err
    }
    s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
      "numAttempt", s.numRetriedAttempts)
    return err
  }
  s.Log.Info(fmt.Sprintf("successfully leased an allotment from the licensing server")
  s.recordEvent(pod, Granted, "successfully obtained a license from the server")
  s.allotment = allotment
} else {
  s.allotment = allotmentStatus
}

func (s *SmartLicenseReconciler) grantASAcLicenseToOperate(pod *corev1.Pod) error {
  if s.allotment != nil {
    s.Log.Info("license status verified, communicating the status to ASA")
    s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
    reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
    if err != nil {
      s.Log.Info(fmt.Sprintf("failed to grant license to ASA, will retry (reason: %s)", err.Error()),
        "reason", reason)
      s.numRetriedAttempts = s.numRetriedAttempts + 1
      if s.numRetriedAttempts > MaxRetryAttempts {
        s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
          "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
        s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to
          obtain a license (%s), "+
          "retrying the operation", err.Error()))
        _ = s.revokeASAcLicenseAndRetry()
        return err
      }
      s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
        "numAttempt", s.numRetriedAttempts)
      return err
    }
    s.Log.Info(fmt.Sprintf("successfully granted the license")
    s.recordEvent(pod, Granted, "successfully obtained a license from the server")
    s.allotment = s.allotment
    return nil
  }

  return err
}
if err != nil {
    s.Log.Error(err, "failed to grant license")
    return err
}
if reason != "" {
    err = fmt.Errorf("ASAc failed to set license : %v", reason)
    return err
}
s.numRetriedAttempts = 0
s.Log.Info("successfully granted license to ASA")
} else {
    s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")
}
return nil
}

func (s *SmartLicenseReconciler) releaseAllotment() error {
    _ = s.revokeASAcLicenseAndRetry()
    if s.allotment != nil {
        err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
            ContextId: s.allotment.ContextId,
            Tenant:    s.tenant,
        })
        if err != nil {
            s.Log.Error(err, "failed to release the allotment to server")
            return err
        }
        s.allotment = nil
    }
    return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
    podName := types.NamespacedName{
        Namespace: os.Getenv("POD_NAMESPACE"),
        Name:      os.Getenv("POD_NAME"),
    }
    pod, err := s.CoreClient.Pods().Get(podName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
    }
    switch event.Type {
    case proto.AllotmentEvent_RELEASE_ALLOTMENT:
        s.Log.Info("license requested to be released by the server, un-licensing ASA")
        if err == nil {
            s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying to acquire")
        }
_ = s.releaseAllotment()

case proto.AllotmentEvent_REPORT_ALLOTMENT:
s.Log.Info("license requested to be reported to the server")
_ = s.reportAllotment()
}
}

func (s *SmartLicenseReconciler) reportAllotment() error {
allotment := &lca.AllotmentReport{ContextId: "", Tenant: s.tenant, NumCores: 0}
if s.allotment != nil {
}
err := s.Licenser.Allotment().ReportAllotment(allotment)
if err != nil {
    s.Log.Error(err, "failed to report the allotment to server")
}
return err
}

// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import (
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
    time "time"
)

// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl     *gomock.Controller
    recorder *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
}

// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}
// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}

// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
}

// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add", reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}

// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T-helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddRateLimited", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
func (m *MockRateLimitingInterface) Done(arg0 interface{}) {
    m.ctrl.T.Helper()
m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
func (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Done",
    reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}

// Forget mocks base method
func (m *MockRateLimitingInterface) Forget(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
func (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Forget",
    reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
func (m *MockRateLimitingInterface) Get() (interface{}, bool) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Get")
    ret0, _ := ret[0].(interface{})
    ret1, _ := ret[1].(bool)
    return ret0, ret1
}

// Get indicates an expected call of Get
func (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Get",
    reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Len")
    ret0, _ := ret[0].(int)
    return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}

// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "NumRequeues", arg0)
    ret0, _ := ret[0].(int)
    return ret0
}

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
}

// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}

// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShuttingDown))
}
apiVersion: v1
kind: Secret
metadata:
  name: cssm-token
  namespace: sfcn-system
stringData:
  # this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
token: "NGVmN2EwNjctMzRhZS00M2ZkLTkyODktYjImMjBmNThiNjJkLTETZDgyMTIx%0AOTU2NjF8UnBHL3NzTUU5S1daeDJiSmNBYStBMTVvK05qQlBzTHJJSkk0TE9r%0ARUg4WT0%3D%0A"
---
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: sfcn-system
spec:
  action: "REGISTER"
tokenSecret:
  name: cssm-token
  namespace: sfcn-system
  minLicenseCount: 1
  maxLicenseCount: 12
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
FROM gcr.io/distroless/java-debian10:nonroot
WORKDIR /
COPY license-broker/bin/sa-server-all.jar sa-server-all.jar
ENTRYPOINT ["java", ":-jar", "sa-server-all.jar"]
package listeners_test
import (  
  v1 "css.cisco.com/kasa/license-broker/api/v1"  
  "k8s.io/client-go/kubernetes/scheme"  
  "testing"
  . "github.com/onsi/ginkgo"  
  . "github.com/onsi/gomega"
)
const (  
  smartLicenseName = "license-sample"  
  defaultNs = "default"  
  licenseType = "L-ASAV10S-STD"  
)
func TestListeners(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Listeners Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: smartlicense-redirector
  namespace: sfcn-system
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: sfcn-system
  minLicenseCount: 1
  maxLicenseCount: 4
  scalingRef:
    kind: Deployment
    name: sfcn-vpnredirector-enforcer
package listeners_test

import (
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensingProto "css.cisco.com/licensing/client-agent/proto"
  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/client/fake"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const ( epDeploymentName = "epDeployment" entitlementNumber = 4 coresPerLicenseType = 2
var _ = Describe("Entitlement Listener Test", func() {

licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

var listener *listeners.EntitlementListener
var fakeClient client.Client
var smartLicense *v1.SmartLicense

BeforeEach(func() {
    var defaultLicenseCount uint32 = 1
    var maxLicenseCount uint32 = 3
    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1.SmartLicenseSpec{
            Action: v1.Register,
            LicenseType: licenseType,
            MinLicenseCount: &defaultLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor: &defaultLicenseCount,
        },
    }
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()

    listener = &listeners.EntitlementListener{
        Log: logf.NullLogger{},
        Client: fakeClient,
        LicenseNsName: licenseNsName,
    }
})

It("should update license status on OUT_OF_COMPLIANCE event", func() {
    event := licensingProto.EntitlementEvent{
        Type: licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
        Message: "entitlement is out of compliance",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})
It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
    event := licensingProto.EntitlementEvent{
        Type:    licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
        Message: "granted new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:    licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
        Message: "failed to reserve a new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

/*******************************************************************************
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* Unauthorized redistribution prohibited.
*******************************************************************************/

package v1

import (  
    "context"
    "fmt"
    appsv1 "k8s.io/api/apps/v1"
// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac89-96bb5a8def84"

var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1

// log is for logging in this package.
var smartlicenselog = logf.Log.WithName("smartlicense-resource")
var webhookClient client.Client

func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {
    webhookClient = mgr.GetClient()
    return ctrl.NewWebhookManagedBy(mgr).
        For(r).
        Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io

var _ webhook.Defaulter = &SmartLicense{}

// Default implements webhook.Defaulter so a webhook will be registered for the type
func (r *SmartLicense) Default() {
    log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)

    if r.Spec.Action == "" {
        r.Spec.Action = Register
    }
    if r.Spec.LicenseType == "" {
        r.Spec.LicenseType = SFWLicenceTag
    }
    if r.Spec.MinLicenseCount == nil {
        r.Spec.MinLicenseCount = &defaultMinLicenseCount
    }
if r.Spec.MaxLicenseCount == nil {
    r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
}

if r.Spec.ScalingFactor == nil {
    r.Spec.ScalingFactor = &defaultScalingFactor
}

log.V(1).Info("updated SmartLicense default values")

// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io

var _ webhook.Validator = &SmartLicense{}

// ValidateCreate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateCreate() error {
    smartlicenselog.V(1).Info("validate create", "name", r.Name)

    var allErrs field.ErrorList
    r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.ScalingFactor, "scalingFactor", &allErrs)
    r.requireRegisterAction(&allErrs)
    r.validateLicenseCount(&allErrs)
    r.validateToken(&allErrs)
    r.validateScalingRef(&allErrs)

    if len(allErrs) == 0 {
        return nil
    }

    return allErrs.ToAggregate()
}

// ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
    smartlicenselog.V(1).Info("validate update", "name", r.Name)

    var allErrs field.ErrorList
    r.validateLicenseCount(&allErrs)

    // avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
    if r.GetDeletionTimestamp() == nil {
        r.validateToken(&allErrs)
        r.validateScalingRef(&allErrs)
    }
}
oldObj := old.(*SmartLicense)
r.requireNoLicenseTypeChange(&allErrs, oldObj)

if len(allErrs) == 0 {
    return nil
}
return allErrs.ToAggregate()

// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}

func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
    if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
        *errs = append(*errs,
            field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
    }
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")
    if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount <
        *r.Spec.MinLicenseCount {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum
            license count"))
    }
}

func (r *SmartLicense) validateToken(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("tokenSecret")
    secret := &v1.Secret{}
    if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "token secret is not found"))
        } else {
            *errs = append(*errs, field.Invalid(path, secret.Data, "token secret is invalid"))
        }
    }
}
return
} else {
*errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
return
}

if len(secret.Data[TokenKeyName]) == 0 {
*errs = append(*errs, field.Required(path.Child("data").Child(TokenKeyName), "cannot be empty"))
}

func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
path := field.NewPath("spec").Child("scalingRef")

if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == "" {
*errs = append(*errs, field.Required(path, "kind or name of referenced object cannot be empty"))
return
}

key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
var obj client.Object
switch r.Spec.ScalingRef.Kind {
case DeploymentKind:
obj = &appsv1.Deployment{
}

case HPAKind:
obj = &autoscalingv1.HorizontalPodAutoscaler{
}

default:
return
}

if err := webhookClient.Get(context.TODO(), key, obj); err != nil {
if errors.IsNotFound(err) {
*errs = append(*errs, field.Required(path, "referenced object is not found"))
return
} else {
*errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: %w", err)))
return
}

}

func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
if val == nil || *val < min {
path := field.NewPath("spec").Child(path)
*errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to %d", min)))
}
package mocks

import (
    "css.cisco.com/kasa/license-broker/api/v1"
    "github.com/golang/mock/gomock"
    "k8s.io/api/apps/v1"
    "reflect"
)

// MockReplicasCalculator is a mock of ReplicasCalculator interface
type MockReplicasCalculator struct {
    ctrl     *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}

// MockReplicasCalculatorMockRecorder is the mock recorder for MockReplicasCalculator
type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

// NewMockReplicasCalculator creates a new mock instance
func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

// CalculateMaxLicensedReplicas mocks base method
func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1 *v10.Deployment) (int32, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
    ret0, _ := ret[0].(int32)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "CalculateMaxLicensedReplicas",
        reflect.TypeOf((*MockReplicasCalculator)(nil).CalculateMaxLicensedReplicas), arg0, arg1)
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import (
    clientagent "css.cisco.com/licensing/client-agent"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
    ctrl     *gomock.Controller
    recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
    mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
    mock := &MockLicensingClient{ctrl: ctrl}
    mock.recorder = &MockLicensingClientMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
    return m.recorder
}

// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Allotment")
    ret0, _ := ret[0].(clientagent.AllotmentService)
    return ret0
}
// Allotment indicates an expected call of Allotment
func (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Allotment",
reflect.TypeOf((*MockLicensingClient)(nil).Allotment))
}

// Entitlement mocks base method
func (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Entitlement")
ret0, _ := ret[0].(clientagent.EntitlementService)
return ret0
}

// Entitlement indicates an expected call of Entitlement
func (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
mock.ctrl.T.Helper()
return mock.ctrl.RecordCallWithMethodType(mock.ctrl, "Entitlement",
reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
func (m *MockLicensingClient) Registration() clientagent.RegistrationService {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Registration")
ret0, _ := ret[0].(clientagent.RegistrationService)
return ret0
}

// Subscription mocks base method
func (m *MockLicensingClient) Subscription() clientagent.SubscriptionService {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Subscription")
ret0, _ := ret[0].(clientagent.SubscriptionService)
return ret0
}

// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {

---

Open Source Used In kASA v1.5 3733
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
reflect.TypeOf((*MockLicensingClient)(nil).Subscription))
}

package services_test

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/services"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

cost (  
    smartLicenseName = "license-sample"
    defaultNs = "default"
    licenseType = "L-ASAV10S-STD"
)

var (  
    minLicenseCount uint32 = 1
    maxLicenseCount uint32 = 5
    scalingFactor uint32 = 2
)

var _ = Describe("ReplicasCalculator Service Test", func() {  
    var (  
        deployment *appsv1.Deployment
        licenses []v1.SmartLicense
        fakeClient client.Client
        replicasCalculator *services.ReplicasCalculator
        smartLicense v1.SmartLicense
        node *corev1.Node
    )

    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}
    BeforeEach(func() {  

licenses := []v1.SmartLicense{}
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
replicasCalculator = services.NewReplicasCalculator(fakeClient, logf_NullLogger{})

var replicaCount int32 = 1
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},
    Spec: appsv1.DeploymentSpec{
        Replicas: &replicaCount,
        Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},
        Template: corev1.PodTemplateSpec{
                Name: "ep-container",
                Resources: corev1.ResourceRequirements{
                    Limits: map[corev1.ResourceName]resource.Quantity{
                        "cpu": resource.MustParse("2000m"),
                    },
                },
            },
        },
    },
    Status: appsv1.DeploymentStatus{ReadyReplicas: replicaCount},
}

pod := &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name: "ep-pod",
        Namespace: defaultNs,
        Labels: map[string]string{"role": "enforcer"},
    },
    Spec: corev1.PodSpec{NodeName: "ep-node"},
} Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

node = &corev1.Node{
    ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
} Expect(fakeClient.Create(context.TODO(), node)).To(Succeed())

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

smartLicense = v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
Action:  v1.Register,
LicenseType:  licenseType,
MinLicenseCount:  &minLicenseCount,
MaxLicenseCount:  &maxLicenseCount,
ScalingFactor:  &scalingFactor,
)
Expect(fakeClient.Create(context.TODO(), &smartLicense)).To(Succeed())
})

AfterEach(func() {
Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Pod{})).To(Succeed())
Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Node{})).To(Succeed())
Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
})

It("should return default value because license state is not in compliance", func() {
smartLicense.Status.LicenseState = v1.OutOfCompliance
Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())
licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(2)))
Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should calculate max limits based on 2 smart licenses", func() {
smartLicense2 := v1.SmartLicense{
Spec: v1.SmartLicenseSpec{
Action:  v1.Register,
LicenseType:  licenseType,
MinLicenseCount:  &minLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,
Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance, CoresPerLicense: 1},

Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
licenses = append(licenses, smartLicense2, smartLicense)

maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(4)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense2)).ShouldNot(HaveOccurred())
Expect(smartLicense2.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))

It("should look at node limits if pod containers do not have limits defined", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))

})

It("should return default value if pod containers do not have limits defined and deployment ready replicas is 0", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    deployment.Status.ReadyReplicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(*deployment.Spec.Replicas))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))

})
It("should return default value if there is no node defined in pod spec", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{}
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  Expect(fakeClient.Delete(context.TODO(), node)).To(Succeed())

  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).Should(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
  Expect(maxReplicas).Should(Equal(int32(0)))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

{{ include "aegis.configmap.standard" (list . "config" "kasa.licensebroker.config") }}
---
{{- define "kasa.licensebroker.config" -}}
{{- $ := first . -}}
{{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") -}}
{{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName -}}
apiVersion: v1
dkind: ConfigMap
data:
  server-id.json: |
  |
  "name": "{{ $licenseServerName }}",
  "hostname": "{{ $hostname }}",
  {{/* Empty string hides an IP address from being visible on CSSM */)}}</
  "ipAddress": "",
  "productId": "SFW",
  "softwareTag": "regid.2021-01.com.cisco.SFW,1.0_6f4891e2-97a4-443b-ad9a-9675b85b504f",
  {{/* Serial number must consist of 11 upper-case letters according to CSSM */)}}</
  "serialNumber": "{{ $hostname | sha256sum | trunc 11 | upper }}",
  "storagePath": "/home/nonroot/licensing/{{ $.Release.Namespace }}",
  "transportHttpUrl": "{{ $.Values.licenseServerTransportUrl }}"
}
{{- end -}}
package controllers

import {
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/handlers"
  "css.cisco.com/kasa/pkg/predicates"
type HPALicenseReconciler struct {
    client.Client
    Log                logr.Logger
    Recorder           record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(&predicates.LabelExistsPredicate{Key: LicenseHolderLabel})).
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).
        Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    hpa := &autoscalingv1.HorizontalPodAutoscaler{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("HPA does not exist, nothing to reconcile")
            return ctrl.Result{}, client.IgnoreNotFound(err)
        } else {
            return ctrl.Result{}, err
        }
    }

    // ...
licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}
registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
hpaLicenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpaLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)
    }
    log.Info("updated HPA labels")
}

if len(hpaLicenses) == 0 {
    log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(hpaLicenses) {
    log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")
    return ctrl.Result{}, nil
}

    log.Info("scaled resource is not deployment")
    return ctrl.Result{}, nil
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)
if err != nil {
    return ctrl.Result{}, err
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpaLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

if hpa.Spec.MaxReplicas > maxLicensedReplicas {
    hpa.Spec.MaxReplicas = maxLicensedReplicas
}

changedFields := []string{"MaxReplicas"}
    changedFields = append(changedFields, "MinReplicas")
}

if err = c.Client.Update(context.Background(), hpa); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update HPA resource: %w", err)
}

c.Recorder.Event(hpa, corev1.EventTypeWarning, "HPAScaledDown", fmt.Sprintf("Decreased HPA's %s to %d as it is the maximum EP replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", changedFields, maxLicensedReplicas))
log.Info(fmt.Sprintf("successfully decreased HPA's %s to max license limit", changedFields), "updatedHPAMaxReplicas", hpa.Spec.MaxReplicas)
return ctrl.Result{}, nil
}
log.Info("skipping HPA update, system has enough licenses to have all HPA's MaxReplicas running", "hpaMaxReplicas", hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa *autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
    deploymentName := hpa.Spec.ScaleTargetRef.Name
    deployment := &appsv1.Deployment{}
    if err != nil {
        return nil, err
    }
    return deployment, err
}

---

apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
  creationTimestamp: null
  name: mutating-webhook-configuration
webhooks:
- admissionReviewVersions:
  - v1
  clientConfig:
    service:
      name: webhook-service
      namespace: system
      path: /mutate-sfcn-cisco-com-v1-smartlicense
  failurePolicy: Fail
  name: msmartlicense.kb.io
rules:
- apiGroups:
  - sfcn.cisco.com
  apiVersions:
  - v1
  operations:
  - CREATE
  - UPDATE
  resources:
  - smartlicenses
sideEffects: None

---

apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
creationTimestamp: null
name: validating-webhook-configuration
webhooks:
- admissionReviewVersions:
  - v1
  clientConfig:
    service:
      name: webhook-service
      namespace: system
      path: /validate-sfcn-cisco-com-v1-smartlicense
  failurePolicy: Fail
  name: vsmartlicense.kb.io
  rules:
  - apiGroups:
    - sfcn.cisco.com
    apiVersions:
    - v1
    operations:
    - CREATE
    - UPDATE
    resources:
    - smartlicenses
    sideEffects: None

// +build !ignore_autogenerated

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***************************************************************/

// Code generated by controller-gen. DO NOT EDIT.
package v1

import (  "k8s.io/apimachinery/pkg/runtime"
)

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.  
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {  
*out = *in  
out.TypeMeta = in.TypeMeta  
in.Spec.DeepCopyInto(&out.Spec)  
out.Status = in.Status  
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicense.  
func (in *SmartLicense) DeepCopy() *SmartLicense {  
if in == nil {  
return nil  
}  
out := new(SmartLicense)  
in.DeepCopyInto(out)  
return out  
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.  
func (in *SmartLicense) DeepCopyObject() runtime.Object {  
if c := in.DeepCopy(); c != nil {  
return c  
}  
return nil  
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.  
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {  
*out = *in  
out.TypeMeta = in.TypeMeta  
in.ListMeta.DeepCopyInto(&out.ListMeta)  
if in.Items != nil {  
in, out := &in.Items, &out.Items  
*out = make([]SmartLicense, len(*in))  
for i := range *in {  
(*in)[i].DeepCopyInto(&(*out)[i])  
}  
}  
}
// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
in.DeepCopyInto(out)
    return out

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseSpec.
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseSpec)
in.DeepCopyInto(out)
    return out
// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {
    *out = *in
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseStatus.
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
    in.DeepCopyInto(out)
    return out
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: EntitlementService)

// MockEntitlementService is a mock of EntitlementService interface
type MockEntitlementService struct {
    ctrl     *gomock.Controller
    recorder *MockEntitlementServiceMockRecorder
}

// MockEntitlementServiceMockRecorder is the mock recorder for MockEntitlementService
type MockEntitlementServiceMockRecorder struct {
    mock *MockEntitlementService
}

// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
    mock.recorder = &MockEntitlementServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}

// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Notify", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify", reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}

// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement", reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/api/machinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
)
const (  
secretName = "secretTest"
)

var _ = Describe("SecretHandler", func() {
var handler handler.EventHandler  
var mockCtrl *gomock.Controller  
var mockQueue *mocks.MockRateLimitingInterface  
var coreClient client.Client

BeforeEach(func() {
mockCtrl = gomock.NewController(GinkgoT())
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
handler = handlers.SecretHandler(coreClient)
})

AfterEach(func() {
mockCtrl.Finish()
})

It("should do nothing where there are no smart license objects", func() {
handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
}, mockQueue)
})

It("should not add request because secret is not used in SmartLicense object", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name:  "some_secret",
Namespace: defaultNamespace,
},
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.RegistrationFailed,
},
})
It("should not add request because SmartLicense is registered", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name: smartLicenseName,
                Namespace: defaultNamespace,
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Registered,
            },
        }
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
        mockQueue)
    })

It("should not add request because SmartLicense is deregistered", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name: smartLicenseName,
                Namespace: defaultNamespace,
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Deregistered,
            },
        }
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
        mockQueue)
    })

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It("should add request because SmartLicense status is registration failed", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      secretName,
                Namespace: defaultNamespace,
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.RegistrationFailed,
            },
        }
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
    })

    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
    }, mockQueue)
})

It("should add request for SmartLicense even if secret is in different namespace", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      secretName,
                Namespace: "test-namespace",
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.RegistrationFailed,
            },
        }
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
    })
})
handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: "test-namespace"},
    },
    . mockQueue
})

# License Broker

License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).

## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:

```
```
```
golang -w GOPRIVATE="css.cisco.com/*"
```
```
```
h1:LmzpDX56iTiv29bbRTlsUNLaFuhWRQBWjQdVyAevI8= 
github.com/Azure/go-autorest/autorest v0.9.0/go.mod
h1:xyHB1BMTZ0caDHU7I0+g046+BFDTQ8rEZB0s4Yfa6bl= 
github.com/Azure/go-autorest/autorest v0.9.6/go.mod
h1:FAqLg97kS7b5l5qQ+RSTUdAmGFqi0vUdVNNXa8q630= 
github.com/Azure/go-autorest/autorest/adal v0.5.0/go.mod
h1:8Z9fGy2MpX0PvDjB1pEgQTFmVqGhiHBW7RJJEcizWz0= 
github.com/Azure/go-autorest/autorest/adal v0.8.2/go.mod
h1:ZJhuQCITq4x3535RH2iMOxYr3d2CT/7TiQCVZ3n3Q= 
github.com/Azure/go-autorest/autorest/date v0.1.0/go.mod
h1:plVf30PSKwf2DNjijBjWF/7vvR+rCUD/ELuzDCXwHUVA= 
github.com/Azure/go-autorest/autorest/date v0.2.0/go.mod
h1:vcORJHLJEh643/Ioh9+vPmf1Ij9AEBM5FuBIXLmly0g= 
github.com/Azure/go-autorest/autorest/mocks v0.1.0/go.mod
h1:OTyCOPRA2IgILWxXyBee2F5Gr4kF2zd2J5cFRalDN0= 
github.com/Azure/go-autorest/autorest/mocks v0.2.0/go.mod
h1:OTyCOPRA2IgILWxXyBee2F5Gr4kF2zd2J5cFRalDN0= 
github.com/Azure/go-autorest/autorest/mocks v0.3.0/go.mod
h1:a8FDp3DYzQ4RYIYVAXAN3SVsi0IT7gL2j2ronKKP0syM= 
github.com/Azure/go-autorest/logger v0.1.0/go.mod h1:oExouG+K6PryyCJFjVSXi/k0c6LSNGds39diKrK37vrc= 
github.com/Azure/go-autorest/tracing v0.5.0/go.mod h1:rsXK6OKccPW3HqB+WTQzfbyf21GcRlFBr0Kn4Dk= 
github.com/BurntSushi/toml v0.3.1 h1:WXkYYL6Yr3qBF1K79EBnL4mak0OimBF0XU9F128QQ= 
github.com/BurntSushi/toml v0.3.1/go.mod h1:xHWCNGJg5oqiDr8zfno3MHue2Hi51sBks0p3qcyfWMU= 
github.com/BurntSushi/xgbl v0.0.20160522181843-27f122750802/go.mod
h1:JVqGOEym/WIBOVXweHU+Q+/VP0lqkL8qeRx9hJbQ= 
github.com/NYTimes/gziphandler v0.0.0-20170623195520-56545f4a5d46/go.mod
h1:3wb06e3pkSAbeQ52E9H9iFoQsEEEWGN49994WTCIlnhQ= 
github.com/OneOfOne/xxhash v1.2.2/go.mod h1:HSdplMjZKSmBqAxg5vPj2TmRDmfkzw+cTZAEI6WjhecU= 
github.com/PuerkitoBio/purell v1.0.0/go.mod h1:cl1wQzuBbs3ec3px9rAF61PvFuxPbtSwDGJws/X0= 
github.com/PuerkitoBio/purell v1.1.0/go.mod h1:cl1wQzuBbs3ec3px9rAF61PvFuxPbtSwDGJws/X0= 
github.com/PuerkitoBio/purell v1.1.1/go.mod h1:cl1wQzuBbs3ec3px9rAF61PvFuxPbtSwDGJws/X0= 
github.com/PuerkitoBio/urlesc v0.0.0-20160726150825-5bd2802263f2/go.mod
h1:uGdkoq3SwY9Y+13lGih111/XLaGBb4BfwtxLd5jeuxE= 
github.com/PuerkitoBio/urlesc v0.0.0-20170810143723-56545f4a5d46/go.mod
h1:uGdkoq3SwY9Y+13lGih111/XLaGBb4BfwtxLd5jeuxE= 
github.com/agnivade/levenshtein v1.0.1/go.mod h1:CURSv3d9uamI+FovSIcKfLhAUS9S4RaHIDsdSBg7IM= 
github.com/alechthomas/template v0.0.0-20160405071501-a0175ee3bccc/go.mod
h1:LOuyumcjzFXgccqObdFLyjbyU7F6xHnclSeseNh= 
github.com/alechthomas/template v0.0.0-20190718012654-f15b899a751/go.mod
h1:LOuyumcjzFXgccqObdFLyjbyU7F6xHnclSeseNh= 
github.com/alechthomas/units v0.0.0-20151022065526-2eef8857e7cf/go.mod
h1:ybypYRFXyAe+OPACYpWeL0wqObRcAqCMya13uyzqw0= 
github.com/alechthomas/units v0.0.0-20190717042225-c3de4f5363f4/go.mod
h1:ybypYRFXyAe+OPACYpWeL0wqObRcAqCMya13uyzqw0= 
github.com/andreyyvit/diff v0.0.0-20170406064948-c7f18ee0883/go.mod
h1:rCClTJhsFo29kK6Cu0RXKm700vrl8Wk0WNJnlpRjy=8/ 
github.com/armon/console-api v0.0.0-20180202201655-eb2c6b5be1b6/go.mod
h1:grANhF5doyW3UAsr3K4I6qtAmlQcZDesFNEHPZAZj8=  

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GitHub.com/matttn/go-colorable v0.0.9/go.mod

GitHub.com/matttn/go-isatty v0.0.4/go.mod

GitHub.com/matttn/go-nunewidth v0.0.2/go.mod

GitHub.com/matttproud/golangprotobuf_extensions v1.0.1/go.mod

GitHub.com/mitchellh/go-homedir v1.1.0/go.mod

GitHub.com/mitchellh/mapstructure v1.1.2/go.mod

GitHub.com/moby/term v0.0.0-20200301120042-672cc06f55cd/go.mod

GitHub.com/modern-go/concurrent v0.0.0-20180306012644-bacd9c7ef1dd/go.mod

GitHub.com/modern-go/reflect2 v0.0.0-20180701023420-4b7aa43c6742/go.mod

GitHub.com/munnerz/go-autoneg v0.0.0-20120707110453-a547fc61f48d/go.mod

GitHub.com/mwitkow/go-conntrack v0.0.0-20161129095857-cc309e4a2223/go.mod

GitHub.com/oklog/ulid v1.3.1/go.mod

GitHub.com/onsi/ginkgo v0.0.0-20170829122221-11459a886d9c/go.mod

GitHub.com/onsi/gomega v0.0.0-20170829122221-11459a886d9c/go.mod

GitHub.com/onsi/gomega v1.7.0/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod

GitHub.com/onsi/gomega v1.7.1/go.mod
github.com/onsi/gomega v1.10.2
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github.com/onsi/gomega v1.10.2/go.mod h1:iN09h71vgCQne3DLsj+a5owkm+at2ye+TCB1ybHNo=

github.com/pborman/uuid v1.2.0/go.mod h1:X/NO0urCmaxf9VXbdT7C2Yzkj2IKimNn4k+gtPdI/k=
github.com/pelletier/go-toml v1.2.0/go.mod h1:5z9KED0ma1S8pY6P1sdu5f8dpfGrGBd/94hg?liaic=

github.com/peterbourgon/diskv v2.0.1+incompatible/go.mod

h1:uqgh8zWWhv1HBMNNOuNu0Nh0yR3/BzD58J1SH1USCU=

github.com/pkg/errors v0.8.0/go.mod h1:bwawxfHBFNV+/L2hUp1rHAduV31MnDRdf1r5NINr0=

github.com/pkg/errors v0.8.1/go.mod h1:bwawxfHBFNV+/L2hUp1rHAduV31MnDRdf1r5NINr0=

github.com/pkg/errors v0.9.1/go.mod h1:FE8Lx1zS2140wpjy7q8sBeixbURkuAhArK5UwLGJwT4=

github.com/pkg/errors v0.9.1/go.mod h1:bwawxfHBFNV+/L2hUp1rHAduV31MnDRdf1r5NINr0=

github.com/pmezard/go-difflib v1.0.0/go.mod

h1:4DBwDE0NGyQoBHbLQYPwSUOcCMWR5BEZlk/fI1ZbAQM=

github.com/pmezard/go-difflib v1.0.0/go.mod h1:IK77koFhYxTK1pRnkKqkJgsb7g7vZNVY4sRDY7/4=

github.com/pquerna/cachecontrol v0.0.0-20171018203845-0dec1b0a21/go.mod

h1:prYjPMnNq4dINPVPmShWobRqXY3q7vP+80DqgxxUrUIA=

github.com/prometheus/client_golang v0.9.1/go.mod

h1:7SWeBe2y4D6OKWSNQUaRYU/AaXPKyh/ddV+NvNZz0KFW=

github.com/prometheus/client_golang v0.9.3/go.mod h1:/TN21ttK/J9q6uSwbBd54HaHCDft0taMvbcHiPoso=

h1:7SWeBe2y4D6OKWSNQUaRYU/AaXPKyh/ddV+NvNZz0KFW=

github.com/prometheus/client_golang v0.9.7/go.mod h1:6df961etRT2GnBNRI70OPL5SnadC4K3y3P06CFIhmo=

github.com/prometheus/client_golang v1.7.1/go.mod h1:NTGy1Ja9pYoBYo+xAeH/qiWnLRtr3hJPNjaVUNjn0pDA=

github.com/prometheus/client_golang v1.7.1/go.mod

h1:PY5Wy2awLA44sXw4AOSAfBetzPP4j5+D66vVCBb+pe2M=

github.com/prometheus/client_model v0.0.0-20180712105110-5c3871d89910/go.mod

h1:MbSGuTsp3dbXC40dX6PRTWyKYBtGTE9ssqQNg2j38bo=

github.com/prometheus/client_model v0.0.0-20190129233127-fd36f4220a90/go.mod

h1:xMI15A0UpDSsEKSfMN9yXemIoYk6Tm2C1GYGdfsGttqa=

github.com/prometheus/client_model v0.0.0-20190812154241-14fe0d1b01d4/go.mod

h1:xMI15A0UpDSsEKSfMN9yXemIoYk6Tm2C1GYGdfsGttqa=

github.com/prometheus/client_model v0.0.0-20181113130724-41aa239b4cc/go.mod

h1:daVV7qS5jZbuso7PdcryaAuosAZbrN9i79WvCfTMWvro=

github.com/prometheus/common v0.0.0-20181005140218-185b288413d/go.mod

h1:c3A6t6R/oaqEKCNdg8wHV1ftS6BRyBlhji8uT2IjGk=

github.com/prometheus/common v0.0.0-20190507164030-5867b95ac084/go.mod

h1:1Ty9m7e9z355MbcOE/UhFTIMyKhUPL4wbC5sTzCD31i8KEA=

github.com/prometheus/procs v0.0.2/go.mod h1:TjEm7eze9355MbeOE/UhFTIMyKhUPL4wbC5sTzCD31i8KEA=

github.com/prometheus/procs v0.0.2/go.mod h1:TjEm7eze9355MbeOE/UhFTIMyKhUPL4wbC5sTzCD31i8KEA=

github.com/prometheus/procs v0.1.3/go.mod h1:F0+qUvHoKsqa22sc6iCHF5WGIW+dwj292pOdFhl1VFBS8=

github.com/prometheus/procs v0.1.3/go.mod h1:1V6e/gmhcEcM9jH3sFOCxxUZ+zL1ycd40A4YeYWda=

github.com/prometheus/tsdb v0.7.1/go.mod h1:qhTCs0VvXwvX/y3TzZRD7rbWM+i1jKtxU40TwiPHuXU=

github.com/rogpeppe/fastuud v0.0.0-20150106093220-6724a5798afa/go.mod

h1:XRv65sW27p1b0cqNHLig55HIMJaRePC05w15cZf1WYg=

github.com/rogpeppe/go-internal v1.3.0/go.mod h1:MB8Dsm7K20IrFYOpMWESew/cY81heoFRclV5y23IUDJ4=

github.com/russross/blackfriday/v2 v2.0.1/go.mod
Open Source Used In kASA v1.5
Open Source Used In kASA v1.5  3770

```
h1:ezvh/TsK7cY6rbqRK0oQQ8IAqLxYwxyPwPA1PyZy0ii0=
k8s.io/klog/v2 v2.0.0/go.mod h1:PB/zABn139FHAv07az/IF9Wp1bk3vTpT2XSJ76fSDE=
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k8s.io/klog/v2 v2.2.0/go.mod h1:Od+F08eJp+V3HWU9npSrPpgp9DGU4GzlpG/TmITuYh/Y=
k8s.io/kube-openapi v0.0.0-20200805232855-6acecd4b50c6
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k8s.io/utils v0.0.0-20200729134348-d5654de09c73/go.mod
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sigs.k8s.io/apiserver-network-proxy/connectivity-client v0.0.9/go.mod
h1:dzAXnQbTRyDlZPJX2SUPEqvnB+j7AJjlo7PEwigU0=
sigs.k8s.io/controller-runtime v0.7.2 h1:gD2Jzp0BlLvSyRyVNox+bcRcz1UUUxKDJpUCb56Ukk=
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sigs.k8s.io/structured-merge-diff/v4 v4.0.1 h1:XyTMOt5Qz/XliBRJhAt+vi+HvttY0KvSqqhKxQ0xVbA=
sigs.k8s.io/structured-merge-diff/v4 v4.0.1/go.mod h1:b1ZCV9HiH24zZiZ/41RQgc6oK1F7G282QMxDPyydCw=
sigs.k8s.io/yaml v1.1.0/go.mod h1:UJmg0vDUViEyp3mg5v9WPzZCDxu4rQW1olI1uml+o=
sigs.k8s.io/yaml v1.2.0 h1:kr/MCeFWJWtWyoAh0R9c8EjH9OumOmoF9YGiZd7lfm/Q=
sigs.k8s.io/yaml v1.2.0/go.mod h1:yXDCHCao9+ENCVLSE62v9V9sji2MKu5j3NFtrofGhJc=

```
```
```
```
fsGroup: 65532

{{- if eq $global.platform "eks" }}
dnsPolicy: ClusterFirstWithHostNet
hostNetwork: true
{{- end }}

{{- if ($Values.global.platform | eq "azure") }}
{{- /* https://github.com/kubernetes-sigs/azuredisk-csi-driver/issues/815
azure disk seems to ignore fsGroup setting right now for v1.2.0 release,
need an init container to fix permissions */}}

initContainers:
  - name: change-ownership
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    command: ['sh', '-c', 'chown -R 65532:65532 /home/nonroot ']
    volumeMounts:
      - mountPath: /home/nonroot
        name: disk
    securityContext:
      # Files or directories created with HostPath on the host are only writable by root. Which means, you either
      # need to run your container process as root or modify the file permissions on the host to be writable by
      # non-root user.
      runAsUser: 0
      capabilities:
        add:
          - DAC_OVERRIDE
          - FOWNER

containers:
  - name: manager
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
    env:
      {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
    args:
      - --zap-log-level={{ $.Values.logLevel }}
      - --zap-encoder={{ $.Values.logFormat }}
      - --webhook-port={{ $.Values.webhookPort }}
      - --metrics-port={{ $.Values.metricsPort }}
      - --license-server-port={{ $.Values.licenseServerPort }}
    ports:
      - containerPort: {{ $.Values.webhookPort }}
        name: webhook-server
        protocol: TCP
    resources:
      requests:
        cpu: {{ $.Values.managerCoreRequest }}
        memory: {{ $.Values.managerMemoryRequest }}
      limits:
        cpu: {{ $.Values.managerCoreLimit }}
memory: {{ $.Values.managerMemoryLimit }}

securityContext:
  allowPrivilegeEscalation: false

- name: license-server

  image: {{ include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) }}

  imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}

  command:
    - "java"
    - "-Xms{{ $.Values.licenseServerXms }}"
    - "-Xmx{{ $.Values.licenseServerXmx }}"
    - "-jar"
    - "sa-server-all.jar"
    - "--configFile"
    - "/etc/licensing/server-id.json"
    - "--port"
    - "{{ $.Values.licenseServerPort | quote }}"

  ports:
    - containerPort: {{ $.Values.licenseServerPort }}

  protocol: TCP

  securityContext:
    # 65532 is ID of nonroot user
    runAsUser: 65532
    allowPrivilegeEscalation: false

  env:
    {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}

  resources:
    requests:
      cpu: {{ $.Values.licenseServerCoreRequest }}
      memory: {{ $.Values.licenseServerMemoryRequest }}

    limits:
      cpu: {{ $.Values.licenseServerCoreLimit }}
      memory: {{ $.Values.licenseServerMemoryLimit }}

  volumeMounts:
    - mountPath: /home/nonroot
      name: disk
    - mountPath: /etc/licensing/server-id.json
      name: license-config
      subPath: server-id.json

  volumes:
    - name: disk
      persistentVolumeClaim:
        claimName: {{ include "aegis.metadata.fullname" (list $ "server") }}

    - name: license-config
      configMap:
        name: {{ include "aegis.metadata.fullname" (list $ "config") }}

  {{- if ne $global.platform "kind" }}
  imagePullSecrets:
    - name: regsfcn
  {{- end }}
```yaml
---

{{ include "aegis.services.deployment" (list $ "configurer" "kasa.licensebroker.server") -}}

{{- define "kasa.licensebroker.server" -}}

{{- $ := first . -}}

apiVersion: v1

kind: Service

metadata:

name: {{ include "aegis.metadata.fullname" (list $ "server") }}

spec:

ports:

- protocol: TCP

  port: 80

  targetPort: {{ $.Values.licenseServerPort }}

  type: ClusterIP

{{- end -}}

package controllers

import (

  v1 "css.cisco.com/kasa/license-broker/api/v1"

  . "github.com/onsi/ginkgo"

  . "github.com/onsi/gomega"

  autoscalingv1 "k8s.io/api/autoscaling/v1"

  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"

  "k8s.io/apimachinery/pkg/types"

  "strings"

)

var _ = Describe("Common Test", func() { 

  It("serialNumber", func() {

    serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())

    Expect(len(serialNum)).Should(Equal(11))

    Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))

    Expect(serialNum).Should(Equal("F0529A6CDD9"))

  })

  It("containsString", func() {

    list := []string{"one", "two", "three"}

    Expect(containsString(list, "three")).Should(BeTrue())

    Expect(containsString(list, "four")).Should(BeFalse())

  })

  It("removeString", func() {

```

---

{{ include "aegis.services.deployment" (list $ "configurer" "kasa.licensebroker.server") -}}

{{- define "kasa.licensebroker.server" -}}

{{- $ := first . -}}

apiVersion: v1

kind: Service

metadata:

name: {{ include "aegis.metadata.fullname" (list $ "server") }}

spec:

ports:

- protocol: TCP

  port: 80

  targetPort: {{ $.Values.licenseServerPort }}

  type: ClusterIP

{{- end -}}

package controllers

import (

  v1 "css.cisco.com/kasa/license-broker/api/v1"

  . "github.com/onsi/ginkgo"

  . "github.com/onsi/gomega"

  autoscalingv1 "k8s.io/api/autoscaling/v1"

  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"

  "k8s.io/apimachinery/pkg/types"

  "strings"

)

var _ = Describe("Common Test", func() { 

  It("serialNumber", func() {

    serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())

    Expect(len(serialNum)).Should(Equal(11))

    Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))

    Expect(serialNum).Should(Equal("F0529A6CDD9"))

  })

  It("containsString", func() {

    list := []string{"one", "two", "three"}

    Expect(containsString(list, "three")).Should(BeTrue())

    Expect(containsString(list, "four")).Should(BeFalse())

  })

  It("removeString", func() {

```
list := []string{"one", "two", "three"}
Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
}

It("filterLicensesByState", func() {
    licenses := []v1.SmartLicense{
    {
        ObjectMeta: metav1.ObjectMeta{
            Name: "license1",
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Deregistered,
        },
    },
    {
        ObjectMeta: metav1.ObjectMeta{
            Name: "license2",
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Registered,
        },
    }
}

    filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
    Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
    {
        ObjectMeta: metav1.ObjectMeta{
            Name: "license1",
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Deregistered,
        },
    }}))

    filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
    Expect(filteredLicenses).Should(BeEmpty())
})

It("filterLicensesByKind", func() {
    var licenses v1.SmartLicenseList
    licenses.Items = []v1.SmartLicense{ {
        Spec: v1.SmartLicenseSpec{
            ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
        },
    },
}}
Spec: v1.SmartLicenseSpec{
  ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
},
},
{
Spec: v1.SmartLicenseSpec{
  ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName1"},
},
},
}
filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
  Spec: v1.SmartLicenseSpec{
    ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
  },
})))
filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
Expect(filteredLicenses).Should(BeNil())
filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
  Spec: v1.SmartLicenseSpec{
    ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
  },
})))
}
It("pendingLicenseExists", func() {
  licenses := []v1.SmartLicense{
    {Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance},
    },
    {Status: v1.SmartLicenseStatus{LicenseState: v1.OutOfCompliance},
    },
  }
  Expect(pendingLicenseExists(licenses)).Should(BeFalse())
  licenses = append(licenses, v1.SmartLicense{
    Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState},
  })
  Expect(pendingLicenseExists(licenses)).Should(BeTrue())
})
It("setLicenseLabel", func() {
  meta := metav1.ObjectMeta{

Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing.
There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.
# Smart Licensing

* Licensing a kASA cluster involves licensing every ASA instance running in the cluster. Since the ASA instances are ephemeral, a license server runs locally in your cluster to manage the license lifecycle of these ASA instances. This server is responsible for registering the set of ASA instances you license with the Cisco Smart Software Manager, obtain or release the licenses based on the number of cores those instances use, and releasing all the licenses back to your Smart account when you deregister the cluster.

* After kASA bundle is successfully installed with licensing enabled, to license the cluster, you need a token from your Smart Account that has Secure Firewall (SFW) licenses.
Go to [software.cisco.com](www.software.cisco.com) and navigate to Smart Software Licensing. Find `asac-dev`
virtual account that has the SFW licenses and generate a token from it. For development purposes, we have created a token that you can use:

```plaintext
YTRkNWFlM2MtZWEzYi00MWEzLWI2MDEtZmIzMzdjZGQ2ODJiLTE2NDgzMiN8bGpoZE
xXdGNxSDkvY0h3cndkUjFpVmpGbEZ2YVBwTTdUUEJ0MWhZ%0AMStTRT0%3D%0A
```

If this token has expired, please send an email to sfcn-controlplane@cisco.com

* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc) and a service type (e.g. `Deployment` or `HorizontalPodAutoscaler`).

* Examples of the secret and the Smart License object are located [here](../../license-broker/config/samples/sfcn.cisco.com_v1_smartlicense.yaml).

---

**Title:** Deployment Components  
**Weight:** 2

**Description:**  
Understanding the components of Cluster Licensing and their deployment to Kubernetes resources:

- **Title:** "Image #:counter"

---

Licensing setup comprises two components - the License Server, and the License Controller. References to Server and Controller in this document mean the License Server and License Controller.

1. **User** creates a Smart License resource and applies it to the Kubernetes API Server  
2. **Kubernetes** API Server sends a notification to License Controller.  
3. License Controller inspects the configuration in the Smart License resource
   
   1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server, which then talks to CSSM to reserve the licenses and responds back to the Controller
   
   2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server

4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.  
5. The License Server checks its pool to see if it has sufficient licenses to grant the request

---
1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates this status to ASAc.
2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.

## Packaging

Licensing components are packaged into two Kubernetes Deployment resources targeting different namespaces and distributed via Helm as part of the `sfcn-bundle` Helm chart.

### License Broker

The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

License Broker is set to be deployed once per Cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode).

The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.

### License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the [Controller](#license-controller) sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses.
from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.

## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the License Server([{{ relref "#license-server" > }}]). It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests]({{ relref "monitoring#unauthorized-requests" > }}) for more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the form of events on that resource.
### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart License resource in the same namespace.

Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  # license type can be blank or not set explicitly to let the system use the default value  
  # At present, there is only one license type for kASA, so this field is reserved for future use.  
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by obtaining a token from the [Virtual Account](#smart-and-virtual-accounts) and doing a base64 encoding of that text. This can be done from a shell as follows

```shell
echo "your-token" | base64
```

And, use that content in the Secret as follows

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: cssm-token
  namespace: cisco-systems
data:
  # this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
```
The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual account as you are expecting the number of vCPUs in your cluster namespace.

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`. The resource specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a minimum of 1 license and upto 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA license type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request for upto 10 vCPUs. Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing configuration thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the License Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the license configuration. In the example here, the Deployment replica count would be set to 2.

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more replicas, the license Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to the account. Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.
When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient number of licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to retry the operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the `scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or down, it reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may ask the pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the pod is assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its pool. Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the virtual account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following configuration, the Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this number to the number of vCPUs the enforcer pods will be using.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  # scaling factor of 4 implies the license reservations change in increments/decrements of 4
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

### Unregistering the Cluster Namespace
Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates un-registration and on successfully unregistering from the virtual account, the Controller deletes the resource.

### The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

#### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

{{% alert title="Note" color="primary" %}}

It is recommended that a CPU limit be specified on all the containers where the ASA is running. If you prefer to take advantage of burstable CPU of the Node, be advised that the licensed cores would be that of the Node rather than the Pod.

{{% /alert %}}

#### Licensing ASA

When the ASA comes up, it does not hold a license and therefore runs at a low-bandwidth mode, typically 100kbps and has very restricted capabilities and features it supports. The Manager tries to get a license from the License Server and if successful communicates the status to ASA. Once licensed, ASA runs at its full potential.

The Manager periodically verifies the status of the license it obtained, with the License Server, and if the license is not valid anymore either because the License Server has insufficient licenses, or the Manager failed to verify the validity despite several retries, it will revoke the license of ASA and keeps retrying to fetch the license.
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  creationTimestamp: null
name: broker-role
rules:
- apiGroups:
  - apps
  resources:
  - deployments
  verbs:
  - get
  - list
  - update
  - watch
  - apiGroups:
  - apps
  resources:
  - replicaset
  verbs:
  - get
  - list
  - watch
  - apiGroups:
  - autoscaling
  resources:
  - horizontalpodautoscaler
  verbs:
  - get
  - list
  - update
  - watch
  - apiGroups:
    - ""
  resources:
  - pods
  verbs:
  - delete
  - get
  - list
  - update
  - watch
  - apiGroups:
    - ""
  resources:
  - secrets
  verbs:
  - get
- list
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses
verbs:
- create
- delete
- get
- list
- patch
- update
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses/status
verbs:
- get
- patch
- update
apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into versioned archives
# to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They're included as
# a dependency of application charts to inject those utilities and functions into the rendering
# pipeline. Library charts do not define any templates and therefore cannot be deployed.
type: application

# This is the chart version. This version number should be incremented each time you make changes
# to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
version: 0.1.0

# This is the version number of the application being deployed. This version number should be
# incremented each time you make changes to the application. Versions are not expected to
# follow Semantic Versioning. They should reflect the version the application is using.
appVersion: 1.16.0

dependencies:
- name: aegis-common
version: "0.1.0"
repository: "file://../aegis-common"
module css.cisco.com/kasa/license-broker

go 1.14

require {
css.cisco.com/kasa/pkg/predicates v0.0.0
css.cisco.com/licensing/client-agent v0.1.11
github.com/go-logr/logr v0.3.0
github.com/golang/mock v1.3.1
github.com/onsi/ginkgo v1.14.1
github.com/onsi/gomega v1.10.2
k8s.io/api v0.19.2
k8s.io/apimachinery v0.19.2
k8s.io/client-go v0.19.2
k8s.io/utils v0.0.0-20200912215256-4140de9c8800
sigs.k8s.io/controller-runtime v0.7.2
}

replace css.cisco.com/kasa/pkg/predicates v0.0.0 => ../pkg/predicates

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: AllotmentService)

// Package mocks is a generated GoMock package.
package mocks

import {
proto "css.cisco.com/licensing/client-agent/proto"
service "css.cisco.com/licensing/client-agent/service"
gomock "github.com/golang/mock/gomock"
reflect "reflect"
}

// MockAllotmentService is a mock of AllotmentService interface
type MockAllotmentService struct {
ctrl   *gomock.Controller
recorder *MockAllotmentServiceMockRecorder
}

// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService
type MockAllotmentServiceMockRecorder struct {
mock *MockAllotmentService
}

// NewMockAllotmentService creates a new mock instance
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {
mock := &MockAllotmentService{ctrl: ctrl}
return mock
}
mock.recorder = &MockAllotmentServiceMockRecorder{mock}
return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {
return m.recorder
}

// LeaseAllotment mocks base method
func (m *MockAllotmentService) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "LeaseAllotment", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
}

// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}
### Cisco Smart Software Manager (CSSM)

Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage
the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any licensing activity outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed [here](https://software-stage.cisco.com).

There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html) often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.

{{{ alert title="Warning" color="warning" % }

kASA Licensing currently supports only direct access to CSSM. The system is NOT tested for accessing CSSM from behind an HTTPs proxy or via Satellite, and the behavior is unknown; though, in theory, it may work.

}}

### Smart License

Smart License is the license that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that license from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).
### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.

Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited to. The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account. You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased. This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation

License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the
products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product.

The reservation process requires connectivity to internet and only on successful reservation can you use the product in Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR).

PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does not mean the product supports it. You should check the product documentation to verify the support for license reservation.

{{% alert title="Warning" color="warning" %}}
kASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.
{{% /alert %}}

### References

If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

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---

package integ_tests

import (  
"context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
var _ = Describe("SmartLicense Webhook Test", func() {
    const defaultNamespace = "default"

    var defaultCount uint32 = 1

    var secret *corev1.Secret
    var hpa *autoscalingv1.HorizontalPodAutoscaler

   BeforeEach(func() {
        secret = &corev1.Secret{
            Data:       map[string][]byte{"token": []byte("MTIz")},
        }
        Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())
        hpa = &autoscalingv1.HorizontalPodAutoscaler{
            Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
                MaxReplicas:  3,
            },
        }
        Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
    })

    AfterEach(func() {
        Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
        Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
    })

    Context("Mutating Webhook", func() {
        It("should fill in values on creation", func() {
            license := &v1.SmartLicense{
                Spec: v1.SmartLicenseSpec{
                },
            }
            err := k8sClient.Create(testCtx, license)
            Expect(err).ShouldNot(HaveOccurred())
            err = k8sClient.Get(testCtx, types.NamespacedName{
                Namespace: defaultNamespace,
                Name:      "foo",
            })
        })
    })
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```
}, license)
Expect(err).ShouldNot(HaveOccurred())
Expect(license.Spec.Action).To(Equal(v1.Register))
Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.ScalingFactor).To(Equal(&defaultCount))
}
}

Context("Validating Webhook", func() {

It("should pass for valid object", func() {
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }
  Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
})

It("has fields validations", func() {
  //given
  var zeroLicenses uint32 = 0
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      MinLicenseCount: &zeroLicenses,
      MaxLicenseCount: &zeroLicenses,
      ScalingFactor: &zeroLicenses,
    },
  }
  //when
  err := k8sClient.Create(testCtx, license)
  //then
  Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: "] + "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1]"))
})

It("should return error if max value is less then min value", func() {

```
// given
var minLicenses uint32 = 5
var maxLicenses uint32 = 3
license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
        MinLicenseCount: &minLicenses,
        MaxLicenseCount: &maxLicenses,
    },
}

// when
err := k8sClient.Create(context.TODO(), license)

// then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))
}

It("should return error when creating license with non-REGISTER action", func() {
    // given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action:      v1.Deregister,
        },
    }

    // when
    err := k8sClient.Create(context.TODO(), license)

    // then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))
})

It("should return error when secret does not exist", func() {
    // given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    // when
    err := k8sClient.Create(context.TODO(), license)

    // then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: secret "non-existing-secret" not found"))
})
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
}

It("should return error when secret does not token key", func() {
  //given
  secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
  Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))
})

It("should return error when invalid scalingRef kind is specified", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.scalingRef.kind: Unsupported value: "Pod": supported values:

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It("should return error when scalingRef does not exist", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    //when
    err := k8sClient.Create(context.TODO(), license)
    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found"))
})

It("should not allow changing licenseType after registration", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    Expect(k8sClient.Create(context.TODO(), license)).To(Succeed())
    license.Status.RegistrationState = v1.Registered
    Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())
    //when
    license.Spec.LicenseType = "buzz"
    err := k8sClient.Update(context.TODO(), license)
    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
name: broker-role-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: broker-role
subjects:
- kind: ServiceAccount
  name: default
  namespace: system

package controllers_test

import (
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

package handlers_test

import (
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

func TestHandlers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {
  Expect(v1.AddToScheme(scheme.Scheme)).To(Succeed())
})
package integ_tests

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "github.com/go-logr/logr"
    . "github.com/onsi/ginkgo"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/client-go/rest"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
)

func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))
    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }

    close(done)
    if err := mgr.Start(ctx); err != nil {
        return err
    }
    return nil
}
package controllers_test

import (
const (  
epDeploymentName = "epDeployment"
initialDeploymentReplicas int32 = 3
)

var _ = Describe("Deployment License Controller Test", func() {

deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}  
var 
  reconciler       *controllers.DeploymentLicenseReconciler
  fakeClient       client.Client
  mockCtrl         *gomock.Controller
  deployment       *appsv1.Deployment
  smartLicense     *v1.SmartLicense
  recorder         *record.FakeRecorder
  replicasCalculatorMock *mocks.MockReplicasCalculator
)

BeforeEach(func() {
  mockCtrl = gomock.NewController(GinkgoT())
  fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
  recorder = record.NewFakeRecorder(1024)
  replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

  reconciler = &controllers.DeploymentLicenseReconciler{
    Client:    fakeClient,
    Log:       logf.NullLogger{},
  }

  expectedDeployment := &appsv1.Deployment{
    Metadata: metav1.ObjectMeta{
      Namespace: defaultNs,
      Name: epDeploymentName,
    },
    Spec: appsv1.DeploymentSpec{
      Replicas: initialDeploymentReplicas,
      Template: &corev1.PodTemplateSpec{
        Spec: corev1.PodSpec{
          Replicas: initialDeploymentReplicas,
          Containers: []corev1.Container{
            {Name: "controller", Image: "controller-image"},
          },
        },
      },
    },
  }

  reconciliationResult := reconciler.Reconcile(context.Background(), deploymentNsName, expectedDeployment)

  reconciliationResult = reconciliationResult.Info("Deployment reconciled successfully")

  defer mockCtrl.Finish()
Recorder: recorder,
ReplicasCalculator: replicasCalculatorMock,

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor: &scalingFactor,
    },
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: epDeploymentName,
        Namespace: defaultNs,
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
        },
    },
    Spec: appsv1.DeploymentSpec{
        Replicas: &replicas,
    },
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
    mockCtrl.Finish()
})

It("should skip if Deployment does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})
It("should skip if Deployment SmartLicense does not exist", func() {
  Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())
  Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if SmartLicense is in deregistered state", func() {
  smartLicense.Status.RegistrationState = v1.Deregistered
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())
  Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if registered SmartLicense has enough licenses", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(4), nil)
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())
  Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
  Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())
  Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
  Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
  Expect(recorder.Events).Should(HaveLen(2))
  Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled")))
})
Deployment to initial replicas number 3

It("should an event if initial replica number annotation is incorrect", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)

deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(HaveOccurred())
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial-
replicas-count label is not correct. Please, update it to correct number.")))
})

It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
    *deployment.Spec.Replicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(25), nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
})

It("should send a warning if deployment controlled by HPA", func() {
    hpa := &autoscalingv1.HorizontalPodAutoscaler{
        ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: initialHPAMaxReplicas,
        },
    }

    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(4), nil)

    hpa := &autoscalingv1.HorizontalPodAutoscaler{
        ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: initialHPAMaxReplicas,
        },
    }

    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)

    hpa := &autoscalingv1.HorizontalPodAutoscaler{
        ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: initialHPAMaxReplicas,
        },
    }

    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(25), nil)

    hpa := &autoscalingv1.HorizontalPodAutoscaler{
        ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: initialHPAMaxReplicas,
        },
    }

    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(4), nil)
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())
Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf("Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", epDeploymentName, epHpaName, epHpaName))))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3"))))
}
}
package handlers

import (  
"context"  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
"fmt"  
coreV1 "k8s.io/api/core/v1"  
k8s.io/apimachinery/pkg/types"  
k8s.io/client-go/util/workqueue"  
ctrl "sigs.k8s.io/controller-runtime"  
"sigs.k8s.io/controller-runtime/pkg/client"  
"sigs.k8s.io/controller-runtime/pkg/event"  
"sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
  return handler.Funcs{
    UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
      if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
        licenseList := v1.SmartLicenseList{}
        err := c.List(context.TODO(), &licenseList)
        if err != nil {
          secretLog.Error(err,
            "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
          panic(err.Error())
        }
    
      for _, smartLicense := range licenseList.Items {
        if smartLicense.Spec.TokenSecret.Name == secret.Name &&
          
            // Code continues here...
        }
      }
    }
  }
}

package handlers
if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
    Namespace: smartLicense.Namespace,
    Name:     smartLicense.Name,
}})}
}
}
}
} else {
    secretLog.Error(fmt.Errorf("cannot cast %T to Secret", evt.ObjectNew), "event is ignored")
}
,
,
}

package v1_test

import {
    v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
    "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1/mocks"
    dispatcherMock "cisco.com/kasa/operator/enforcementpoint/dispatcher/mocks"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    clientagent "css.cisco.com/licensing/client-agent"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
}

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService
var _ = Describe("SmartLicense Controller Test", func() {

cost(
    podName = "sfcn-enforcer"
podNamespace = "sfcn-system"
nodename = "aws-eks-node0"
)

var tenant, podNamespacedName = &clientagent.Tenant{
    Name: podNamespace + "/" + podName,
    Attributes: map[string]string{
        "role": "license-requestor",
    },
}, types.NamespacedName{
    Namespace: podNamespace,
    Name: podName,
}

newPod := func(name, namespace, nodeName string) *coreV1.Pod {
    return &coreV1.Pod{
        TypeMeta: metav1.TypeMeta{
            Kind:    "Pod",
            APIVersion: "v1",
        },
        ObjectMeta: metav1.ObjectMeta{
            Name: name,
            Namespace: namespace,
            Labels: tenant.Attributes,
        },
        Spec: coreV1.PodSpec{
            NodeName: nodeName,
            Containers: []coreV1.Container{
                {
                    Name: "ep-container",
                    Resources: coreV1.ResourceRequirements{
                        Limits: map[coreV1.ResourceName]resource.Quantity{
                            "cpu": resource.MustParse("2000m"),
                        },
                    },
                },
            },
        }
    }
}

newNode := func(name string) *coreV1.Node {
    return &coreV1.Node{
        TypeMeta: metav1.TypeMeta{Kind: "Node", APIVersion: "v1"},
        ObjectMeta: metav1.ObjectMeta{Name: name},
        Status: coreV1.NodeStatus{
            Capacity: map[coreV1.ResourceName]resource.Quantity{
        }}
    }
}
"cpu": resource.MustParse("4"),
    }
)
}

var (  
pod        *coreV1.Pod  
node       *coreV1.Node  
reconciler   *v1.SmartLicenseReconciler  
fakeClient  client.Client  
mockCtrl   *gomock.Controller  
licensingClient *mocks.MockLicensingClient  
allotmentService *mocks.MockAllotmentService  
dispatcher   *dispatcherMock.MockGatewayClient  
recorder    *record.FakeRecorder  
)

resetRecorder := func() {  
  recorder = record.NewFakeRecorder(1024)  
  reconciler.Recorder = recorder
}

reconcileAndExpectFail := func() {  
  resetRecorder()  
  result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})  
  Expect(err).ShouldNot(HaveOccurred()) // failure is determined by requeue after duration  
  Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration}))
}

reconcileAndExpectSuccess := func() {  
  resetRecorder()  
  result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})  
  Expect(err).ShouldNot(HaveOccurred())  
  Expect(result).To(Equal(ctrl.Result{}))
}

recordedEvents := func() []string {  
  close(recorder.Events)  
  var events []string  
  for event := range recorder.Events {  
    events = append(events, event)  
  }  
  return events
}

lastRecordedEvent := func() string {  
  events := recordedEvents()  
  if len(events) == 0 {

return ""

return events[0]


BeforeEach(func() {
    pod = newPod(podName, podNamespace, nodeName)
    node = newNode(nodeName)
    data := []client.Object{pod, node}
    mockCtrl = gomock.NewController(GinkgoT())
    scheme := runtime.NewScheme()
    Expect(coreV1.AddToScheme(scheme)).To(Succeed())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
    allotmentService = mocks.NewMockAllotmentService(mockCtrl)
    licensingClient = mocks.NewMockLicensingClient(mockCtrl)
    recorder = record.NewFakeRecorder(1024)
    reconciler = &v1.SmartLicenseReconciler{
        CoreClient: coreV1Client.New(fakeClient, context.Background),
        Licenser:   licensingClient,
        Log:        logf.NullLogger{},
        Recorder:   recorder,
        Dispatcher: dispatcher,
    }
    licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()

    It("should revoke ASAc license after failing multiple attempts of registration", func() {
        allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(fmt.Errorf("test registration failure")).AnyTimes()
        dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
        dispatcher.EXPECT().RevokeLicense().Times(1)
        numAttempts := 0
        for numAttempts < v1.MaxRetryAttempts {
            reconcileAndExpectFail()
            numAttempts += 1
            if numAttempts == 1 {
                // on the first attempt expect an event is recorded
                Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
            } else {
                Expect(lastRecordedEvent()).Should(BeEmpty())
            }
        }
        reconcileAndExpectFail()
        Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
    })
ItReconcileSuccessfullyWithExpectedNumberOfCores := func(numCores uint32) {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil)
    allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
        PoolName: podNamespace,
        Tenant:   tenant,
        NumCores: numCores, // this is the limit specified for the container
    })).Return(&clientagent.AllotmentRequestStatus{
        ContextId:          "test-context",
        Tenant:             tenant,
        NumCores:           numCores,
        SmartAccountName:   "test-domain",
        VirtualAccountName: "test-account",
        ExportControlled:   true,
    }, nil)
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().GrantLicense(true)

    reconcileAndExpectSuccess()
    Expect(recordedEvents()).Should(ConsistOf(
        HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),
        HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),
        HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified")))
}

It("should verify the license status and request on successful registration", func() {
    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
        Name:  "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
    })
    Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
    ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})

It("should revoke ASAc license after successful registration but fails to get a lease", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().GrantLicense().Times(1)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil).AnyTimes()
    allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
        PoolName: podNamespace,
        Tenant:   tenant,
        NumCores: 2, // this is the limit specified for the container
    })).Return(&clientagent.AllotmentRequestStatus{
        ContextId:          "test-context",
        Tenant:             tenant,
        NumCores:           numCores,
It("should revoke ASAc license when server requests to the release the allotment", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
    ContextId: "test-context",
    Tenant:    tenant,
}).Return(nil)

ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
}).Return(nil)

Expect(lastRecordedEvent()).Should(HavePrefix(  
    "Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license")
})

It("should report the allotment it holds when the server requests so", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

    allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
        ContextId: "test-context",
        Tenant
ContextId: "test-context",
Tenant:    tenant,
NumCores:  2,
}).Return(nil)

ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
  ContextId: "test-context",
  Type:      proto.AllotmentEvent_REPORT_ALLOTMENT,
  Message:   "testing release allotment request",
  Tenant:    tenant,
})
Expect(lastRecordedEvent()).Should(BeEmpty())
)

It("should mark tenant as unregistered if license server is unavailable and retry again", func () {
  dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
  allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
  allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil,
    fmt.Errorf("some error occures: %w", lca.ErrLicenseServerUnavailable))
  res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})

  Expect(err).Should(BeNil())
  Expect(res).ShouldNot(BeNil())
  Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
})

AfterEach(func() {
  mockCtrl.Finish()
})

/******************************************************
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*******************************************************/

package controllers

import {
  "context"
  "css.cisco.com/kasa/license-broker/controllers/handlers"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensing "css.cisco.com/licensing/client-agent"
  "errors"
  "fmt"
  "github.com/go-logr/logr"
apiErrors "k8s.io/apimachinery/pkg/api/errors"
"k8s.io/apimachinery/pkg/runtime"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/tools/record"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/builder"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"
corePredicate "sigs.k8s.io/controller-runtime/pkg/predicate"
"sigs.k8s.io/controller-runtime/pkg/source"

v1 "css.cisco.com/kasa/license-broker/api/v1"
coreV1 "k8s.io/api/core/v1"
"time"
)

const SFCNProductId = "SFW"

const (registrationReason = "Registration"
  deregistrationReason = "Deregistration"
  FinalizerName = "sfcn.cisco.com/license-degistration-finalizer"
)

// SmartLicenseReconciler reconciles a SmartLicense object
type SmartLicenseReconciler struct {
  Client            client.Client
  LicensingClient   licensing.LicensingClient
  Log               logr.Logger
  Recorder          record.EventRecorder
  Scheme            *runtime.Scheme
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
  return ctrl.NewControllerManagedBy(mgr).
    For(&v1.SmartLicense{}, builder.WithPredicates(&corePredicate.GenerationChangedPredicate{})).
    Watches(&source.Channel{Source: oobChangeNotifier}, &handler.EnqueueRequestForObject{}).
    Complete(r)
}

// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses,verbs=get;list;watch;create;update;patch;delete
// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses/status,verbs=get;update;patch
// +kubebuilder:rbac:groups=core,resources=secrets,verbs=get;list;watch
// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list;watch;update;delete
func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := r.Log.WithValues("smartlicense", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    var license v1.SmartLicense
    if err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("SmartLicense does not exist, nothing to reconcile")
            return ctrl.Result{}, client.IgnoreNotFound(err)
        }
        return ctrl.Result{}, err
    }

    if license.ObjectMeta.DeletionTimestamp.IsZero() {
        if err := r.addFinalizerIfMissing(&license); err != nil {
            return ctrl.Result{}, err
        }
    } else {
        // the license is being deleted, need to deregister it first
        return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
    }

    switch license.Spec.Action {
    case v1.Register:
        err := r.registerPlatform(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
        }

        err = r.scaleEntitlements(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
        }

        if err = r.recordSuccessAndUpdateStatus(&license, registrationReason); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
        }
        return ctrl.Result{}, nil
    }
}
case v1.Deregister:
    err := r.deregisterPlatform(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, deregistrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to deregister the platform: %w", err)
    }

    if err = r.recordSuccessAndUpdateStatus(&license, deregistrationReason); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
    }
    return ctrl.Result{}, nil
}

default:
    // should not happen due to CRD validation, but not returning an error as subsequent reconciliations will not fix the
    // issue anyway
    // 'action' value")
    return ctrl.Result{}, nil
}

func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
    if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
        r.licenseLogger(license).Info("added finalizer")
    }
    return nil
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    if containsString(license.ObjectMeta.Finalizers, FinalizerName) {  //TODO: return error and do not remove finalizer when corner cases are tested
        if license.Status.RegistrationState == v1.Registered {
            if err := r.deregisterPlatform(license); err != nil {
                log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
                return err
            }
            log.Info("removing finalizer without deregistration as platform is not registered")
        }
        license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
    }
}
func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {
    licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
    log := r.licenseLogger(license)
    token, err := r.getToken(license)
    if err != nil {
        return fmt.Errorf("failed to retrieve licensing token: %w", err)
    }
    log.Info("trying to register platform", "platformName", licenseNsName.String())
    deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client, 
        ctrl.Log.WithName("listeners").WithName("DeregistrationListener"), r.Recorder, oobChangeNotifier)
    registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
        Uuid:         string(license.UID),
        Name:         licenseNsName.String(),
        SerialNumber: serialNumber(licenseNsName.String()),
        ProductId:    SFCNProductId,
        PoolName:     license.Namespace,
    }, token, deregistrationListener)
    if err != nil {
        license.Status.RegistrationState = v1.RegistrationFailed
        license.Status.LicenseState = v1.Unlicensed
        return fmt.Errorf("failed to complete registration call: %w", err)
    }
    log.Info("registered the platform in CSSM", "registrationInfo", registration)
    license.Status.RegistrationState = v1.Registered
    if !registration.IsRegistered {
        license.Status.LicenseState = v1.PendingLicenseState
    }
    license.Status.AccountDomain = registration.SmartAccountName
    license.Status.AccountName = registration.VirtualAccountName
    license.Status.ContextId = registration.ContextId
    license.Status.ExportControlled = registration.ExportControlled

    entitlementListener := &listeners.EntitlementListener{
        Log:      ctrl.Log.WithName("listeners").WithName("EntitlementListener"),
        Client:   r.Client,
        LicenseNsName: licenseNsName,
    }
    if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
        if errors.Is(err, licensing.ErrDuplicateListener) {
            log.Info("entitlement listener is already added", "contextId", registration.ContextId)
        } else {
            return fmt.Errorf("failed to add entitlement listener: %w", err)
        }
    }
    return nil
}
func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
    if license.Status.RegistrationState != v1.Registered {
        return fmt.Errorf("platform must be registered before license reservation")
    }
    log := r.licenseLogger(license)

    log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
    err := r.LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
        ContextId:       license.Status.ContextId,
        EntitlementId:   license.Spec.LicenseType,
        MinEntitlements: *license.Spec.MinLicenseCount,
        MaxEntitlements: *license.Spec.MaxLicenseCount,
        ScalingFactor:   *license.Spec.ScalingFactor,
    })
    if err != nil {
        return fmt.Errorf("failed to enable licensing scaling: %w", err)
    }

    log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
    return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)

    state := license.Status.RegistrationState
    if state == v1.Deregistered {
        log.Info("platform is already deregistered, skipping deregistration")
        return nil
    }

    err := r.LicensingClient.Registration().Deregister(license.Status.ContextId)
    if err != nil {
        license.Status.RegistrationState = v1.DeregistrationFailed
        return fmt.Errorf("failed to complete deregistration call: %w", err)
    }

    log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.EstimatedMaxReplicas = 0
license.Status.CoresPerLicense = 0
license.Status.LicenseNumber = 0
return nil
}
func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
secretNamespacedName := types.NamespacedName{
Namespace: license.Spec.TokenSecret.Namespace,
Name:
license.Spec.TokenSecret.Name,
}
var tokenSecret coreV1.Secret
if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
return "", fmt.Errorf("failed to get token secret: %w", err)
}
return string(tokenSecret.Data[v1.TokenKeyName]), nil
}
func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error)
{
r.Recorder.Event(license, coreV1.EventTypeWarning, reason,
fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
license.Status.ErrorReason = err.Error()
if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
r.Log.Error(statusErr, "failed to update SmartLicense status")
}
}
func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
r.Recorder.Event(license, coreV1.EventTypeNormal, reason, "SmartLicense state updated.")
license.Status.ErrorReason = ""
if err := r.Client.Status().Update(context.Background(), license); err != nil {
return err
}
return nil
}
func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
}
package controllers_test
import (
"context"
v1 "css.cisco.com/kasa/license-broker/api/v1"
"css.cisco.com/kasa/license-broker/controllers"
"css.cisco.com/kasa/license-broker/controllers/mocks"
licensing "css.cisco.com/licensing/client-agent"
"fmt"

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"github.com/golang/mock/gomock"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
corev1 "k8s.io/api/core/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/kubernetes/scheme"
"k8s.io/client-go/tools/record"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/registration.go css.cisco.com/licensing/client-agent RegistrationService
//go:generate mockgen -package=mocks -destination=./mocks/entitlement.go css.cisco.com/licensing/client-agent EntitlementService

const (smartLicenseName = "license-sample"secretName = "secret-sample"defaultNs = "default"licenseType = "L-ASAV105-STD"secretToken = "MTIz"
)

var (minLicenseCount uint32 = 1maxLicenseCount uint32 = 5newMaxLicenseCount uint32 = 10scalingFactor uint32 = 2
)

var _ = Describe("SmartLicense Controller Test", func() {

licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

var reconciler *controllers.SmartLicenseReconciler
var fakeClient client.Client
var mockCtrl *gomock.Controller

var licensingClient *mocks.MockLicensingClient
var registrationService *mocks.MockRegistrationService
var entitlementService *mocks.MockEntitlementService
var (  
smartLicense *v1.SmartLicense  
secret     *corev1.Secret  
)  

BeforeEach(func() {  
mockCtrl = gomock.NewController(GinkgoT())  
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  

registrationService = mocks.NewMockRegistrationService(mockCtrl)  
entitlementService = mocks.NewMockEntitlementService(mockCtrl)  
licensingClient = mocks.NewMockLicensingClient(mockCtrl)  
reconciler = &controllers.SmartLicenseReconciler{  
Client: fakeClient,  
LicensingClient: licensingClient,  
Log: logf.NullLogger{},  
Recorder: record.NewFakeRecorder(1024),  
}  

licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()  
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()  

secret = &corev1.Secret{  
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},  
Data: map[string][]byte{"token": []byte(secretToken)},  
}  
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())  

smartLicense = &v1.SmartLicense{  
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},  
Spec: v1.SmartLicenseSpec{  
Action: v1.Register,  
TokenSecret: corev1.SecretReference{  
Name: secretName,  
Namespace: defaultNs,  
},  
LicenseType: licenseType,  
MinLicenseCount: &minLicenseCount,  
MaxLicenseCount: &maxLicenseCount,  
ScalingFactor: &scalingFactor,  
},  
}  
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())  
})  

AfterEach(func() {  
mockCtrl.Finish()  
})
Context("platform registration", func() {
It("should register platform in licensing system", func() {
registrationService.EXPECT().Register(&licensing.Platform{
Uuid:    string(smartLicense.UID),
Name:    licenseNsName.String(),
SerialNumber: "8B201B63BB8",
ProductId: controllers.SFCNProductId,
PoolName:   defaultNs,
}, secretToken, gomock.Any()).Return(&licensing.Registration{
ContextId:          "testContextId",
SmartAccountName:   "TestAccountName",
VirtualAccountName: "TestVirtualName",
ExportControlled:   true,
IsRegistered:       false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
ContextId:       "testContextId",
EntitlementId:   licenseType,
MinEntitlements: minLicenseCount,
MaxEntitlements: maxLicenseCount,
ScalingFactor:   scalingFactor,
}).Return(nil)
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))})

It("should ignore ErrDuplicateListener error", func() {
registrationService.EXPECT().Register(gomock.Any(), gomock.Any(), gomock.Any()).Return(&licensing.Registration{
ContextId: "testContextId",
IsRegistered: false,
}, nil)
entitlementService.EXPECT().ScaleEntitlement(gomock.Any()).Return(nil)
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
}

Context("platform deregistration", func() {
  It("should deregister platform in licensing system", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.ContextId = "testContextId"
    smartLicense.Status.RegistrationState = v1.Registered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
  })

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
  Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
})

It("should skip deregistration if platform is already deregistered", func() {
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  smartLicense.Status.RegistrationState = v1.Deregistered
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})

It("should deregister platform on resource deletion", func() {
  smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
  now := metav1.Now()
  smartLicense.DeletionTimestamp = &now
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
smartLicense.Status.RegistrationState = v1.Registered
smartLicense.Status.ContextId = "testContextId"
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
registrationService.EXPECT().Deregister("testContextId").Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
// cannot check finalizer removal due to a bug in fakeClient: https://github.com/kubernetes/client-go/issues/607
// Expect(smartLicense.Finalizers).ShouldNot(ContainElement(finalizerName))
})
})

Context("smart license updating", func() {
It("license state should not be updated", func() {
  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  licenseStateBeforeUpdate := smartLicense.Status.LicenseState,
smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
    gomock.Any()).Return(&licensing.Registration{
      ContextId:    "testContextId",
      IsRegistered: true,
    }, nil)
  entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
  entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
    ContextId:    "testContextId",
    EntitlementId: licenseType,
    MinEntitlements: minLicenseCount,
    MaxEntitlements: newMaxLicenseCount,
    ScalingFactor: scalingFactor,
  }).Return(nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))
})
})

package subscribers

import (licensing "css.cisco.com/licensing/client-agent"
  "css.cisco.com/licensing/client-agent/proto"

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func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
    return &subscriptionListener{
        channel: channel,
        log:     log,
    }
}

type subscriptionListener struct {
    channel chan event.GenericEvent
    log     logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)
    switch e.Type {
    case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED, proto.AllotmentEvent_ALLOTMENT_DENIED:
        l.log.V(1).Info("scheduling event for PodLicenseReconciler")
        l.sendEventToChannel(e.Tenant.Name)
    }
}

func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
        Name:      namespacedName[1],
        Namespace: namespacedName[0],
    }}
    l.channel <- event.GenericEvent{Object: pod}
}

package listeners
import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "time"
}

func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger,
                               recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
    return &deregistrationListener{
        log:             log,
        client:          client,
        licenseNsName:   licenseNsName,
        recorder:        recorder,
        notifierChannel: notifierChannel,
        retries:         int
    }
}

const MaxRetries = 10

func OnAutoDeregistrationUpdatesSmartLicenseStatusToDeregisteredState()
// The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
    log := d.log.WithValues("smartlicense", d.licenseNsName)
    log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)
    if err := d.warnSmartLicenseDeregistered(msg); err != nil {
        if d.retries < MaxRetries {
            log.Error(err, "failed to process auto-deregistration event. retrying...")
            d.retries++
        } else {
            log.Error(err, "failed to process auto-deregistration event after retries")
        }
    }
```go
time.Sleep(1 * time.Second)
d.OnAutoDeregistration(platform, msg)
return
}
log.Error(err, "failed to process auto-deregistration event")
return
}
d.retries = 0
log.V(1).Info("successfully processed auto-deregistration event")
}

func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
    var license v1.SmartLicense
    if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status-LicenseNumber = 0
    license.Status.CoresPerLicense = 0
    license.Status.EstimatedMaxReplicas = 0
    if err := d.client.Status().Update(context.Background(), &license); err != nil {
        return fmt.Errorf("failed to update SmartLicense status: %w", err)
    }
    d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
    d.notifierChannel <- event.GenericEvent{Object: &license}
    return nil
}
```

```go
package controllers

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/pkg/predicates"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
```

package mocks

//go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator

type ReplicasCalculator interface {
  CalculateMaxLicensedReplicas/licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error)
}

type DeploymentLicenseReconciler struct {
  client.Client
  Log                logr.Logger
  Recorder           record.EventRecorder
  ReplicasCalculator ReplicasCalculator
}

func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
  return ctrl.NewControllerManagedBy(mgr).
    For(&appsv1.Deployment{}, builder.WithPredicates(
      &predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey: InitialReplicasNumberAnnotation}).
    Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.DeploymentHandler()).
    Complete(c)
}

// Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value
// when it exceeds the replicas allowed by licensing config.
func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
  log := c.Log.WithValues("deployment", req.NamespacedName)
  log.V(1).Info("reconciliation started")
  start := time.Now()
  defer func() {
    log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
  }()

  deployment := &appsv1.Deployment{
    if err != nil {
      if errors.IsNotFound(err) {

```
log.Info("Deployment does not exist, nothing to reconcile")
}
return ctrl.Result{}, client.IgnoreNotFound(err)
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("updated Deployment labels")
}

if len(deploymentLicenses) == 0 {
    log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentControlledByHPA", "%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", deployment.Name, hpa.Name, hpa.Name)
if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
    initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
    if err != nil {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "WrongInitialReplicasNumber",
            fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
        return ctrl.Result{}, err
    }
    log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
    *deployment.Spec.Replicas = int32(initialReplicasCountInt)
    // delete initial replicas number from Deployment annotations to don't back to initial number on each reconciliation
    delete(deployment.Annotations, InitialReplicasNumberAnnotation)
    if err = c.Client.Update(context.Background(), deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    c.Recorder.Event(deployment, corev1.EventTypeNormal, "ScaledDeploymentToInitialReplicasNumber",
        fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))
}

if *deployment.Spec.Replicas > maxLicensedReplicas {
    log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas",
        *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
    *deployment.Spec.Replicas = maxLicensedReplicas
    if err = c.Client.Update(context.Background(), deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
    }
        Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check
        SmartLicense resource to increase the limit.", maxLicensedReplicas))
    log.Info("successfully scaled down deployment to max license limit", "updatedReplicas",
        *deployment.Spec.Replicas)
    return ctrl.Result{}, nil
}

log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas",
    *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment
groupv1.Deployment) (*autoscalingv1.HorizontalPodAutoscaler, error) {
    hpaList := &autoscalingv1.HorizontalPodAutoscalerList{}
if err != nil {
    return nil, err
}

for _, hpa := range hpaList.Items {
        return &hpa, err
    }
}

return nil, err
}

package controllers

import {
    "context"
    "errors"
    "fmt"
    "strconv"
    "time"

    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/pkg/predicates"
    licensing "css.cisco.com/licensing/client-agent"
    "github.com/go-logr/logr"
    appsV1 "k8s.io/api/apps/v1"
    autoscalingV1 "k8s.io/api/autoscaling/v1"
    coreV1 "k8s.io/api/core/v1"
    corev1 "k8s.io/api/core/v1"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/labels"
    "k8s.io/apimachinery/pkg/selection"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "k8s.io/utils/pointer"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/source"
}

type PodLicenseReconciler struct {
    client.Client
    LicensingClient licensing.LicensingClient
    Log            logr.Logger
}

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Recorder record.EventRecorder

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&coreV1.Pod{}, builder.WithPredicates(&predicates.LabelExistsPredicate{Key: LicenseHolderLabel})).
        Watches(&source.Channel{Source: eventChannel}, &handler.EnqueueRequestForObject{}).
        Complete(c)
}

// Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
// a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
// On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    pod := coreV1.Pod{}
    podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
    err := c.Client.Get(ctx, podNsName, &pod)
    if err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("Pod does not exist, releasing allotments it might still hold")
            return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
        }
        return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
    }

    status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    shouldHaveLicensingLabel := status != nil && status.NumCores != 0
    changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
    if changed {
        if err = c.Client.Update(ctx, &pod); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
        }
        log.Info("updated Pod labels")
    }
}
deployment, err := c.findPodDeployment(&pod)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
}

if deployment == nil {
    log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
    if err := c.Client.Delete(context.Background(), &pod); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
    }
    c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration."))
    log.Info("deleted orphan Pod")
    return ctrl.Result{}, nil
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

serviceRole := getDeploymentServiceRole(deployment)

if !serviceRoleIsRegistered, err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole) {
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
    }
    if !serviceRoleIsRegistered {
        if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
            return ctrl.Result{}, err
        }
    } else {
        if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
            return ctrl.Result{}, err
        }
    }
}

if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
    return ctrl.Result{}, err
}

return ctrl.Result{}, nil

// releaseAllotmentsIfAny releases licensing allotments that Pod held in the licence-server
 func (c *PodLicenseReconciler) releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
tenant := &licensing.Tenant{Name: nsName.String()}
status, err := c.LicensingClient.Allotment().Status(tenant)
if err != nil {
    if errors.Is(err, licensing.ErrNotRegistered) {
        log.Info("Pod tenant is not registered in license server, nothing to release")
        return nil
    }
    return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
}

if status != nil && status.NumCores != 0 {
    log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
    if err := c.LicensingClient.Allotment().ReleaseAllotment(&licensing.AllotmentRelease{
        ContextId: status.ContextId,
        Tenant:    tenant,
    }); err != nil {
        return fmt.Errorf("failed to release Pod allotments: %w", err)
    }
    log.Info("successfully released Pod allotments")
    return nil
}

log.Info("Pod does not hold any allotments, nothing to release")
return nil
}

func (c *PodLicenseReconciler) podLogger(pod *corev1.Pod) logr.Logger {
}

func toLicenseTenant(pod corev1.Pod) *licensing.Tenant {
    podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
    return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each service role
// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is scaled down.
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the namespace")

    trialDeploymentList := appsv1.DeploymentList{}

labelSelector := labels.NewSelector()
trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals, []string{"true"})
if err == nil {
    labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
}
serviceRole := getDeploymentServiceRole(deployment)
serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals, []string{string(serviceRole)})
if err == nil {
    labelSelector = labelSelector.Add(*serviceLabelRequirement)
}
if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
    Namespace: deployment.Namespace,
    LabelSelector: labelSelector,
}); err != nil {
    return fmt.Errorf("failed to fetch Deployments with trial license label")
}
log.Info("Length of trial deployment list", "length", len(trialDeploymentList.Items))
var allowedReplicas int32 = 0
trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name == deployment.Name
if trialDeploymentIsAbsent || isDeploymentInTrial {
    log.Info("Deployment has to be marked as trial license holder")
    allowedReplicas = 1
}

trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
scaleDownRequired := *deployment.Spec.Replicas > allowedReplicas
if scaleDownRequired || trialLabelUpdated {
    initialReplicasNumber := strconv.Itoa(int(pointer.Int32PtrDerefOr(deployment.Spec.Replicas, 1)))
    log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
    deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
    deployment.Spec.Replicas = &allowedReplicas
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    if scaleDownRequired {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown", fmt.Sprintf("Decreased Deployment's Replicas to %d "+
            "as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. "+
            "Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas))
        log.Info("scaled Deployment", "replica count", allowedReplicas)
    }
}
return nil
// throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
// If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList []v1.SmartLicense, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
    if err != nil {
        return fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }

    if !containsString(licensedDeploymentNames, deployment.Name) {
        log.Info("scaling down Pod's Deployment to 0 as it requested license but does not belong to any licensed EP deployment")
        *deployment.Spec.Replicas = 0
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment resource: %w", err)
        }
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
            fmt.Sprintf("Decreased Deployment's Replicas to 0 "+
                "as it requested license but does not belong to any licensed EP deployment. "+
                "Please, check SmartLicense resources to update licensing configuration."))
        log.Info("scaled down Pod's Deployment to 0")
        return nil
    }

    log.Info("verified that Pod belongs to the licensed Deployment")
    return nil
}

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
func (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment: %w", err)
        }
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
            fmt.Sprintf("Decreased Deployment's Replicas to 0 "+
                "as it requested license but does not belong to any licensed EP deployment. "+
                "Please, check SmartLicense resources to update licensing configuration."))
        log.Info("removed Deployment trial license label")
        return nil
    }

    log.Info("verified that Pod belongs to the licensed Deployment")
    return nil
}

// getLicensedDeploymentNames collects names of all Deployments that have a corresponding SmartLicense resource.
func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
    var deploymentNames []string
    for _, license := range licenseList {
        }
switch license.Spec.ScalingRef.Kind {
  case v1.DeploymentKind:
    deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
  case v1.HPAKind:
    hpa := &autoscalingv1.HorizontalPodAutoscaler{
      hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
      if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
        return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
      }
      deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
    }
  default:
}

// findPodDeployment tries to find Pod's Deployment if Pod is managed by Deployment. 
// If Pod is not managed by Deployment controller, `nil` is returned.
func (c *PodLicenseReconciler) findPodDeployment(pod *corev1.Pod) (*appsv1.Deployment, error) {
  log := c.podLogger(pod)
  if len(pod.OwnerReferences) != 1 || !*pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind != "ReplicaSet" {
    log.Info("pod is not owned by ReplicaSet")
    return nil, nil
  }

  replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
  replicaSet := &appsv1.ReplicaSet{
    replicaSetNsName.Name, replicaSetNsName.Namespace}
  if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
    return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
  }

  if len(replicaSet.OwnerReferences) != 1 || !*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
    log.Info("pod's ReplicaSet is not owned by Deployment")
    return nil, nil
  }

  deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
  deployment := &appsv1.Deployment{
    deploymentNsName.Name, deploymentNsName.Namespace}
  if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
    return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
  }
  return deployment, nil
}
// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in registeredLicenses.
// It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified service role label.
func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense, namespace string, serviceRole string) (bool, error) {
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
    if err != nil {
        return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }
    for _, deploymentName := range licensedDeploymentNames {
        deployment := &appsv1.Deployment{
            deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
            err := c.Client.Get(context.Background(), deploymentNsName, deployment)
            if err != nil {
                return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
            }
            if getDeploymentServiceRole(deployment) == serviceRole {
                return true, nil
            }
        }
    }
    return false, nil
}

func getDeploymentServiceRole(deployment *appsv1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: RegistrationService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

//MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {

Open Source Used In kASA v1.5

```go
ctrl *gomock.Controller
recorder *MockRegistrationServiceMockRecorder

// MockRegistrationServiceMockRecorder is the mock recorder for MockRegistrationService
type MockRegistrationServiceMockRecorder struct {
mock *MockRegistrationService
}

// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister",
        reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener) (*service.Registration, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
    ret0, _ := ret[0].(*service.Registration)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
```
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}
val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistrylessTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val getPublicTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String, String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra

val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(":")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

ext {
    set("publishImages", listOf("imageName" as String,
        licenseServerImageName") as String
    )
}

tasks {
    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }

    named("dockerBuild") {
        doLast {
            exec {
                environment("DOCKER_BUILDKIT", 1)
            }
        }
    }
}
commandLine("docker build -f ./Dockerfile -t $imageNameForPush ../").split(" "))
}
val artifactoryUser = project.findProperty("artifactoryUser")!! as String
val artifactoryApiKey = project.findProperty("artifactoryApiKey")!! as String
val saArtifactoryUrl = project.findProperty("saArtifactoryUrl")!! as String
val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
val downloadUrl = "$saArtifactoryUrl/com/cisco/css/sl/sa-server/$saServerArtifactVersion/sa-server" + 
"-$saServerArtifactVersion-all.jar"
if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
  exec {
    setWorkingDir("bin")
    commandLine = listOf(
      "bash", "-c",
      "curl -f -u $artifactoryUser:$artifactoryApiKey -O $downloadUrl"
    )
  }
}
exec {
  environment("DOCKER_BUILDKIT", 1)
  commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../").split(" "))
}
}
}
val licenseServerImageName: String? by project
onlyIf {
  licenseServerImageName != null
}
doLast {
  val sourceTag: String? by project
  val sourceRepo: String? by project
  val imageTag: String? by project
  if (sourceTag == null || sourceRepo == null || imageTag == null) {
    val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please,
specify them with: -PsouceTag=<srcImageTag> -PsoureRepo=<sourceRepoName> -PimageTag=<targetImageTag>"
    logger.error(msg)
    throw GradleException(msg)
  }
  val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
  val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split(':')[0]
promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
}
}

named("check") {
doLast {
    execCommands(listOf(
        "go fmt ./...",
        "go vet ./...")
    )
}
}

named("test") {
    doLast {
        execCommands(listOf(
            "go test -coverpkg=./... -coverprofile cover.out ./...",
            "go tool cover -func=cover.out -o ${project.name}-cover.txt"
        )
    )
}
}

named("publish") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        println(execCommand("docker push $serverImageNameForPush"))
    }
}

named("manifests") {
    dependsOn("controller-gen")
    description = "Generates manifests for k8s deployment using Helm"
    doLast {
        execHelmCommand("helm dependency update")
        val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")} . --namespace $systemNamespace --set nameOverride=licenseapi")
        buildDir.deleteRecursively()
        buildDir.mkdir()
        File("$buildDir/license-broker.yaml").writeText(stdOut)
    }
}

named<Copy>("generateValuesFile") {
    expand(
        "platform" to project.findProperty("platform")!!,
        "registry" to project.findProperty("dockerRegistry")!!,
        "artifactoryRepo" to project.findProperty("imageDirectory")!!,
        "controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
    )
doLast {
    val clusterName: String by project
    execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")
    execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
}
}
}
Please review the EULA agreement and set the flag '--set global.acceptEULA=[yes, or agree]' for acknowledgement.

Cisco End User License Agreement

package integ_tests

import (  
    "context"  
    v1 "css.cisco.com/kasa/license-broker/api/v1"  
    . "github.com/onsi/ginkgo"  
    . "github.com/onsi/gomega"  
    "k8s.io/apimachinery/pkg/api/errors"  
    "k8s.io/client-go/kubernetes/scheme"  
    "k8s.io/client-go/rest"  
    "path/filepath"  
    "sigs.k8s.io/controller-runtime/pkg/client"  
    "sigs.k8s.io/controller-runtime/pkg/envtest"  
    "sigs.k8s.io/controller-runtime/pkg/envtest/printer"  
    "sigs.k8s.io/controller-runtime/pkg/log/zap"  
    "strings"  
    "testing"  
    "time"
)

logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {
    RegisterFailHandler(Fail)
    SetDefaultEventuallyTimeout(time.Minute)
    RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite", []Reporter{printer.NewlineReporter{}})
}
var _ = BeforeSuite(func(done Done) {
    logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))

    By("bootstrapping test environment")
    apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
    apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
    testEnv = &envtest.Environment{
        WebhookInstallOptions: envtest.WebhookInstallOptions{
            Paths: []string{filepath.Join("..", "config", "webhook")},
        },
        CRDDirectoryPaths: []string{filepath.Join("..", "config", "crd")},
        KubeAPIServerFlags: apiServerFlags,
        ControlPlaneStartTimeout: 100 * time.Second,
        ControlPlaneStopTimeout: 100 * time.Second,
    }

    var err error
    cfg, err = testEnv.Start()
    Expect(err).ToNot(HaveOccurred())
    Expect(cfg).ToNot(BeNil())

    err = v1.AddToScheme(scheme.Scheme)
    Expect(err).ToNot(HaveOccurred())

    k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
    Expect(err).ToNot(HaveOccurred())
    Expect(k8sClient).ToNot(BeNil())

    By("running webhook server")
    go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done)
}, envtest.StartTimeout)

var _ = AfterSuite(func(done Done) {
    By("tearing down the test environment")
    cancelCtx()
    Expect(testEnv.Stop()).ToNot(HaveOccurred())

    close(done)
}, envtest.StopTimeout)

func errCauses(err error) []string {
    var causes []string
    if statusError, ok := err.(*errors.StatusError); ok {
        for _, cause := range statusError.Status().Details.Causes {
            causes = append(causes, strings.Split(cause.Message, ": ")[:2])
        }
    }
    return causes
}
package v1

import (
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
)

const TokenKeyName = "token"

type RegistrationAction string

const (  
    Register  RegistrationAction = "REGISTER"  
    Deregister RegistrationAction = "DEREGISTER"
)

// SmartLicenseSpec defines the desired state of SmartLicense
type SmartLicenseSpec struct {

    // Action is the desired state of the Smart Agent license registration.  
    // +kubebuilder:validation:Enum=REGISTER;DEREGISTER  
    // +optional  
    Action RegistrationAction `json:"action"`

    // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.  
    TokenSecret v1.SecretReference `json:"tokenSecret"`

    // LicenseType defines the type of license to request/release, usually the SKU of the license.  
    // The default value is a SFW license tag being able to handle 1vCPU.  
    // +optional  
    LicenseType string `json:"licenseType"`

    // MinLicenseCount is a minimum number of licenses SFCN reserves for the product.  
    // The default value is 1.  
    // +optional  
    MinLicenseCount *uint32 `json:"minLicenseCount,omitempty"`

    // MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.
// The default value is equal to MinLicenseCount.
// +optional
MaxLicenseCount *uint32 `json:"maxLicenseCount,omitempty"

// ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when
// scaling up or down.
// The default value is 1.
// +optional
ScalingFactor *uint32 `json:"scalingFactor,omitempty"

// ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA
// resources are supported.
ScalingRef autoscalingv1.CrossVersionObjectReference `json:"scalingRef,omitempty"

type LicenseState string

const (
    PendingLicenseState LicenseState = "PENDING"
    Unlicensed  LicenseState = "UNLICENSED"
    InCompliance LicenseState = "IN_COMPLIANCE"
    OutOfCompliance LicenseState = "OUT_OF_COMPLIANCE"
    Overage     LicenseState = "OVERAGE"
)

const (    DeploymentKind = "Deployment"
    HPAKind = "HorizontalPodAutoscaler"
)

type RegistrationState string

const (    PendingRegistrationState RegistrationState = "PENDING"
    Registered RegistrationState = "REGISTERED"
    RegistrationFailed RegistrationState = "REGISTRATION_FAILED"
    Deregistered RegistrationState = "DEREGISTERED"
    DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
)

// SmartLicenseStatus defines the observed state of SmartLicense
type SmartLicenseStatus struct {

    // AccountDomain is the account domain in Cisco Software Central.
    AccountDomain string `json:"accountDomain,omitempty"

    // AccountName is the name of the virtual account in Cisco Software Central.
    AccountName string `json:"accountName,omitempty"
// RegistrationState is the registration status of the SFCN product in Cisco Software Central.
/+kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DEREGISTRATION_FAILED
RegistrationState RegistrationState `json:"registrationState,omitempty"`

// LicenseState is the state of the reserved licenses.
/+kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVERAGE
LicenseState LicenseState `json:"licenseState,omitempty"`

// ErrorReason specifies the error due to which the SFCN product was not registered in Cisco Software Central.
ErrorReason string `json:"errorReason,omitempty"`

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
LicenseNumber uint32 `json:"licenseNumber,omitempty"`

// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicense,omitempty"`

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicas,omitempty"`

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlled,omitempty"`

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextId,omitempty"`
}

/+kubebuilder:object:root=true
/+kubebuilder:subresource:status
/+kubebuilder:printcolumn:name="Age",type="date",JSONPath=".metadata.creationTimestamp"
/+kubebuilder:printcolumn:name="Registration State",type="string",JSONPath=".status.registrationState"
/+kubebuilder:printcolumn:name="License Number",type="integer",JSONPath=".status.licenseNumber"
/+kubebuilder:printcolumn:name="Domain",type="string",priority=1,JSONPath=".status.accountDomain"
/+kubebuilder:printcolumn:name="Account",type="string",priority=1,JSONPath=".status.accountName"

// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
    metav1.TypeMeta `json:"",inline"
    metav1.ObjectMeta `json:"metadata,omitempty"

    Spec SmartLicenseSpec `json:"spec,omitempty"
    Status SmartLicenseStatus `json:"status,omitempty"
package v1

import (
    "k8s.io/apimachinery/pkg/runtime/schema"
    "sigs.k8s.io/controller-runtime/pkg/scheme"
)

var (    // GroupVersion is group version used to register these objects
)

// SchemeBuilder is used to add go types to the GroupVersionKind scheme
SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}

// AddToScheme adds the types in this group-version to the given scheme.
AddToScheme = SchemeBuilder.AddToScheme
)

domain: sfcn.cisco.com
repo: css.cisco.com/kasa/license-broker
resources:
- group: sfcn.cisco.com
  kind: SmartLicense
  version: v1
  version: "2"
package controllers

import {
    "crypto/md5"
    "fmt"
}

v1 "css.cisco.com/kasa/license-broker/api/v1"
metav1 "k8s.io/api/machinery/pkg/apis/meta/v1"

const ( LicenseHolderLabel = "sfcn.cisco.com/license-holder" TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder" ServiceRoleLabel = "sfcn.cisco.com/service-role"
// DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set DefaultServiceRole = "default"
InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"
)

// serialNumber generates platform's Serial Number for SmartLicense resource.
// According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {
    return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName)))[0:11]
}

func containsString(slice []string, s string) bool {
    for _, item := range slice {
        if item == s {
            return true
        }
    }
    return false
}

func removeString(slice []string, s string) (result []string) {
    for _, item := range slice {
        if item == s {
            continue
        }
        result = append(result, item)
    }
    return
}

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Status.Template.RegistrationState == state {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}
if license.Status.RegistrationState == state {
    filteredLicenses = append(filteredLicenses, license)
}
}
return filteredLicenses
}

// filterLicensesByKind filters SmartLicenses by given kind and name properties of ScalingRef field and returns the result.
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// pendingLicenseExists returns true if any license in the list is in Pending state.
func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status.LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

// setLicenseLabel makes sure that the licensing label is present when `shouldBePresent` is `true` and that the label is absent when `shouldBePresent` is `false`.
func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
        return true
    }
    if _, ok := meta.Labels[label]; ok && !shouldBePresent {
        delete(meta.Labels, label)
        return true
    }
    return false
}
package services

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "math"
    "sigs.k8s.io/controller-runtime/pkg/client"
)

    return &ReplicasCalculator{client, logger}
}

type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and calculates maximum amount of replicas based on licensing. // If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    var maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 &
    deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods", "deployment", deployment.Name)
        // it can be a scenario when we have spec.Replicas = 5, but Status.ReadyReplicas = 0. So, we just return desired replicas by a user.
        return *deployment.Spec.Replicas, nil
    }
    var err error
    if coresQuantity == 0 &
    deployment.Status.ReadyReplicas != 0 {
        coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
        if err != nil {
            return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
        }
    }
}
r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores", coresQuantity)

for _, license := range licenses {
    if license.Status.LicenseState == v1.InCompliance {
        maxLicensedCores := int(*license.Spec.MaxLicenseCount) * int(license.Status.CoresPerLicense)
        maxLicensedReplicas := int32(maxLicensedCores / int(coresQuantity))
        r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)
        maxLimit += maxLicensedReplicas
        license.Status.EstimatedMaxReplicas = maxLicensedReplicas
        if err := r.Client.Status().Update(ctx, &license); err != nil {
            return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
        }
    }
}
// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil
}

func (r *ReplicasCalculator) getCoresQuantity(deployment *appsv1.Deployment) uint32 {
    coresQuantity := resource.MustParse("0")
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
            return 0
        }
        coresQuantity.Add(containerLimit)
    }
    return uint32(coresQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
    podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    if err != nil {
        return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
    }
    pods := corev1.PodList{}
    if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
        return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
    }
// TODO: do not rely on the fact that all nodes have the same CPU limit
pod := pods.Items[0]

node := corev1.Node{}
odeNsName := types.NamespacedName{Name: pod.Spec.NodeName}
if err := r.Client.Get(ctx, nodeNsName, &node); err != nil {
    return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
}
r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPULimit, nil

1.298 base-files 9.9+deb9u13
1.298.1 Available under license:

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[This is the first released version of the library GPL. It is
numbered 2 because it goes with version 2 of the ordinary GPL.]

Preamble

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However, unrestricted linking of non-free programs would deprive the
users of those programs of all benefit from the free status of the
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Version 3, 29 June 2007

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1.299 kasa-pkg-client-core v0.0.0

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```yaml
{{- $global := default (dict ) $.Values.global -}}
{{- $dataPlaneNamespace := include "aegis.namespace.dataPlaneNamespace" (list $) -}}
{{- if ($global.platform | eq "azure") }}
{{ include "kasa.licensebroker.storageAzureDisk" (list $ "azure-disk-sc") }}
{{- else if ($global.platform | ne "aws") | and ($global.platform | ne "eks") }}
{{ include "kasa.licensebroker.storageLocal" (list $ "broker") }}
{{- end }}
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: {{ template "aegis.metadata.fullname" (list $ "server") }}
labels: {{ include "aegis.metadata.standardLabels" (list $) | nindent 4 }}
spec:
  accessModes:
  - ReadWriteOnce
  volumeMode: Filesystem
{{- if ($global.platform | eq "aws") | or ($global.platform | eq "eks") }}
storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */}}
{{- else if ($global.platform | eq "azure") }}
storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc") }} {{/* example yaml has
```
managed-csi' as the name which is vague af */})

{{- else if ($global.platform | eq "kind") }}
  storageClassName: "standard" {{/* Kind has a default 'standard' StorageClass so reusing it here */}}
{{- else }}
  storageClassName: {{ include "aegis.metadata.fullname" (list $ "broker") }}
{{- end }}

resources:
  requests:
    storage: {{$.Values.licenseServerStorage}}

---

{{- define "kasa.licensebroker.storageLocal" -}}
  {{- $ := first . -}}
  {{- $storageName := last . -}}
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  {{ template "aegis.metadata.standard" (list $ $storageName) }}
  provisioner: kubernetes.io/no-provisioner
  reclaimPolicy: Delete
  volumeBindingMode: WaitForFirstConsumer
{{- end -}}

---

{{- define "kasa.licensebroker.storageAzureDisk" -}}
  {{- $ := first . -}}
  {{- $storageName := last . -}}
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  {{ template "aegis.metadata.standard" (list $ $storageName) }}
  provisioner: disk.csi.azure.com
  parameters:
    {{- /* TODO: parameterize the sku and other params https://github.com/kubernetes-sigs/azuredisk-csi-driver/blob/v1.2.0/docs/driver-parameters.md */}}
  reclaimPolicy: Delete
  volumeBindingMode: WaitForFirstConsumer
  allowVolumeExpansion: true
{{- end -}}

{{- define "kasa.validate.eula" -}}
  {{- $ := first . -}}
  $acceptValues := list "yes" "agree"
  {{ if $.Release.IsInstall | and (not ($acceptValues | has $.Values.global.acceptEULA)) -}}
    {{- $.Files.Get "eula/EULA.txt" }}
  {{- end -}}
{{- end -}}

package listeners_test

import (
"context"

v1 "css.cisco.com/kasa/license-broker/api/v1"
"css.cisco.com/kasa/license-broker/controllers/listeners"
licensing "css.cisco.com/licensing/client-agent"
"github.com/golang/mock/gomock"
"github.com/onsi/ginkgo"
"github.com/onsi/gomega"
corev1 "k8s.io/api/core/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/kubernetes/scheme"
"k8s.io/client-go/tools/record"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
"sigs.k8s.io/controller-runtime/pkg/event"
logf "sigs.k8s.io/controller-runtime/pkg/log"

var _ = Describe("Deregistration Listener Test", func() {

licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

var listener licensing.DeregistrationListener
var fakeClient client.Client
var mockCtrl *gomock.Controller
var recorder *record.FakeRecorder

var smartLicense *v1.SmartLicense
var notifier chan event.GenericEvent

BeforeEach(func() {
  smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
      Action:      v1.Register,
      LicenseType: licenseType,
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.Registered,
      LicenseState:      v1.InCompliance,
      ErrorReason:       "",
    },
  }
  mockCtrl = gomock.NewController(GinkgoT())
  fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
  recorder = record.NewFakeRecorder(1024)
notifier = make(chan event.GenericEvent, 10)

listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger{}, recorder, notifier)

AfterEach(func() {
  mockCtrl.Finish()
})

It("should update SmartLicense status on deregistration event", func() {
  listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
  Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response to out-of-band event from License Server")))
  Expect(notifier).Should(Receive(&event.GenericEvent{
    Object: smartLicense,
  }))
})

package services_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"

  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})
package controllers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/api/metrics/v1"
    "k8s.io/api/metrics/pod/v1"
    "k8s.io/api/core/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    "k8s.io/utils/pointer"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (
    epHpaName                   = "epHPA"
    initialHPAMaxReplicas int32 = 3
)

var _ = Describe("HPA License Controller Test", func() {

    hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}
    var (hpaNsName = types.NamespacedName{Namespace: defaultNs, Name: epHpaName}

    reconciler         *controllers.HPALicenseReconciler
    fakeClient         client.Client
    mockCtrl           *gomock.Controller
    hpa                 *autoscalingv1.HorizontalPodAutoscaler
    smartLicense        *v1.SmartLicense
    recorder            *record.FakeRecorder
    replicasCalculatorMock *mocks.MockReplicasCalculator
)

    BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
        recorder = record.NewFakeRecorder(1024)
        replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

        reconciler = &controllers.HPALicenseReconciler{
Client: fakeClient,
Log: logf.NullLogger{},
Recorder: recorder,
ReplicasCalculator: replicasCalculatorMock,

smartLicense = &v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
  Spec: v1.SmartLicenseSpec{
    Action: v1.Register,
    LicenseType: licenseType,
    MinLicenseCount: &minLicenseCount,
    MaxLicenseCount: &maxLicenseCount,
    ScalingFactor: &scalingFactor,
  },
  Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

deployment := &appsv1.Deployment{
  ObjectMeta: metav1.ObjectMeta{
    Name: "ep",
    Namespace: defaultNs,
  },
  Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

hpa = &autoscalingv1.HorizontalPodAutoscaler{
  ObjectMeta: metav1.ObjectMeta{
    Name: epHpaName,
    Namespace: defaultNs,
  },
  Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
    MaxReplicas: initialHPAMaxReplicas,
  },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

AfterEach(func() {
  Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
})
It("should skip if HPA does not exist", func() {
  Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
  Expect(err).To(BeNil())
})

It("should skip if HPA SmartLicense does not exist", func() {
  Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
  Expect(err).To(BeNil())
}

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if SmartLicense is in deregistered state", func() {
  smartLicense.Status.RegistrationState = v1.Deregistered
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
  Expect(err).To(BeNil())
}

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if registered SmartLicense has enough licenses", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
  gomock.Any()).Return(initialHPAMaxReplicas, nil)
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
  Expect(err).To(BeNil())
}

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
  gomock.Any()).Return(int32(2), nil)
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
  Expect(err).To(BeNil())
}

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
  gomock.Any()).Return(int32(2), nil)
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
  Expect(err).To(BeNil())
}

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Spec.MinReplicas).Should(BeNil())
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))
}

It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
 replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
 gomock.Any()).Return(int32(2), nil)
 Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

 hpa.Spec.MaxReplicas = 10
 hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
 Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())

 _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName })
 Expect(err).To(BeatNil())

 Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
 Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
 Expect(*hpa.Spec.MinReplicas).Should(Equal(int32(2)))
 Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
 Expect(recorder.Events).Should(HaveLen(1))
 Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas MinReplicas] to 2 ")))
})

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
 replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
 gomock.Any()).Return(int32(2), nil)
 Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
 smartLicense2 := &v1.SmartLicense{
 Spec: smartLicense.Spec,
 }
 Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())
 smartLicense3 := &v1.SmartLicense{
 ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
 Spec: smartLicense.Spec,
 Status: v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
 }
Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))

---

apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  annotations:
    controller-gen.kubebuilder.io/version: v0.4.1
creationTimestamp: null
name: smartlicenses.sfcn.cisco.com
spec:
group: sfcn.cisco.com
names:
  kind: SmartLicense
  listKind: SmartLicenseList
  plural: smartlicenses
  singular: smartlicense
scope: Namespaced
versions:
  - additionalPrinterColumns:
    - jsonPath: .metadata.creationTimestamp
      name: Age
      type: date
    - jsonPath: .status.registrationState
      name: Registration State
      type: string
    - jsonPath: .status.licenseState
      name: License State
      type: string
    - jsonPath: .status.licenseNumber
      name: License Number
      type: integer
    - jsonPath: .status.accountDomain
      name: Domain
      priority: 1
      type: string
- jsonPath: .status.accountName
  name: Account
  priority: 1
  type: string
  name: v1

schema:
  openAPIV3Schema:
    description: SmartLicense is the Schema for the smartlicenses API
    properties:
      apiVersion:
        description: 'APIVersion defines the versioned schema of this representation of an object. Servers should convert recognized schemas to the latest internal value, and may reject unrecognized values. More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#resources'
        type: string
      kind:
        description: 'Kind is a string value representing the REST resource this object represents. Servers may infer this from the endpoint the client submits requests to. Cannot be updated. In CamelCase. More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'
        type: string
      metadata:
        type: object
      spec:
        description: SmartLicenseSpec defines the desired state of SmartLicense
        properties:
          action:
            description: Action is the desired state of the Smart Agent license registration.
            enum:
              - REGISTER
              - DEREGISTER
            type: string
          licenseType:
            description: LicenseType defines the type of license to request/release, usually the SKU of the license. The default value is a SFW license tag being able to handle 1vCPU.
            type: string
          maxLicenseCount:
            description: MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product. The default value is equal to MinLicenseCount.
            format: int32
            type: integer
          minLicenseCount:
            description: MinLicenseCount is a minimum number of licenses SFCN reserves for the product. The default value is 1.
            format: int32
type: integer
scalingFactor:
description: ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down. The default value is 1.
format: int32
type: integer
scalingRef:
description: ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
properties:
  apiVersion:
    description: API version of the referent
type: string
  kind:
    description: 'Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds”
type: string
  name:
    description: 'Name of the referent; More info: http://kubernetes.io/docs/user-guide/identifiers#names'
type: string
required:
- kind
- name
type: object
tokenSecret:
description: TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
properties:
  name:
    description: Name is unique within a namespace to reference a secret resource.
type: string
  namespace:
    description: Namespace defines the space within which the secret name must be unique.
type: string
type: object
required:
- tokenSecret
type: object
status:
description: SmartLicenseStatus defines the observed state of SmartLicense properties:
accountDomain:
  description: AccountDomain is the account domain in Cisco Software Central.
type: string
accountName:
  description: AccountName is the name of the virtual account in Cisco
              Software Central.
  type: string
contextId:
  description: ContextId is an internal identifier uniquely defining
              platform registration.
  type: string
coresPerLicense:
  description: CoresPerLicense is number of cores per one requested
              LicenseType.
  format: int32
  type: integer
errorReason:
  description: ErrorReason specifies the error due to which the the
              SFCN product was not registered in Cisco Software Central.
  type: string
estimatedMaxReplicas:
  description: EstimatedMaxReplicas is maximum count of ep pod replicas.
              It is calculated based on MaxLicenseCount and CoresPerLicense.
  format: int32
  type: integer
exportControlled:
  description: ExportControlled is a flag indicating whether the export-controlled
              functionality was enabled while generating the token on Cisco Software
              Central. If true, this indicates a Strong Encryption (3DES/AES)
              license.
  type: boolean
licenseNumber:
  description: LicenseNumber is the amount of licenses SFCN has registered
              for the product at particular time.
  format: int32
  type: integer
licenseState:
  description: LicenseState is the state of the reserved licenses.
  enum:
  - PENDING
  - UNLICENSED
  - IN_COMPLIANCE
  - OUT_OF_COMPLIANCE
  - OVERAGE
  type: string
registrationState:
  description: RegistrationState is the registration status of the SFCN
              product in Cisco Software Central.
  enum:
  - PENDING
  - REGISTERED
- REGISTRATION_FAILED
- Deregistered
- Deregistration_FAILED

type: string

type: object

type: object

served: true

storage: true

subresources:

status: {}
const (
  epPodName = "epPod"
  redirectorEpPodName = "redirectorEpPod"
  defaultServiceRole = "default"
  vpnRedirectorServiceRole = "vpnredirector"
  deploymentName2 = "test-deployment-2"
  secondDefaultEpDeploymentName = "secondDefaultEpDeployment"
  redirectorEpDeploymentName = "vpnRedirectorEpDeployment"
  initialRedirectorDeploymentReplicas int32 = 2
)

var controllerTrue = true

var _ = Describe("Pod License Controller Test", func() {
  podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}
  redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}
  deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
  redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpDeploymentName}

  var reconciler *controllers.PodLicenseReconciler
  var fakeClient client.Client
  var mockCtrl *gomock.Controller
  var recorder *record.FakeRecorder

  var licensingClient *mocks.MockLicensingClient
  var allotmentService *mocks.MockAllotmentService

  var pod *corev1.Pod
  var deployment *appsv1.Deployment
  var redirectorPod *corev1.Pod
  var redirectorDeployment *appsv1.Deployment
  var smartLicense *v1.SmartLicense

 BeforeEach(func() {

    pod = &corev1.Pod{
      ObjectMeta: metav1.ObjectMeta{
        Name:            epPodName,
       Namespace:       defaultNs,
      OwnerReferences: []metav1.OwnerReference{ {Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue} },
    },
  }

  replicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
      Name:            epReplicaSet,
      Namespace:       defaultNs,
      OwnerReferences: []metav1.OwnerReference{ {Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue} },
    },
  }

  // Other test code...
})
replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: epDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}
secondDefaultDeployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: secondDefaultEpDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}
redirectorPod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name: redirectorEpPodName,
        Namespace: defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "redirectorEpReplicaSet", Controller: &controllerTrue}},
    },
}
redirectorReplicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name: "redirectorEpReplicaSet",
        Namespace: defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName, Controller: &controllerTrue}},
    },
}
redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: redirectorEpDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}
Name: redirectorEpDeploymentName,
Namespace: defaultNs,
Labels: map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},

smartLicense = &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
Action: v1.Register,
LicenseType: licenseType,
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.Registered,
},
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(
deployment, replicaSet, pod, secondDefaultDeployment,
redirectorDeployment, redirectorReplicaSet, redirectorPod,
smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()

reconciler = &controllers.PodLicenseReconciler{
Client: fakeClient,
LicensingClient: licensingClient,
Log: logf.NullLogger{},
Recorder: recorder,
}

AfterEach(func() {
mockCtrl.Finish()
})

It("should add the licensing label for licensed pod", func() {
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})

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It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
        Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name:
        epDeploymentName}, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
})

It("should ensure one replica per service role without SmartLicense", func() {
// initiate reconcile for the pod which is part of deployment with vpnredirector service role and without smart license
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
    Expect(err).To(BeNil())

    redirDeployment := appsv1.Deployment{}
    Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
    Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))

    Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

// create another deployment with vpnredirector role
    redirectorEpPodName2 := "redirectorEpPod2"
    redirectorEpDeploymentName2 := "redirectorEpDeployment2"
    replicaSetName2 := "redirectorEpReplicaSet2"
    redirectorPod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name: redirectorEpPodName2,
            Namespace: defaultNs,
            OwnerReferences: []metav1.OwnerReference{
                {Kind: "ReplicaSet", Name: replicaSetName2, Controller: 
                    &controllerTrue}},
        },
    }

    // expect the deployment to be scaled to 1 and mark it as trial license holder
    redirDeployment := appsv1.Deployment{
        Spec: 
            appsv1.DeploymentSpec{
                Replicas: int32(1),
                
                
            }
    }
    Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
    Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))

    Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))
})
Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
redirectorReplicaSet2 := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            replicaSetName2,
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName2,
            Controller: &controllerTrue}},
    },
}
Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
initialRedirector2Replicas := int32(3)
redirectorDeployment2 := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        redirectorEpDeploymentName2,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &initialRedirector2Replicas},
}
Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())
// initiate reconcile for the pod which is part of another deployment with vpnredirector service role and without
// smart license
redirector2PodNsName := types.NamespacedName{Name: redirectorEpPodName2, Namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirector2PodNsName.String()}).Return(nil, nil)
    _, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
Expect(err).To(BeNil())
// expect the second vpnredirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2,
    Namespace: defaultNs}, &redirDeployment2)).To(Succeed())
Expect(*redirDeployment2.Spec.Replicas).Should(Equal(int32(0)))
Expect(redirDeployment2.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(redirDeployment2.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment2.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirector2Replicas))))
}

Context("on pod removal", func() {

    It("should release licensing allotments", func() {
        Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
        return(&licensing.AllotmentStatusResponse{ContextId: "fooBar", NumCores: 2}, nil)
        allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{...})
    })
})
ContextId: "fooBar",
Tenant:   &licensing.Tenant{Name: podNsName.String()},
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

It("should requeue request if failed to release licensing allotments", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
ContextId: "fooBar",
Tenant:   &licensing.Tenant{Name: podNsName.String()},
}).Return(errors.New("failed to release allotments"))

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(HaveOccurred())
})

It("should not release licensing allotments if tenant is not registered", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, fmt.Errorf("unknown tenant: %w", licensing.ErrNotRegistered))

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

It("should not release licensing allotments when NumCores is 0", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

})
Context("for pod without corresponding SmartLicense", func) {

It("should remove pod if not belong to any deployment", func) {
pod.OwnerReferences = nil
Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

err = fakeClient.Get(context.TODO(), podNsName, pod)
Expect(err).NotTo(BeNil())
Expect(apiErrors.IsNotFound(err)).To(BeTrue())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license but does not belong to any Deployment")))
}

It("should scale down pod's deployment", func) {
smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested a license but does not belong to any licensed EP deployment")))
}

Context("without SmartLicense resources", func) {
BeforeEach(func) {
Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
}

It("should scale down Deployment to 1 Replica and mark as trial", func) {
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested a license but does not belong to any licensed EP deployment")))

})}
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
}

It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func()
{
    var replicaCount int32 = 4
    var expectedInitialReplicasNumber int32 = 4

    createDeployment := func(name string, role string) *appsv1.Deployment {
        pod := &corev1.Pod{
            ObjectMeta: metav1.ObjectMeta{
                Name:            fmt.Sprintf("pod-%s", name),
                Namespace:       defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: fmt.Sprintf("rs-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

        replicaSet := &appsv1.ReplicaSet{
            ObjectMeta: metav1.ObjectMeta{
                Name:            fmt.Sprintf("rs-%s", name),
                Namespace:       defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

        deployment := &appsv1.Deployment{
            ObjectMeta: metav1.ObjectMeta{
                Namespace:   defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name), Controller: &controllerTrue}},
            },
            Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
        }

        Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())
    }
}


podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
Expect(err).To(BeNil())

return deployment
}

deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", "")

assertScaledDown := func(d *appsv1.Deployment) {
Expect(*d.Spec.Replicas).Should(Equal(int32(0)))
Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(expectedInitialReplicasNumber))))
}
assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
}

It("should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist", func() {
deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
var replicaCount int32 = 1
pod2 := &corev1.Pod{
ObjectMeta: metav1.ObjectMeta{
Name: "deployment-test-2",
Namespace: defaultNs,
OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue}},
},

})
Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())

replicaSet2 := &appsv1.ReplicaSet{
  ObjectMeta: metav1.ObjectMeta{
    Name:            "epReplicaSet2",
    Namespace:       defaultNs,
    OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: deploymentName2, Controller: &controllerTrue}},
  },
}

Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())

deployment2 := &appsv1.Deployment{
  ObjectMeta: metav1.ObjectMeta{
    Name:        deploymentName2,
    Namespace:   defaultNs,
    Labels:      map[string]string{controllers.ServiceRoleLabel: "new-service-role"},
    Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
  },
  Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}

Expect(fakeClient.Create(context.TODO(), deployment2)).To(Succeed())

pod2NsName := types.NamespacedName{Namespace: defaultNs, Name: "deployment-test-2"}
alloctionService.EXPECT().Status(&licensing.Tenant{Name: pod2NsName.String(), Attributes: pod.Labels}).Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: pod2NsName})
Expect(err).To(BeNil())

deployment2Ns := types.NamespacedName{Namespace: defaultNs, Name: deploymentName2}
Expect(fakeClient.Get(context.TODO(), deployment2Ns, deployment2)).To(Succeed())
Expect(*deployment2.Spec.Replicas).Should(Equal(int32(1)))
Expect(deployment2.Labels).Should(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(recorder.Events).ShouldNot(HaveLen(1))

---
title: "Monitoring Status"
weight: 3
description: >
  Learn how to monitor the ASA operational status and critical license events
---

### Smart License Status
When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: "" # omitted to use default value
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
status:
  accountDomain: InternalTestDemoAccount8.cisco.com
  accountName: asac-dev
  contextId: '6947693726752581822'
  coresPerLicense: 1
  estimatedMaxReplicas: 2
  exportControlled: true
  licenseState: IN_COMPLIANCE
  registrationState: REGISTERED
```

### ASA Licensing State

The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are

* AwaitingLicense (Warning)
* LicenseCommunicationFailed (Warning)
* LicenseGranted (Normal)
* LicenseVerified (Normal)
* LicenseRevoked (Warning)

```

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.
```

When the ASA comes up successfully, the Manager tries to obtain a license for the [number of cores](#{relref "deployment/#core-calculation"}) the Pod uses. During this period, the Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For instance, when the ASA came up for the first time and operating at reduced throughput, this event would read something like

```
Warning     AwaitingLicense     ASA operating at reduced throughput because it was not licensed, requesting for a new license
```

And, if the ASA came up and operating at full potential, then

```
Warning     AwaitingLicense     ASA operating at full potential but not licensed, requesting for a new license
```

The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could not communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a `LicenseCommunicationFailed` warning event with the reasoning behind the failure.

```
Warning     LicenseCommunicationFailed     ASA operating at reduced throughput because of license communication failure
```

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the license granted to it and on successful verification, emits a `LicenseVerified` event.

```
Normal     LicenseGranted     successfully obtained a license from the server
Normal     LicenseVerified     ASA operating at full potential, license status verified
```

It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the
licenses have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale down the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager emits a `LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be granted a license, or it will be removed by Kubernetes because the controller scaled down the cluster.

```markdown
Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license, retrying to acquire
```
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"]
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates/"]

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ../pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api/ api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
# disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13

WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot
USER nonroot
ENTRYPOINT ["manager"]

package listeners

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    licensing "css.cisco.com/licensing/client-agent"
    licensingProto "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "sigs.k8s.io/controller-runtime/pkg/client"
)

type EntitlementListener struct {
    Log    logr.Logger
}
func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
    log := l.Log.WithValues("smartlicense", l.LicenseNsName)
    log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)

    if err := l.processEvent(event); err != nil {
        log.Error(err, "failed to process entitlement event")
        return
    }
    log.V(1).Info("successfully processed entitlement event")
}

func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()
    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense", l.LicenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }
    originalLicense := license.DeepCopy()

    switch event.Type {
    case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
        license.Status.LicenseState = v1.OutOfCompliance
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
        license.Status.LicenseState = v1.Unlicensed
        license.Status.EstimatedMaxReplicas = 0
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
        license.Status.LicenseState = v1.InCompliance
    default:
        return fmt.Errorf("unknown event type: %s", event.Type.String())
    }
    license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
    license.Status.LicenseNumber = uint32(event.EntitlementNumber)

    // using patch to avoid conflict errors caused by version mismatch and optimistic lock
    // as events from the server have the latest data, it is admissible to overwrite status without version check
    if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
        return fmt.Errorf("failed to patch SmartLicense status: %w", err)
    }
}

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return nil
#
# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.

global:
  platform: $platform
  imageCredentials:
    # the url to the docker registry, for example dockerhub.cisco.com
    registry: $registry
    artifactoryRepo: $artifactoryRepo
  apiGroup: sfcn.cisco.com
  fullNamePrefix: sfcn-license-

# Docker image for the controller that manages licensing CRDs and their reconciliation
controllerImage: $controllerImage

# Docker image for the server-agent license server
licenseServerImage: $licenseServerImage

# licenseServerPort is the port where the server-agent license server is listening for requests
licenseServerPort: 17051

# licenseServerTransportUrl is the http transport to make use of to connect to CSSM
licenseServerTransportUrl: $licenseServerTransportUrl

# Default image policy that is used by all pod containers unless being explicitly overwritten
defaultImagePullPolicy: $defaultImagePullPolicy

# log verbosity
logLevel: $logLevel

# zap log encoder
# options: console, json
logFormat: $logFormat

# managerMemoryRequest specifies the amount of memory to allocate per request for manager container
managerMemoryRequest: "20Mi"

# managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
managerCoreRequest: "100m"

# managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
managerMemoryLimit: "100Mi"

# managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
managerCoreLimit: "100m"
# metricsPort is the port the metric endpoint binds to
metricsPort: 17080

# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"

# licenseServerXms specifies the amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory
licenseServerXms: "128M"

# licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container
licenseServerCoreRequest: "100m"

# licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container
licenseServerMemoryLimit: "768Mi"

# licenseServerXmx specifies the maximum amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory
licenseServerXmx: "512M"

# licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container
licenseServerCoreLimit: "300m"

# licenseServerStorage specifies the persistent volume size to use for storing licensing data
licenseServerStorage: "1Gi"

# disktype for dynamic azure disk storage on azure platform
# options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
azureDiskStorageAccountType: "Standard_LRS"

package handlers_test

import {
   v1 "css.cisco.com/kasa/license-broker/api/v1"
   "css.cisco.com/kasa/license-broker/controllers/handlers"
   "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
   "github.com/golang/mock/gomock"
   . "github.com/onsi/ginkgo"
   autoscalingv1 "k8s.io/api/autoscaling/v1"
   metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
   "k8s.io/apimachinery/pkg/types"
   "sigs.k8s.io/controller-runtime/pkg/event"
const (  
defaultNamespace = "default"  
smartLicenseName = "smart-license"  
deploymentName = "ep-deployment"  
deploymentName2 = "ep-deployment2"  
hpaName = "ep-hpa"  
hpaName2 = "ep-hpa2"
)

var _ = Describe("DeploymentHandler", func() {  
var handler handler.EventHandler  
var mockCtrl *gomock.Controller  
var mockQueue *mocks.MockRateLimitingInterface

BeforeEach(func() {  
mockCtrl = gomock.NewController(GinkgoT())  
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)  
handler = handlers.DeploymentHandler()
})

AfterEach(func() {  
mockCtrl.Finish()
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {  
mockQueue.EXPECT().Add(reconcile.Request{
  NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
}).

handler.Create(event.CreateEvent{
  Object: &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
    },
  },
}).

mockQueue)  
})

It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {  
handler.Create(event.CreateEvent{
  Object: &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{


It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
    })

    handler.Update(event.UpdateEvent{
        ObjectOld: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
        ObjectNew: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })

    handler.Delete(event.DeleteEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

var _ = Describe("HPAHandler", func() {
    var handler handler.EventHandler
    var handler handler.EventHandler
var mockCtrl *gomock.Controller
var mockQueue *mocks.MockRateLimitingInterface

BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
    handler = handlers.HPAHandler()
})

AfterEach(func() {
    mockCtrl.Finish()
})

It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    handler.Create(event.CreateEvent{Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    }, mockQueue)}
})

It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
    handler.Create(event.CreateEvent{Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    }, mockQueue)}
})

It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
    })
    handler.Update(event.UpdateEvent{
It("adds request to reconcile Deployment when SmartLicense with HPA kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })

    handler.Delete(event.DeleteEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
            mockQueue
        }
    })
})
func DeploymentHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.DeploymentKind)
}

// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.HPAKind)
}

func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
    return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
        smartLicense, ok := obj.(*v1.SmartLicense)
        if !ok {
            log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
            return []ctrl.Request{}
        }
        if smartLicense.Spec.ScalingRef.Kind != scalingRefKind {
            return []ctrl.Request{}
        }
        return []ctrl.Request{{NamespacedName: types.NamespacedName{
            Namespace: smartLicense.Namespace,
            Name:      smartLicense.Spec.ScalingRef.Name,
        }}}
    })
}

package v1

import {
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/build"
const (  
  RetryDuration = 15 * time.Second  
  MaxWaitingDuration = 5 * time.Minute  
  MaxRetryAttempts = int(MaxWaitingDuration / RetryDuration)  
  LicenseCmd = "show license feature"  
  UnlicensedResponse = "Licensing Status: Unlicensed"  
  LicensedResponse = "Licensing Status: Licensed"
)

func (l licenseEvent) reasonCode() string {  
  switch l {  
  case Revoked:  
    return "LicenseRevoked"  
  case Awaiting:  
    return "AwaitingLicense"  
  case Granted:  
    return "LicenseGranted"  
  case Verified:  
    return "LicenseVerified"  
  case CommunicationFailed:  
    return "LicenseCommunicationFailed"  
  }  
  return "LicenseActivity"  
}

func (l licenseEvent) eventType() string {  
  switch l {  
  case Awaiting, Revoked, CommunicationFailed:  
    return coreV1.EventTypeWarning  
  default:  
    return coreV1.EventTypeNormal  
  }
type SmartLicenseReconciler struct {
    Log                logr.Logger
    CoreClient         *coreV1Client.CoreV1Client
    License  lca.LicensingClient
    Dispatcher         dispatcher.GatewayClient
    Recorder           record.EventRecorder
    tenant             *lca.Tenant
    numRetriedAttempts int
    allotment          *lca.AllotmentRequestStatus // needed to report the allotment held to server on request
    requiredNumCores   uint32
    isRegistered       bool
    lastRecordedEvent  licenseEvent // needed to avoid reporting the same event repeatedly
    notificationChan   chan event.GenericEvent
}

func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher) *SmartLicenseReconciler {
    s.notificationChan = make(chan event.GenericEvent)
    lsp.AddListener(s)
    return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
    pod := &coreV1.Pod{
    }
    s.Log.Info("lina (re)started, initiating license reconciliation")
    s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    podName := os.Getenv("POD_NAME")
    podNamespace := os.Getenv("POD_NAMESPACE")
    return ctrl.NewControllerManagedBy(mgr).
    Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{}).
    For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{
        Name:      podName,
        Namespace: podNamespace,
    })).Complete(s)
}

// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list

func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result,
error) {
    s.Log.Info("reconciling license status", "pod", request)
    errResult := reconcile.Result{RequeueAfter: RetryDuration}
    pod, err := s.CoreClient.Pods().Get(request.NamespacedName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NamespacedName)
        return errResult, err
    }
    if s.lastRecordedEvent == 0 {
        licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
        if err != nil {
            s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
            return errResult, nil
        }
        if strings.Contains(licenseResponse, LicensedResponse) {
            s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
            s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
        } else if strings.Contains(licenseResponse, UnlicensedResponse) {
            s.recordEvent(pod, Awaiting, "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
        }
    }

    if pod.DeletionTimestamp == nil {
        s.computeRequiredNumCores(pod)
        // (re)register with the license server
        err := s.registerTenantWithLicenseServer(pod)
        if err != nil {
            return errResult, nil
        }
        // registration successful, fetch or request allotment of this tenant
        err = s.syncAllotmentStatus(pod)
        if err != nil {
            return errResult, nil
        }
        err = s.grantASAcLicenseToOperate(pod)
        if err != nil {
            return errResult, nil
        }
    } else {
        err := s.releaseAllotment()
        if err != nil {
            s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
            return errResult, nil
        }
    }
}

return reconcile.Result{}, nil
func (s *SmartLicenseReconciler) recordEvent(pod *coreV1.Pod, event licenseEvent, description string) {
    if s.lastRecordedEvent != event || event == Verified { // always record verified events
        s.lastRecordedEvent = event
        s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
    }
}

func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *coreV1.Pod) {
    requiredCoresQuantity := resource.MustParse("0")
    var containerCores = make(map[string]string)
    for _, container := range pod.Spec.Containers {
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container", container.Name)
            if err != nil {
                s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
                continue
            }
            // set the required core quantities directly to the capacity of the node
            requiredCoresQuantity = *node.Status.Capacity.Cpu()
            break
        }
        requiredCoresQuantity.Add(containerLimit)
    }
    s.requiredNumCores = uint32(requiredCoresQuantity.Value())
    if len(pod.Spec.Containers) == len(containerCores) {
        s.Log.Info("computed resources usage", "cpu", containerCores)
    }
    s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
}

func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *coreV1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}.String(),
            Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            s.numRetriedAttempts = s.numRetriedAttempts + 1
            if s.numRetriedAttempts > MaxRetryAttempts {
                s.Log.Info("failed to communicate with licensing server with in allowed retry attempts", "+
                "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
                s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license")
            }
        }
    }
    return nil
}
func (s *SmartLicenseReconciler) revokeASAcLicenseAndRetry() error {
    reason, err := s.Dispatcher.RevokeLicense()
    if err != nil {
        s.Log.Error(err, "failed to revoke license")
        return err
    }
    if reason != "" {
        err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
        return err
    }
    s.Log.Info("successfully revoked ASAc license")
    s.numRetriedAttempts = 0
    return nil
}

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *coreV1.Pod) error {
    allotmentStatus, err := s.Licenser.Allotment().Status(s.tenant)
    if err != nil {
        if errors.Is(err, lca.ErrLicenseServerUnavailable) {
            s.Log.Info("licensing server is unavailable, unregistering the tenant")
            s.isRegistered = false
        }
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {  // "un-licensing ASA and continue retry"
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
                communication failure (%s), "+
                "retrying communication", err.Error()))
            _ = s.revokeASAcLicenseAndRetry()
            return err
        }
    }
    s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)", err.Error()),
    "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
    return err
}
"retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
return err
}

if allotmentStatus == nil {
    s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
    // no allotment was made to this tenant, requesting one
    allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
        PoolName: pod.Namespace,
        Tenant:   s.tenant,
        NumCores: s.requiredNumCores,
    })
    if err != nil {
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to
                obtain a license (%s), "+
                "retrying the operation", err.Error()))
            _ = s.revokeASAcLicenseAndRetry()
            return err
        }
        s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
            "numAttempt", s.numRetriedAttempts)
        return err
    }
    s.Log.Info(fmt.Sprintf("successfully leased an allotment from the licensing server")
    s.recordEvent(pod, Granted, "successfully obtained a license from the server")
    s.allotment = allotment
} else {
    s.allotment = allotmentStatus
}

s.Log.Info("allotment status verified", "cores", s.allotment.NumCores, "context", s.allotment.ContextId,
    "domain", s.allotment.SmartAccountName, "account", s.allotment.VirtualAccountName, "exportControlled",
    s.allotment.ExportControlled, "tenant", s.allotment.Tenant.Name)
return nil
}

func (s *SmartLicenseReconciler) grantASAcLicenseToOperate(pod *coreV1.Pod) error {
if s.allotment != nil {
    s.Log.Info("license status verified, communicating the status to ASA")
    s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
    reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
    if err != nil {
        s.Log.Error(err, "failed to grant license")
        return err
    }
}
if reason != "" {
    err = fmt.Errorf("ASAc failed to set license : %v", reason)
    return err
}

s.numRetriedAttempts = 0

s.Log.Info("successfully granted license to ASA")

} else {
    s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")

    return nil
}

func (s *SmartLicenseReconciler) releaseAllotment() error {
    _ = s.revokeASAcLicenseAndRetry()

    if s.allotment != nil {
        err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
            ContextId: s.allotment.ContextId,
            Tenant:    s.tenant,
        })
        if err != nil {
            s.Log.Error(err, "failed to release the allotment to server")
            return err
        }
        s.allotment = nil
    }

    return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
    podName := types.NamespacedName{
        Namespace: os.Getenv("POD_NAMESPACE"),
        Name:      os.Getenv("POD_NAME"),
    }

    pod, err := s.CoreClient.Pods().Get(podName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
    }

    switch event.Type {
    case proto.AllotmentEvent_RELEASE_ALLOTMENT:
        s.Log.Info("license requested to be released by the server, un-licensing ASA")
        if err == nil {
            s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying to acquire")
        }
        _ = s.releaseAllotment()
    case proto.AllotmentEvent_REPORT_ALLOTMENT:
        s.Log.Info("license requested to be reported to the server")
        _ = s.reportAllotment()
func (s *SmartLicenseReconciler) reportAllotment() error {
    allotment := &lca.AllotmentReport{ContextId: "", Tenant: s.tenant, NumCores: 0}
    if s.allotment != nil {
    }
    err := s.Licenser.Allotment().ReportAllotment(allotment)
    if err != nil {
        s.Log.Error(err, "failed to report the allotment to server")
    }
    return err
}

// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import (
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
    time "time"
)

// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl     *gomock.Controller
    recorder *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
}

// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}
// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
}

// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add", reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}

// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddRateLimited", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
func (m *MockRateLimitingInterface) Done(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
func (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Done",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}

// Forget mocks base method
func (m *MockRateLimitingInterface) Forget(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
func (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Forget",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
func (m *MockRateLimitingInterface) Get() (interface{}, bool) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Get")
    ret0, _ := ret[0].(interface{})
    ret1, _ := ret[1].(bool)
    return ret0, ret1
}

// Get indicates an expected call of Get
func (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Get",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Len")
    ret0, _ := ret[0].(int)
    return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}
// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "NumRequeues", arg0)
    ret0, _ := ret[0].(int)
    return ret0
}

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
}

// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}

// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShuttingDown))
}

apiVersion: v1
kind: Secret
metadata:
  name: cssm-token
namespace: sfcn-system

stringData:

# this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
token:
"NGVmN2EwNjctMzRhZS00M2ZkLTkyODktYjlmMjBmNThiNjJkLTE2NDYyMTIx%0AOTU2NjF8UnBHL3NzTUU5S1daeDJiSmNBYstBMTVyK05qQIhBzTHIJSkk0TE9r%0ARUg4WT0%3D%0A"

---

displayVersion: sfcn.cisco.com/v1

type: SmartLicense

metadata:

name: sfcn-enforcer
	namespace: sfcn-system

spec:

action: REGISTER

tokenSecret:

name: cssm-token
	namespace: sfcn-system

minLicenseCount: 1

maxLicenseCount: 12

scalingFactor: 4

scalingRef:

kind: Deployment

name: sfcn-enforcer

FROM gcr.io/distroless/java-debian10:nonroot

WORKDIR /

COPY license-broker/bin/sa-server-*all.jar sa-server-all.jar

ENTRYPOINT ["java", ".jar", "sa-server-all.jar"]

package listeners_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
"k8s.io/client-go/kubernetes/scheme"  
"testing"

. "github.com/onsi/ginkgo"  
. "github.com/onsi/gomega"
)

case const (  
smartLicenseName = "license-sample"  
defaultNs = "default"  
licenseType = "L-ASAV10S-STD"
)

func TestListeners(t *testing.T) {

RegisterFailHandler(Fail)
package listeners_test

import (  
    "context"  
    v1 "css.cisco.com/kasa/license-broker/api/v1"  
    "css.cisco.com/kasa/license-broker/controllers/listeners"  
    licensingProto "css.cisco.com/licensing/client-agent/proto"  
    . "github.com/onsi/ginkgo"  
    . "github.com/onsi/gomega"  
    autoscalingv1 "k8s.io/api/autoscaling/v1"  
    corev1 "k8s.io/api/core/v1"  
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
    "k8s.io/apimachinery/pkg/types"  
    "k8s.io/client-go/kubernetes/scheme"  
    "sigs.k8s.io/controller-runtime/pkg/client"  
    "sigs.k8s.io/controller-runtime/pkg/client/fake"  
    logf "sigs.k8s.io/controller-runtime/pkg/log"  
)

const (  
    epDeploymentName = "epDeployment"  
    entitlementNumber = 4  
    coresPerLicenseType = 2  
)

var _ = Describe("Entitlement Listener Test", func() {  
  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}  
  var listener *listeners.EntitlementListener  
  var fakeClient client.Client  
  var smartLicense *v1.SmartLicense

  BeforeEach(func() {  
    var defaultLicenseCount uint32 = 1  
    var maxLicenseCount uint32 = 3  
    smartLicense = &v1.SmartLicense{  
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},  
      Spec: v1.SmartLicenseSpec{  
        Action: v1.Register,  
    })  
  })
})
licenseType:     licenseType,
MinLicenseCount: &defaultLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor:   &defaultLicenseCount,
}
}
}

fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()

logf := logf.LogSource{ }

listener = &listeners.EntitlementListener{
  Log:           logf.NullLogger{ },
  Client:        fakeClient,
  LicenseNsName: licenseNsName,
  }
})

It("should update license status on OUT_OF_COMPLIANCE event", func() {
  event := licensingProto.EntitlementEvent{
    Type:    licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
    Message: "entitlement is out of compliance",
    EntitlementSku:      licenseType,
    EntitlementNumber:   entitlementNumber,
    CoresPerLicenseType: coresPerLicenseType,
  }
  listener.OnEntitlementEvent(&event)

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
  Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
  event := licensingProto.EntitlementEvent{
    Type:    licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
    Message: "granted new entitlement",
    EntitlementSku:      licenseType,
    EntitlementNumber:   entitlementNumber,
    CoresPerLicenseType: coresPerLicenseType,
  }
  listener.OnEntitlementEvent(&event)

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
  Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
  Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})
It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:        licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
        Message:     "failed to reserve a new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
}
}

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
    name: smartlicense-redirector
    namespace: sfcn-system
spec:
    action: "REGISTER"
    tokenSecret:
        name: cssm-token
        namespace: sfcn-system
    minLicenseCount: 1
    maxLicenseCount: 4
    scalingRef:
        kind: Deployment
        name: sfcn-vpnredirector-enforcer

**************************************************************
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***************************************************************/

package v1

import (    "context"    "fmt"    appsv1 "k8s.io/api/apps/v1"    autoscalingv1 "k8s.io/api/autoscaling/v1"    v1 "k8s.io/api/core/v1"    "k8s.io/apimachinery/pkg/api/errors"    "k8s.io/apimachinery/pkg/runtime"
"k8s.io/apimachinery/pkg/types"
"k8s.io/apimachinery/pkg/util/validation/field"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
logf "sigs.k8s.io/controller-runtime/pkg/log"
"sigs.k8s.io/controller-runtime/pkg/webhook"
)

// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac89-96bb5a8def84"

var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1

// log is for logging in this package.
var smartlicenselog = logf.Log.WithName("smartlicense-resource")
var webhookClient client.Client

func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {
    webhookClient = mgr.GetClient()
    return ctrl.NewWebhookManagedBy(mgr).
        For(r).
        Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io
var _ webhook.Defaulter = &SmartLicense{ }

// Default implements webhook.Defaulter so a webhook will be registered for the type
func (r *SmartLicense) Default() {
    log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)

    if r.Spec.Action == "" {
        r.Spec.Action = Register
    }
    if r.Spec.LicenseType == "" {
        r.Spec.LicenseType = SFWLicenceTag
    }
    if r.Spec.MinLicenseCount == nil {
        r.Spec.MinLicenseCount = &defaultMinLicenseCount
    }
    if r.Spec.MaxLicenseCount == nil {
        r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
    }
}
if r.Spec.ScalingFactor == nil {
    r.Spec.ScalingFactor = &defaultScalingFactor
}

log.V(1).Info("updated SmartLicense default values")

// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io

var _ webhook.Validator = &SmartLicense{

// ValidateCreate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateCreate() error {
    smartlicenselog.V(1).Info("validate create", "name", r.Name)

    var allErrs field.ErrorList
    r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.ScalingFactor, "scalingFactor", &allErrs)
    r.requireRegisterAction(&allErrs)
    r.validateLicenseCount(&allErrs)
    r.validateToken(&allErrs)
    r.validateScalingRef(&allErrs)

    if len(allErrs) == 0 {
        return nil
    }
    return allErrs.ToAggregate()
}

// ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
    smartlicenselog.V(1).Info("validate update", "name", r.Name)

    var allErrs field.ErrorList
    r.validateLicenseCount(&allErrs)

    // avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
    if r.GetDeletionTimestamp() == nil {
        r.validateToken(&allErrs)
        r.validateScalingRef(&allErrs)
    }

    oldObj := old.(*SmartLicense)
    r.requireNoLicenseTypeChange(&allErrs, oldObj)

    if len(allErrs) == 0 {
return nil
}
return allErrs.ToAggregate()

// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
        field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}

func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
    if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
        *errs = append(*errs,
        field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
    }
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")
    if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount <
    *r.Spec.MinLicenseCount {
        *errs = append(*errs,
        field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum
        license count"))
    }
}

func (r *SmartLicense) validateToken(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("tokenSecret")
    secret := &v1.Secret{}
    if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "token secret is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
            return
        }
    }
}
if len(secret.Data[TokenKeyName]) == 0 {
  *errs = append(*errs, field.Required(path.Child("data"), Child(TokenKeyName), "cannot be empty"))
}

func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
  path := field.NewPath("spec").Child("scalingRef")

  if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == ""
  *errs = append(*errs, field.Required(path, "kind or name of referenced object cannot be empty"))
  return

  key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
  var obj client.Object
  switch r.Spec.ScalingRef.Kind {
    case DeploymentKind:
      obj = &appsv1.Deployment{
    case HPAKind:
      obj = &autoscalingv1.HorizontalPodAutoscaler{
        default:
          return
      }
    }

  if err := webhookClient.Get(context.TODO(), key, obj); err != nil {
    if errors.IsNotFound(err) {
      *errs = append(*errs, field.Required(path, "referenced object is not found"))
      return
    } else {
      *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: %w", err)))
      return
    }
  }

  func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
    if val == nil || *val < min {
      path := field.NewPath("spec"), Child(path)
      *errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to %d", min)))
    }
  }

  // Code generated by MockGen. DO NOT EDIT.
  // Source: css.cisco.com/kasa/license-broker/controllers (interfaces: ReplicasCalculator)
// Package mocks is a generated GoMock package.
package mocks

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    gomock "github.com/golang/mock/gomock"
    v10 "k8s.io/api/apps/v1"
    reflect "reflect"
)

// MockReplicasCalculator is a mock of ReplicasCalculator interface
type MockReplicasCalculator struct {
    ctrl     *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}

// MockReplicasCalculatorMockRecorder is the mock recorder for MockReplicasCalculator
type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

// NewMockReplicasCalculator creates a new mock instance
func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

// CalculateMaxLicensedReplicas mocks base method
func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1 *v10.Deployment) (int32, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
    ret0, _ := ret[0].(int32)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "CalculateMaxLicensedReplicas",
    mr.mock.ctrl.T.Helper(), arg0, arg1)
}

// Generate mocks for the mocks package
Open Source Used In kASA v1.5 3948
const (  
smartLicenseName = "license-sample"  
defaultNs = "default"  
licenseType = "L-ASAV10S-STD"  
)

var (  
minLicenseCount uint32 = 1  
maxLicenseCount uint32 = 5  
scalingFactor uint32 = 2  
)

var _ = Describe("ReplicasCalculator Service Test", func() {  
var (  
deployment *appsv1.Deployment  
licenses []v1.SmartLicense  
fakeClient client.Client  
replicasCalculator *services.ReplicasCalculator  
smartLicense v1.SmartLicense  
node *corev1.Node  
)

licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}  
BeforeEach(func() {  
licenses = []v1.SmartLicense{}  
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
})
replicasCalculator = services.NewReplicasCalculator(fakeClient, logf.NullLogger{ })

var replicaCount int32 = 1
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},
    Spec: appsv1.DeploymentSpec{
        Replicas: &replicaCount,
        Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},
        Template: corev1.PodTemplateSpec{
                Name: "ep-container",
                Resources: corev1.ResourceRequirements{
                    Limits: map[corev1.ResourceName]resource.Quantity{
                        "cpu": resource.MustParse("2000m"),
                    },
                },
            }},
            Status: appsv1.DeploymentStatus{ReadyReplicas: replicaCount},
        }
    }
}
pod := &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name: "ep-pod",
        Namespace: defaultNs,
        Labels: map[string]string{"role": "enforcer"},
    },
    Spec: corev1.PodSpec{NodeName: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

node = &corev1.Node{
    ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), node)).To(Succeed())

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

smartLicense = v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
MinLicenseCount: &minLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,

Expect(fakeClient.Create(context.TODO(), &smartLicense)).To(Succeed())

AfterEach(func() {
  Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Pod{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Node{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
})

It("should return default value because license state is not in compliance", func() {
  smartLicense.Status.LicenseState = v1.OutOfCompliance
  Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())
  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(int32(2)))
  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should calculate max limits based on 2 smart licenses", func() {
  smartLicense2 := v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      Action: v1.Register,
      LicenseType: licenseType,
      MinLicenseCount: &minLicenseCount,
      MaxLicenseCount: &maxLicenseCount,
      ScalingFactor: &scalingFactor,}
It("should look at node limits if pod containers do not have limits defined", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
})

It("should return default value if pod containers do not have limits defined and deployment ready replicas is 0", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    deployment.Status.ReadyReplicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(*deployment.Spec.Replicas)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

It("should return default value if there is no node defined in pod spec", func() {
deployment.Spec.Template = corev1.PodTemplateSpec{ }
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

Expect(fakeClient.Delete(context.TODO(), node)).To(Succeed())

licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).Should(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
Expect(maxReplicas).Should(Equal(int32(0)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})
})

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import {
clientagent "css.cisco.com/licensing/client-agent"
gomock "github.com/golang/mock/gomock"
reflect "reflect"
}

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
ctrl   *gomock.Controller
recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
mock := &MockLicensingClient{ctrl: ctrl}
mock.recorder = &MockLicensingClientMockRecorder{mock}
return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
return m.recorder
}

// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Allotment")
ret0, _ := ret[0].(clientagent.AllotmentService)
return ret0
}

// Allotment indicates an expected call of Allotment
func (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Allotment",
reflect.TypeOf((*MockLicensingClient)(nil).Allotment))
}

// Entitlement mocks base method
func (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Entitlement")
ret0, _ := ret[0].(clientagent.EntitlementService)
return ret0
}

// Entitlement indicates an expected call of Entitlement
func (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Entitlement",
reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
func (m *MockLicensingClient) Registration() clientagent.RegistrationService {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Registration")
ret0, _ := ret[0].(clientagent.RegistrationService)
return ret0
}

// Registration indicates an expected call of Registration
func (mr *MockLicensingClientMockRecorder) Registration() *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Registration",
reflect.TypeOf((*MockLicensingClient)(nil).Registration))
}
// Subscription mocks base method
func (m *MockLicensingClient) Subscription() clientagent.SubscriptionService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Subscription")
    ret0, _ := ret[0].(clientagent.SubscriptionService)
    return ret0
}

// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
        reflect.TypeOf((*MockLicensingClient)(nil).Subscription))
}

{{ include "aegis.configmap.standard" (list . "config" "kasa.licensebroker.config") }}

---

{{- define "kasa.licensebroker.config" -}}
{{- $ := first . -}}
{{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") }}
{{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName }}

apiVersion: v1
kind: ConfigMap
data:
server-id.json: |
  
    "name": "{{ $licenseServerName }}",
    "hostname": "{{ $hostname }}",
    /* Empty string hides an IP address from being visible on CSSM */
    "ipAddress": "",
    "productId": "SFW",
    "softwareTag": "regid.2021-01.com.cisco.SFW,1.0_6f4891e2-97a4-443b-ad9a-9675b85b504f",
    /* Serial number must consist of 11 upper-case letters according to CSSM */
    "serialNumber": "{{ $hostname | sha256sum | trunc 11 | upper }}",
    "storagePath": "/home/nonroot/licensing/{{ $.Release.Namespace }}",
    "transportHttpUrl": "{{ $.Values.licenseServerTransportUrl }}"
}
{{- end -}}

package controllers

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controls/controllers/handlers"
    "css.cisco.com/kasa/pkg/predicates"
    "fmt"
    "github.com/go-logr/logr"
  appsv1 "k8s.io/api/apps/v1"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/api/meta"
  "k8s.io/apimachinery/pkg/runtime"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes"
  "k8s.io/client-go/kubernetes/clientset"
  "k8s.io/client-go/kubernetes/fake"
  "k8s.io/client-go/rest"
  "k8s.io/client-go/tools/clientcmd"  
)
type HPALicenseReconciler struct {
    client.Client
    Log                logr.Logger
    Recorder           record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(&predicates.LabelExistsPredicate{Key: LicenseHolderLabel})).Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    hpa := &autoscalingv1.HorizontalPodAutoscaler{
    }
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("HPA does not exist, nothing to reconcile")
            return ctrl.Result{}, client.IgnoreNotFound(err)
        }
    }
    licenseList := v1.SmartLicenseList{
    }
return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
hpaLicenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpaLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)
    }
    log.Info("updated HPA labels")
}

if len(hpaLicenses) == 0 {
    log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(hpaLicenses) {
    log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")
    return ctrl.Result{}, nil
}

    log.Info("scaled resource is not deployment")
    return ctrl.Result{}, nil
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)
if err != nil {
    return ctrl.Result{}, err
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpaLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

if hpa.Spec.MaxReplicas > maxLicensedReplicas {
    hpa.Spec.MaxReplicas = maxLicensedReplicas
}

changedFields := []string{"MaxReplicas"}
    changedFields = append(changedFields, "MinReplicas")
}
if err = c.Client.Update(context.Background(), hpa); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update HPA resource: %w", err)
}

c.Recorder.Event(hpa, corev1.EventTypeError, "HPAScaledDown", fmt.Sprintf("Decreased HPA's %s to %d as it is the maximum EP replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", changedFields, maxLicensedReplicas))
log.Info(fmt.Sprintf("successfully decreased HPA's %s to max license limit", changedFields), "updatedHPAMaxReplicas", hpa.Spec.MaxReplicas)
return ctrl.Result{}, nil
}
log.Info("skipping HPA update, system has enough licenses to have all HPA's MaxReplicas running", "hpaMaxReplicas", hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa *autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
    deploymentName := hpa.Spec.ScaleTargetRef.Name
    deployment := &appsv1.Deployment{
        if err != nil {
            return nil, err
        }
        return deployment, err
    }
}

---
apiversion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
creationTimestamp: null
name: mutating-webhook-configuration
webhooks:
- admissionReviewVersions:
  - v1
clientConfig:
  service:
    name: webhook-service
    namespace: system
    path: /mutate-sfcn-cisco-com-v1-smartlicense
failurePolicy: Fail
name: msmartlicense.kb.io
rules:
- apiGroups:
  - sfcn.cisco.com
apiVersions:
---

apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
  creationTimestamp: null
name: validating-webhook-configuration
webhooks:
  - admissionReviewVersions:
    - v1
  clientConfig:
    service:
      name: webhook-service
      namespace: system
      path: /validate-sfcn-cisco-com-v1-smartlicense
    failurePolicy: Fail
name: vsmartlicense.kb.io
rules:
  - apiGroups:
    - sfcn.cisco.com
    apiVersions:
      - v1
    operations:
      - CREATE
      - UPDATE
    resources:
      - smartlicenses
    sideEffects: None

// +build !ignore_autogenerated

/*******************************************************************************
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* Unauthorized redistribution prohibited.
*******************************************************************************/

// Code generated by controller-gen. DO NOT EDIT.

package v1

import (
// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.Spec.DeepCopyInto(&out.Spec)
    out.Status = in.Status
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicense.
func (in *SmartLicense) DeepCopy() *SmartLicense {
    if in == nil {
        return nil
    }
    out := new(SmartLicense)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicense) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.ListMeta.DeepCopyInto(&out.ListMeta)
    if in.Items != nil {
        in, out := &in.Items, &out.Items
        *out = make([]SmartLicense, len(*in))
        for i := range *in {
            (*in)[i].DeepCopyInto(&(*out)[i])
        }
    }
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
    in.DeepCopyInto(out)
    return out
}
out := new(SmartLicenseList)
in.DeepCopyInto(out)
return out

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseSpec.
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseSpec)
in.DeepCopyInto(out)
    return out
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {

}
// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseStatus.
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
in.DeepCopyInto(out)
    return out
}

// MockEntitlementService is a mock of EntitlementService interface
type MockEntitlementService struct {
    ctrl     *gomock.Controller
    recorder *MockEntitlementServiceMockRecorder
}

type MockEntitlementServiceMockRecorder struct {
    mock *MockEntitlementService
}

// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
    mock.recorder = &MockEntitlementServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}
// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Notify", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify",
        reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}

// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement",
        reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/api/ metav1"
    "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/control
const (
    secretName = "secretTest"
)

var _ = Describe("SecretHandler", func() {
    var handler handler.EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface
    var coreClient client.Client

    BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
        coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
        handler = handlers.SecretHandler(coreClient)
    })

    AfterEach(func() {
        mockCtrl.Finish()
    })

    It("should do nothing where there are no smart license objects", func() {
        handler.Update(event.UpdateEvent{
            ObjectNew: &corev1.Secret{
                ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
            },
            mockQueue
        })
    })

    It("should not add request because secret is not used in SmartLicense object", func() {
        smartLicenseObject := &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
                TokenSecret: corev1.SecretReference{
                    Name:      "some_secret",
                    Namespace: defaultNamespace,
                },
                Status: v1.SmartLicenseStatus{
                    RegistrationState: v1.RegistrationFailed,
                }
            }
        }
        Expect(coreClient.Create(context.TODO(), smartLicenseObject))

        handler.Update(event.UpdateEvent{
            ObjectNew: &corev1.Secret{
It("should not add request because SmartLicense is registered", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name: smartLicenseName,
Namespace: defaultNamespace,
},
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.Registered,
},
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})

It("should not add request because SmartLicense is deregistered", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name: smartLicenseName,
Namespace: defaultNamespace,
},
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.Deregistered,
},
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})
It("should add request because SmartLicense status is registration failed", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name:      secretName,
        Namespace: defaultNamespace,
      },
      Status: v1.SmartLicenseStatus{
        RegistrationState: v1.RegistrationFailed,
      },
    }
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))

  mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName}
  })

  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
      ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
    mockQueue
  })
})

It("should add request for SmartLicense even if secret is in different namespace", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name:      secretName,
        Namespace: "test-namespace",
      },
      Status: v1.SmartLicenseStatus{
        RegistrationState: v1.RegistrationFailed,
      },
    }
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))

  mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName}
  })

  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{

License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).

## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:

```shell
go env -w GOPRIVATE="css.cisco.com/*"
```

```yaml
{{- include "aegis.deployments.configuration" (list . "license-api" (fromYaml `deployment: kasa.licensebroker.deployment rbac: config/rbac/**.yaml crds: config/crd/**.yaml webhooks: config/webhook/manifests.yaml `)) -]}}
{{- define "kasa.licensebroker.deployment" -}}
{{- $ := first . -}}
{{- $global := default (dict ) $.Values.global -}}
apiVersion: apps/v1
kind: Deployment
spec:
  {{- if eq $global.platform "eks" }}
  {{- if eq $global.platform "eks" }}
  {{- end }}
strategy:
  type: Recreate
  {{- end }}
template:
  metadata:
    annotations:
      checksum/license-config: {{ include "aegis.configmap.standard" (list $ "config" "kasa.licensebroker.config") | sha256sum }}
spec:
  securityContext:
    # 65532 is ID of nonroot user group
    fsGroup: 65532
    {{- if eq $global.platform "eks" }}
    dnsPolicy: ClusterFirstWithHostNet
    hostNetwork: true
    {{- end }}
    {{- if ($Values.global.platform | eq "azure") }}
    {{- /* https://github.com/kubernetes-sigs/azuredisk-csi-driver/issues/815
      azure disk seems to ignore fsGroup setting right now for v1.2.0 release,
      need an init container to fix permissions */ }}
    initContainers:
      - name: change-ownership
        image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
        command: [ 'sh', '-c', 'chown -R 65532:65532 /home/nonroot' ]
        volumeMounts:
          - mountPath: /home/nonroot
            name: disk
        securityContext:
          # Files or directories created with HostPath on the host are only writable by root. Which means, you either
          # need to run your container process as root or modify the file permissions on the host to be writable by
          # non-root user.
          runAsUser: 0
          capabilities:
            add:
              - DAC_OVERRIDE
              - FOWNER
    {{- end }}
  containers:
    - name: manager
      image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
      imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
      env:
        {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
      args:
        - --zap-log-level={{ $.Values.logLevel }}
        - --zap-encoder={{ $.Values.logFormat }}
        - --webhook-port={{ $.Values.webhookPort }}
        - --metrics-port={{ $.Values.metricsPort }}
        - --license-server-port={{ $.Values.licenseServerPort }}
      ports:
        - containerPort: {{ $.Values.webhookPort }}
          name: webhook-server
          protocol: TCP
      resources:
        requests:
          cpu: {{ $.Values.managerCoreRequest }}
memory: {{ $.Values.managerMemoryRequest }}
limits:
  cpu: {{ $.Values.managerCoreLimit }}
  memory: {{ $.Values.managerMemoryLimit }}
securityContext:
  allowPrivilegeEscalation: false
- name: license-server
  image: {{ include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) }}
  imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
  command:
    - "java"
    - "-Xms{{ $.Values.licenseServerXms }}"
    - "-Xmx{{ $.Values.licenseServerXmx }}"
    - "-jar"
    - "sa-server-all.jar"
    - "--configFile"
    - "/etc/licensing/server-id.json"
    - "--port"
    - "{{ $.Values.licenseServerPort | quote }}"
  ports:
    - containerPort: {{ $.Values.licenseServerPort }}
      protocol: TCP
  securityContext:
    # 65532 is ID of nonroot user
    runAsUser: 65532
    allowPrivilegeEscalation: false
  env:
    {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
  resources:
    requests:
      cpu: {{ $.Values.licenseServerCoreRequest }}
      memory: {{ $.Values.licenseServerMemoryRequest }}
    limits:
      cpu: {{ $.Values.licenseServerCoreLimit }}
      memory: {{ $.Values.licenseServerMemoryLimit }}
  volumeMounts:
    - mountPath: /home/nonroot
      name: disk
    - mountPath: /etc/licensing/server-id.json
      name: license-config
      subPath: server-id.json
  volumes:
    - name: disk
      persistentVolumeClaim:
        claimName: {{ include "aegis.metadata.fullname" (list $ "server") }}
    - name: license-config
      configMap:
        name: {{ include "aegis.metadata.fullname" (list $ "config") }}
imagePullSecrets:
  - name: regscfn
terminationGracePeriodSeconds: 10

---

{{ include "aegis.services.deployment" (list $ "configurer" "kasa.licensebroker.server") -}}

{{- define "kasa.licensebroker.server" -}}
{{- $ := first . -}}
apiVersion: v1
class: Service
name: {{ include "aegis.metadata.fullname" (list $ "server") }}
spec:
  ports:
  - protocol: TCP
    port: 80
    targetPort: {{ $.Values.licenseServerPort }}
type: ClusterIP

---

cloud.google.com/go v0.26.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLick0ClmMTw=
cloud.google.com/go v0.34.0/go.mod h1:aQUYkXZzVsufM+DwF1aE+0xfcU+56JwCaLick0ClmMTw=
cloud.google.com/go v0.38.0/go.mod h1:990N+gfupTy94rShfmMCWGDN0LpTmnzTp2qbd1dvSRU=
cloud.google.com/go v0.44.1/go.mod h1:iSa0KzasfP4Uvy3f1mN7PiObzGglwredwwASMv6AU=
cloud.google.com/go v0.44.2/go.mod h1:60680Gw3Yr4ikxnPRSoxxkBct6SA1yMk63TGeaxKY=
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cloud.google.com/go/bigquery v1.0.1/go.mod h1:i:xbL2UJR5RvWAURpBYZTm/cXjCha9bfpx4poX+0=
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cloud.google.com/go/storage v1.0.0/go.mod h1:1htSnMZTZV8YYJWCY8RULGVQBDmpoyjwirjsg+URw=
css.cisco.com/licensing/client-agent v0.1.11 h1:LaC+Lm0do+wx2/tXyne9ao6KToGW0bffQX7VbIx2x0p=
css.cisco.com/licensing/client-agent v0.1.11/go.mod h1:Y2jdZP6Je7neWWhkzff3/4BMMi1vETPwbCBIr/RM=
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h1:H6x/+7gZCb22OMCxBHrMx7a5I7Hp++hsVXbQ4BYO7hU=
github.com/Azure/go-ansiterm v0.0.0-20170929234023-d6e3b3328b78/go.mod
h1:LmzpDX56tiV29bbRTsiUNLaFhufWRQBWJQdVYAEvI=
github.com/Azure/go-autorest/autorest v0.9.0/go.mod
h1:xyHB1BMZT0cuDHU710+g046+BFDTQ8rEZB0s4Yfa6bl=
github.com/Azure/go-autorest/autorest v0.9.6/go.mod
h1:/FALq9T/ks7b515qsQ+RSTUaMgFq0i0UdVNNx8q630=
github.com/Azure/go-autorest/autorest/adal v0.5.0/go.mod
github.com/Azure/go-autorest/azure v0.8.2/go.mod
h1:8Z9fGy2MpX0PvDjB1pEgQTmVqGhiHB7W7RJEcWiZwS0=
github.com/Azure/go-autorest/azure/adal v0.8.2/go.mod
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github.com/Azure/go-autorest/azure/mocks v0.1.0/go.mod
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github.com/BurntSushi/toml v0.3.1/go.mod
h1:IVnqGOEym/WlBOVXwI6kvHm3ib0OimBfBu0Xu9V128OQ=
github.com/agnivade/levenshtein v1.0.1/go.mod
h1:CURSv5d9Uaml+FovSIckLbAUS9S4rqaHIdslSBg7lM=
github.com/alecthomas/units v0.0.0-20151022065326-2ecee857e7cf/go.mod
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github.com/alecthomas/units v0.0.0-20190718012654-fb15b899a751/go.mod
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github.com/asaskevich/govalidator v0.0.0-20180720115003-f9ffefc3facf/go.mod
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github.com/beorn7/perks v0.0.0-20180321164747-3a771d992973/go.mod
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github.com/beorn7/perks v1.0.0/go.mod h1:KWe93zE9D1o94FZ5RNWfwVgQK1VOXIVmxqM+hC6LdV8=
github.com/beorn7/perks v1.0.1 h1:VibKKnNfV8b1zjeoua4cOKq6bYr3WkgKZOX8Z16+hsOM=
github.com/beorn7/perks v1.0.1/go.mod h1:G2ZrVWU2WbWT9wqw4hbrKhnv/1ERSJQ0ihh6rkpw=
github.com/bgentry/speakeasy v0.1.0/go.mod h1:+zsyZBPwW7f6j88CTgsN5bM796AkVf0kBd4zp0CCIs=
github.com/blang/semver v3.5.0/incompatible/go.mod h1:kRBLj5Jt+D4TcO0Oxxy/0fnwbeN5EWlYSAyrTnjyyk=
github.com/census-instrumentation/opencensus-proto v0.2.1/go.mod h1:f6KPmiojXKAl2mvqOA5BBL0949030eGPrqHWWSTnE=
github.com/cesper/xxhash v1.1.0 h1:a6HrQnmkObjyl+G6s0cZiUlUGqrzKutQ6DZxG3p+ko=
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go.uber.org/goleak v1.1.10/go.mod h1:8a7PlsEvH3e/a/ALQe5IiRd6GZcmRmZcEufDUTk4A7A=go.uber.org/multierr v1.1.0/go.mod h1:wR5kdoAfQ0Uk8Qbbj5SNy0Z68jHnMJUG5sJr9q4=go.uber.org/multierr v1.5.0/go.mod h1:FeouvMocepHpRauG9EjokCStLC34zu/fm7aqMUPcKYU=go.uber.org/multierr v1.6.0 h1:y6LFsFStAT5Yt17/XYnHvzXQ7S3geIeZ9W9hyZ5thw=go.uber.org/multierr v1.6.0/go.mod h1:cdWpEpRnG4AhwMwsgHIP0kRPQJjly5kYeJxpXsp9I=go.uber.org/tools v0.0.0-20190618225709-2cfd321de3ee/go.mod
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golang.org/x/crypto v0.0.0-20180904163835-0709b304e793/go.mod
golang.org/x/crypto v0.0.0-20190302223903-b7391e95e576/go.mod
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golang.org/x/crypto v0.0.0-20191206172530-e9b2fee46413/go.mod
golang.org/x/exp v0.0.0-20190121172918-5c40567a2f8/go.mod
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- golang.org/x/oauth2 v0.0.0-20191202225959-858c2ad4c8b6/go.mod
- golang.org/x/sync v0.0.0-20181221193216-37e7f081c4d4/go.mod
- golang.org/x/sync v0.0.0-20190227155943-e225da77a7e6/go.mod
- golang.org/x/sys v0.0.0-20190911185100-cd5d95a43a6e/go.mod
- golang.org/x/sys v0.0.0-20190901185100-0c27d6d1f4c6/go.mod
- golang.org/x/sys v0.0.0-20190826190057-48a0d985849a/go.mod
- golang.org/x/sys v0.0.0-20190423024810-112230192c58/go.mod
- golang.org/x/sys v0.0.0-20190312061237-feed9001313/go.mod
- golang.org/x/sys v0.0.0-20190307160741-15dcb6c0061f/go.mod
- golang.org/x/sys v0.0.0-20190624142023-c5567b49c5d0/go.mod
- golang.org/x/sys v0.0.0-20190606165138-5da285871e9c/go.mod
- golang.org/x/sys v0.0.0-20190507160741-ecd444e8653b/go.mod
- golang.org/x/sys v0.0.0-20190505145724-3ef323f41fd/go.mod
- golang.org/x/sys v0.0.0-2019050412213099d/go.mod
- golang.org/x/sys v0.0.0-20190422165155-953cdad894/go.mod
- golang.org/x/sys v0.0.0-20190402165155-953cdad894/go.mod
- golang.org/x/sys v0.0.0-2019040211213099d/go.mod
- golang.org/x/sys v0.0.0-20190331061237-feed9001313/go.mod
- golang.org/x/sys v0.0.0-20190321052220-f7bb7a8bee54/go.mod
- golang.org/x/sys v0.0.0-20190321052220-f7bb7a8bee54/go.mod
- golang.org/x/sys v0.0.0-20190321052220-f7bb7a8bee54/go.mod
- golang.org/x/sys v0.0.0-20190321052220-f7bb7a8bee54/go.mod
- golang.org/x/sys v0.0.0-20190321052220-f7bb7a8bee54/go.mod
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golang.org/x/sys v0.0.0-20200323222414-85ca7c5b95cd/go.mod
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h1:b+2E5dAYhXwXZwnNZ6UAqBI28+e2cm9otk0dWdXHAeO= google.org/x/tools v0.0.0-20191227053925-7b8e75db28f4/go.mod
h1:TB2adYChydJhpapKDTa4BR/hXZLSloq2Wpct/0txZ28= google.org/x/tools v0.0.0-20200616133436-c1394b75d054
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package controllers

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/apis/meta/v1"
    "strings"
)

var _ = Describe("Common Test", func() {

    It("serialNumber", func() {
        serialNumber := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())
        Expect(len(serialNumber)).Should(Equal(11))
        Expect(strings.ToUpper(serialNumber)).Should(Equal(serialNumber))
        Expect(serialNumber).Should(Equal("F0529A6CDD9"))
    })

    It("containsString", func() {
        list := []string{"one", "two", "three"}
        Expect(containsString(list, "three")).Should(BeTrue())
        Expect(containsString(list, "four")).Should(BeFalse())
    })

    It("removeString", func() {
        list := []string{"one", "two", "three"}
        Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
        Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
    })

})
It("filterLicensesByState", func() {
  licenses := []v1.SmartLicense{
    {
        Name: "license1",
      },
     .Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Deregistered,
      },
    },
    {
        Name: "license2",
      },
     .Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Registered,
      },
    },
  }
  filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
  Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
    {
        Name: "license1",
      },
     .Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Deregistered,
      },
    })))

  filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
  Expect(filteredLicenses).Should(BeEmpty())
})

It("filterLicensesByKind", func() {
  var licenses v1.SmartLicenseList
  licenses.Items = []v1.SmartLicense{
    {
     .Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
      },
    },
    {
     .Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
      },
    },
  }
})

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filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
    Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
    },
}}))
filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
Expect(filteredLicenses).Should(BeNil())
filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
    Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
    },
}}))
}

It("pendingLicenseExists", func() {
    licenses := []v1.SmartLicense{
        {
            Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance},
        },
        {
        },
    }
    Expect(pendingLicenseExists(licenses)).Should(BeFalse())
    licenses = append(licenses, v1.SmartLicense{
        Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState},
    })
    Expect(pendingLicenseExists(licenses)).Should(BeTrue())
})

It("setLicenseLabel", func() {
    meta := metav1.ObjectMeta{}
    res := setLicenseLabel(&meta, LicenseHolderLabel, true)
    Expect(res).Should(BeTrue())
    val, ok := meta.Labels[LicenseHolderLabel]
Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing. There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.

---

* Smart Licensing

* Licensing a kASA cluster involves licensing every ASA instance running in the cluster. Since the ASA instances are ephemeral, a license server runs locally in your cluster to manage the license lifecycle of these ASA instances. This server is responsible for registering the set of ASA instances you license with the Cisco Smart Software Manager, obtain or release the licenses based on the number of cores those instances use, and releasing all the licenses back to your Smart account when you deregister the cluster.

* After kASA bundle is successfully installed with licensing enabled, to license the cluster, you need a token from your Smart Account that has Secure Firewall (SFW) licenses. Go to [software.cisco.com](www.software.cisco.com) and navigate to Smart Software Licensing. Find `asac-dev` virtual account that has the SFW licenses and generate a token from it.

* For development purposes, we have created a token that you can use:
If this token has expired, please send an email to sfcn-controlplane@cisco.com

* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create
  a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc)
  and a service type (e.g. `Deployment` or `HorizontalPodAutoscaler`).

* Examples of the secret and the Smart License object are located
  [here](../../license-broker/config/samples/sfcn.cisco.com_v1_smartlicense.yaml).

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  creationTimestamp: null
name: broker-role
rules:
- apiGroups:
  - apps
    resources:
      - deployments
    verbs:
      - get
      - list
      - update
      - watch
  - apiGroups:
    - apps
      resources:
        - replicasets
      verbs:
        - get
        - list
        - watch
    - apiGroups:
      - autoscaling
        resources:
          - horizontalpodautoscalers
        verbs:
          - get
          - list
          - update
          - watch
```
- apiGroups:
  - ""
resources:
- pods
verbs:
- delete
- get
- list
- update
- watch
- apiGroups:
  - ""
resources:
- secrets
verbs:
- get
- list
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses
verbs:
- create
- delete
- get
- list
- patch
- update
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses/status
verbs:
- get
- patch
- update
---
title: Deployment Components
weight: 2
description: >
Understanding the components of Cluster Licensing and their deployment to Kubernetes
resources:
- src: "**.{png,jpg}"
title: "Image #:counter"
---
Licensing setup comprises two components - the License Server, and the License Controller. References to Server and Controller in this document mean the License Server and License Controller.

License Components showing High-level Communication

1. User creates a Smart License resource and applies it to the Kubernetes API Server
2. Kubernetes API Server sends a notification to License Controller.
3. License Controller inspects the configuration in the Smart License resource
   1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server, which then talks to CSSM to reserve the licenses and responds back to the Controller
   2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server
4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.
5. The License Server checks its pool to see if it has sufficient licenses to grant the request
   1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates this status to ASAc.
   2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.

## Packaging

Licensing components are packaged into two Kubernetes Deployment resources targeting different namespaces and distributed via Helm as part of the `sfcn-bundle` Helm chart

### License Broker

The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

License Broker is set to be deployed once per cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode). The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.
## License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the
[Controller](#license-controller), sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.

## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means
using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the [License Server](#license-server). It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests](#monitoring#unauthorized-requests) for more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the form of events on that resource.

### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart License resource in the same namespace.

Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
# license type can be blank or not set explicitly to let the system use the default value
# At present, there is only one license type for kASA, so this field is reserved for future use.
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

---

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where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by obtaining a token from the [Virtual Account]({{< relref "terminology#smart-and-virtual-accounts">}}) and doing a base64 encoding of that text. This can be done from a shell as follows

```shell
echo "your-token" | base64
```

And, use that content in the Secret as follows

```yaml
apiVersion: v1
cr
kind: Secret
cr
metadata:
    name: ccssm-token
    namespace: cisco-systems
data:
    # this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
token: "TXpJMk1UVXhOV1V0Tm1Jd1ppMDBORFUzTFRnd09ETXRNamMyWm1JMVltWTBORGhtTFRFMk16YzBNamecyJTBBTVhBMk16QihV5FSE1U25WVGNHBpRMEZWU2paSk5FeDRZbHAxYnpkdtGFHeGFZbIJWTDFGWFoyMURjR3h4JTBBVFUxVik9EMCUzRCUwQQ=="
```

The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual account as you are expecting the number of vCPUs in your cluster namespace.

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`. The resource specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a minimum of 1 license and upto 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA license type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request for upto 10 vCPUs.

Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing configuration thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the

{{% alert title="Warning" color="warning" %}}
Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the
License
Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the license configuration.
In the example here, the Deployment replica count would be set to 2.

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more replicas, the license Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to the account.

Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.

### Using the Scaling Factor

When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient number of licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to retry the operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the `scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or down, it reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may ask the pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the pod is assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its pool.

Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the virtual account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following configuration, the Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this number to the number of vCPUs the enforcer pods will be using.

```
yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
```
metadata:
name: sfcn-enforcer
namespace: cisco-systems
spec:
action: "REGISTER"
tokenSecret:
  name: cssm-token
  namespace: cisco-systems
licenseType: ""
minLicenseCount: 1
maxLicenseCount: 10

# scaling factor of 4 implies the license reservations change in increments/decrements of 4
scalingFactor: 4
scalingRef:
  kind: Deployment
  name: sfcn-enforcer
...

### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates unregistration and on successfully unregistering from the virtual account, the Controller deletes the resource.

## The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

{% alert title="Note" color="primary" %}
It is recommended that a CPU limit be specified on all the containers where the ASA is running. If you prefer to take
advantage of burstable CPU of the Node, be advised that the licensed cores would be that of the Node rather than the
Pod.

### Licensing ASA

When the ASA comes up, it does not hold a license and therefore runs at a low-bandwidth mode, typically 100kbps
and has very
restricted capabilities and features it supports. The Manager tries to get a license from the License Server and if
successful
communicates the status to ASA. Once licensed, ASA runs at its full potential.

The Manager periodically verifies the status of the license it obtained, with the License Server, and if the license is
not
valid anymore either because the License Server has insufficient licenses, or the Manager failed to verify the validity
despite
several retries, it will revoke the license of ASA and keeps retrying to fetch the license.

```go
module css.cisco.com/kasa/license-broker

require (
    css.cisco.com/kasa/pkg/predicates v0.0.0
    css.cisco.com/licensing/client-agent v0.1.11
    github.com/go-logr/logr v0.3.0
    github.com/golang/mock v1.3.1
    github.com/onsi/ginkgo v1.14.1
    github.com/onsi/gomega v1.10.2
    k8s.io/api v0.19.2
    k8s.io/apimachinery v0.19.2
    k8s.io/client-go v0.19.2
    k8s.io/utils v0.0.0-20200912215256-4140de9c8800
    sigs.k8s.io/controller-runtime v0.7.2
)

replace css.cisco.com/kasa/pkg/predicates v0.0.0 => ../pkg/predicates

apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into versioned archives
# to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They're included as
# a dependency of application charts to inject those utilities and functions into the rendering
# This is the chart version. This version number should be incremented each time you make changes
# to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
version: 0.1.0

# This is the version number of the application being deployed. This version number should be
# incremented each time you make changes to the application. Versions are not expected to
# follow Semantic Versioning. They should reflect the version the application is using.
appVersion: 1.16.0

dependencies:
  - name: aegis-common
    version: "0.1.0"
    repository: "file://../aegis-common"

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: AllotmentService)

// Package mocks is a generated GoMock package.
package mocks

import (
  proto "css.cisco.com/licensing/client-agent/proto"
  service "css.cisco.com/licensing/client-agent/service"
  gomock "github.com/golang/mock/gomock"
  reflect "reflect"
)

// MockAllotmentService is a mock of AllotmentService interface
type MockAllotmentService struct {
  ctrl  *gomock.Controller
  recorder *MockAllotmentServiceMockRecorder
}

// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService
type MockAllotmentServiceMockRecorder struct {
  mock *MockAllotmentService
}

// NewMockAllotmentService creates a new mock instance
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {
  mock := &MockAllotmentService{ctrl: ctrl}
  mock.recorder = &MockAllotmentServiceMockRecorder{mock}
  return mock
}
// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {
    return m.recorder
}

// LeaseAllotment mocks base method
func (m *MockAllotmentService) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "LeaseAllotment", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
}

// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
// ReportAllotment mocks base method
func (m *MockAllotmentService) ReportAllotment(arg0 *proto.AllotmentReport) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReportAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReportAllotment indicates an expected call of ReportAllotment
func (mr *MockAllotmentServiceMockRecorder) ReportAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReportAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReportAllotment), arg0)
}

// Status mocks base method
func (m *MockAllotmentService) Status(arg0 *proto.Tenant) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Status", arg0)
    ret0, ret1 := ret[0].(*proto.AllotmentRequestStatus), ret[1].(error)
    return ret0, ret1
}

// Status indicates an expected call of Status
func (mr *MockAllotmentServiceMockRecorder) Status(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Status",
        reflect.TypeOf((*MockAllotmentService)(nil).Status), arg0)
}

---

### Cisco Smart Software Manager (CSSM)

Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any licensing activity.
outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed [here](https://software-stage.cisco.com).

There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html) often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.

### Smart License

Smart License is the license that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that license from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).

### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart

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Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.

Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited to. The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account. You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased. This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation

License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product.
The reservation process requires connectivity to internet and only on successful reservation can you use the product in Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR). PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does not mean the product supports it. You should check the product documentation to verify the support for license reservation.

{{% alert title="Warning" color="warning" %}}
kASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.{{% /alert %}}

### References
If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

/**
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 * Unauthorized redistribution prohibited.
 */

package integ_tests

import (  
"context"  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
  "github.com/onsi/ginkgo"  
  "github.com/onsi/gomega"  
autoscalingv1 "k8s.io/api/autoscaling/v1"  
corev1 "k8s.io/api/core/v1"  
metav1 "k8s.io/apiserver/pkg/apis/meta/v1"  
  "k8s.io/apiserver/pkg/types"
)

var _ = Describe("SmartLicense Webhook Test", func() {
const defaultNamespace = "default"

var defaultCount uint32 = 1

var secret *corev1.Secret
var hpa *autoscalingv1.HorizontalPodAutoscaler

BeforeEach(func() {
    secret = &corev1.Secret{
        Data:       map[string][]byte{"token": []byte("MTIz")},
    }
    Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())
    hpa = &autoscalingv1.HorizontalPodAutoscaler{
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: 3,
        },
    }
    Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
})

AfterEach(func() {
    Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
    Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
})

Context("Mutating Webhook", func() {
    It("should fill in values on creation", func() {
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
            },
        }
        err := k8sClient.Create(testCtx, license)
        Expect(err).ShouldNot(HaveOccurred())
        err = k8sClient.Get(testCtx, types.NamespacedName{
            Namespace: defaultNamespace,
            Name: "foo",
        }, license)
        Expect(err).ShouldNot(HaveOccurred())
        Expect(license.Spec.Action).To(Equal(v1.Register))
        Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
    })
})
Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.ScalingFactor).To(Equal(&defaultCount))
})
)
}

Context("Validating Webhook", func() {

It("should pass for valid object", func() {
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
})

It("has fields validations", func() {
    //given
    var zeroLicenses uint32 = 0
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            MinLicenseCount: &zeroLicenses,
            MaxLicenseCount: &zeroLicenses,
            ScalingFactor: &zeroLicenses,
        },
    }

    //when
    err := k8sClient.Create(testCtx, license)

    //then
    Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: ["spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1," +"spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1," +"spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1"]")})

})

It("should return error if max value is less then min value", func() {
    //given
    var minLicenses uint32 = 5
    var maxLicenses uint32 = 3
    license := &v1.SmartLicense{
Spec: v1.SmartLicenseSpec{
MinLicenseCount: &minLicenses,
MaxLicenseCount: &maxLicenses,
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))

It("should return error when creating license with non-REGISTER action", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      Action: v1.Deregister,
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))

})

It("should return error when secret does not exist", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))

})
It("should return error when secret does not token key", func() {
  //given
  secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
  Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
})

It("should return error when invalid scalingRef kind is specified", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.scalingRef.kind: Unsupported value: "Pod": supported values: "Deployment", "HorizontalPodAutoscaler"))
})

It("should return error when scalingRef does not exist", func() {
//given
license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found"))

It("should not allow changing licenseType after registration", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    Expect(k8sClient.Create(context.TODO(), license)).To(Succeed())
    license.Status.RegistrationState = v1.Registered
    Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())

    //when
    license.Spec.LicenseType = "buzz"
    err := k8sClient.Update(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})
})
})

---

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package controllers_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"

    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})

package handlers_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"

    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
)

func TestHandlers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {
    Expect(v1.AddToScheme(scheme.Scheme)).To(Succeed())
})
package integ_tests

import {
    "context"

v1 "css.cisco.com/kasa/license-broker/api/v1"
    "github.com/go-logr/logr"
    "github.com/onsi/ginkgo"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/client-go/rest"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
}

func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))

    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }

    close(done)
    if err := mgr.Start(ctx); err != nil {
        return err
    }

    return nil
}

package controllers_test

import {
    "context"

v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
const (  
epDeploymentName = "epDeployment"
initialDeploymentReplicas int32 = 3
)

var _ = Describe("Deployment License Controller Test", func() {

deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
var (  
reconciler       *controllers.DeploymentLicenseReconciler  
fakeClient       client.Client  
mockCtrl         *gomock.Controller  
deployment       *appsv1.Deployment  
smartLicense     *v1.SmartLicense  
recorder         *record.FakeRecorder  
replicasCalculatorMock *mocks.MockReplicasCalculator
)

BeforeEach(func() {
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
recorder = record.NewFakeRecorder(1024)
replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

reconciler = &controllers.DeploymentLicenseReconciler{
  Client:      fakeClient,
  Log:         logf.NullLogger{ },
  Recorder:    recorder,
  ReplicasCalculator: replicasCalculatorMock,
}


})
smartLicense = &v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
  Spec: v1.SmartLicenseSpec{
    Action: v1.Register,
    LicenseType: licenseType,
    MinLicenseCount: &minLicenseCount,
    MaxLicenseCount: &maxLicenseCount,
    ScalingFactor: &scalingFactor,
  },
  Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
  ObjectMeta: metav1.ObjectMeta{
    Name: epDeploymentName,
    Namespace: defaultNs,
    Annotations: map[string]string{
      controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
    },
  },
  Spec: appsv1.DeploymentSpec{
    Replicas: &replicas,
  },
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

})

AfterEach(func() {
  Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
  mockCtrl.Finish()
})

It("should skip if Deployment does not exist", func() {
  Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())
})

It("should skip if Deployment SmartLicense does not exist", func() {
  Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
})
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
}

It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(4), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(2))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
    Deployment to initial replicas number 3")))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's
    Replicas to 2")))
})
It("should an event if initial replica number annotation is incorrect", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(2), nil)

deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(HaveOccurred())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial-
replicas-count label is not correct. Please, update it to correct number.")))
})

It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
*deployment.Spec.Replicas = 0
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(25), nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
})

It("should send a warning if deployment controlled by HPA", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(4), nil)

hpa := &autoscalingv1.HorizontalPodAutoscaler{
  ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
  Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
    MaxReplicas:  initialHPAMaxReplicas,
  },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), hpa)).To(Succeed())

hpa := &autoscalingv1.HorizontalPodAutoscaler{
  ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
  Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
    MaxReplicas:  initialHPAMaxReplicas,
  },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), hpa)).To(Succeed())

Expect(err).To(BeNil())

})
Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf(
    "Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license
    resource to point to %s HPA",
    epDeploymentName, epHpaName, epHpaName))))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
    Deployment to initial replicas number 3"))
})
}
}
}
package handlers

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/util/workqueue"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
}

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue
RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
    return handler.Funcs{
        UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
            if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
                licenseList := v1.SmartLicenseList{}
                err := c.List(context.TODO(), &licenseList)
                if err != nil {
                    secretLog.Error(err, "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
                    panic(err.Error())
                }

                for _, smartLicense := range licenseList.Items {
                    if smartLicense.Spec.TokenSecret.Name == secret.Name &&
                        if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
                            smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
                            q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                                Namespace: smartLicense.Namespace,
                                Name: smartLicense.Name}})
                        } else {
                            if smartLicense.Status.RegistrationState == v1.Registering {
                                q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                                    Namespace: smartLicense.Namespace,
                                    Name: smartLicense.Name}})
                            }
                        }
                    }
                }
            }
        }
    }
}

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue
RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
    return handler.Funcs{
        UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
            if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
                licenseList := v1.SmartLicenseList{}
                err := c.List(context.TODO(), &licenseList)
                if err != nil {
                    secretLog.Error(err, "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
                    panic(err.Error())
                }

                for _, smartLicense := range licenseList.Items {
                    if smartLicense.Spec.TokenSecret.Name == secret.Name &&
                        if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
                            smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
                            q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                                Namespace: smartLicense.Namespace,
                                Name: smartLicense.Name}})
                        } else {
                            if smartLicense.Status.RegistrationState == v1.Registering {
                                q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                                    Namespace: smartLicense.Namespace,
                                    Name: smartLicense.Name}})
                            }
                        }
                    }
                }
            }
        }
    }
}

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue
RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
    return handler.Funcs{
        UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
            if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
                licenseList := v1.SmartLicenseList{}
                err := c.List(context.TODO(), &licenseList)
                if err != nil {
                    secretLog.Error(err, "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
                    panic(err.Error())
                }

                for _, smartLicense := range licenseList.Items {
                    if smartLicense.Spec.TokenSecret.Name == secret.Name &&
                        if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
                            smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
                            q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                                Namespace: smartLicense.Namespace,
                                Name: smartLicense.Name}})
                        } else {
                            if smartLicense.Status.RegistrationState == v1.Registering {
                                q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                                    Namespace: smartLicense.Namespace,
                                    Name: smartLicense.Name}})
                            }
                        }
                    }
                }
            }
        }
    }
}
Name: smartLicense.Name,
})

} else {
secretLog.Error(fmt.Errorf("cannot cast %T to Secret", evt.ObjectNew), "event is ignored")
}

},

}

package v1_test

import (
 v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1/mocks"
 dispatcherMock "cisco.com/kasa/operator/enforcementpoint/dispatcher/mocks"
 "context"
 coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
 clientagent "css.cisco.com/licensing/client-agent"
 lca "css.cisco.com/licensing/client-agent"
 "css.cisco.com/licensing/client-agent/proto"
 "fmt"
 "github.com/golang/mock/gomock"
 . "github.com/onsi/ginkgo"
 . "github.com/onsi/gomega"
 coreV1 "k8s.io/api/core/v1"
 "k8s.io/apimachinery/pkg/api/resource"
 metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
 "k8s.io/apimachinery/pkg/runtime"
 "k8s.io/apimachinery/pkg/types"
 "k8s.io/client-go/tools/record"
 "os"
 ctrl "sigs.k8s.io/controller-runtime"
 "sigs.k8s.io/controller-runtime/pkg/client"
 "sigs.k8s.io/controller-runtime/pkg/client/fake"
 logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService

var _ = Describe("SmartLicense Controller Test", func() {

 const (
podName = "sfcn-enforcer"
podNamespace = "sfcn-system"
nodeName = "aws-eks-node0"
)

var tenant, podNamespacedName = &clientagent.Tenant{
    Name: podNamespace + "/" + podName,
    Attributes: map[string]string{
        "role": "license-requestor",
    },
}, types.NamespacedName{
    Namespace: podNamespace,
    Name: podName,
}

newPod := func(name, namespace, nodeName string) *coreV1.Pod {
    return &coreV1.Pod{
        TypeMeta: metaV1.TypeMeta{
            Kind: "Pod",
            APIVersion: "v1",
        },
        ObjectMeta: metaV1.ObjectMeta{
            Name: name,
            Namespace: namespace,
            Labels: tenant.Attributes,
        },
        Spec: coreV1.PodSpec{
            NodeName: nodeName, Containers: []coreV1.Container{
                Name: "ep-container",
                Resources: coreV1.ResourceRequirements{
                    Limits: map[coreV1.ResourceName]resource.Quantity{
                        "cpu": resource.MustParse("2000m"),
                    },
                },
            },
        }
    }
}

newNode := func(name string) *coreV1.Node {
    return &coreV1.Node{
        TypeMeta: metaV1.TypeMeta{
            Kind: "Node",
            APIVersion: "v1"},
        ObjectMeta: metaV1.ObjectMeta{
            Name: name,
                "cpu": resource.MustParse("4"),
            },
        }
    }
}
var (  
    pod        *coreV1.Pod  
    node       *coreV1.Node  
    reconciler *v1.SmartLicenseReconciler  
    fakeClient client.Client  
    mockCtrl   *gomock.Controller  
    licensingClient *mocks.MockLicensingClient  
    allotmentService *mocks.MockAllotmentService  
    dispatcher *dispatcherMock.MockGatewayClient  
    recorder   *record.FakeRecorder  
)  
  
  resetRecorder := func() {  
    recorder = record.NewFakeRecorder(1024)  
    reconciler.Recorder = recorder  
  }  
  
  reconcileAndExpectFail := func() {  
    resetRecorder()  
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})  
    Expect(err).ShouldNot(HaveOccurred()) // failure is determined by requeue after duration  
    Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration}))  
  }  
  
  reconcileAndExpectSuccess := func() {  
    resetRecorder()  
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})  
    Expect(err).ShouldNot(HaveOccurred())  
    Expect(result).To(Equal(ctrl.Result{ }))  
  }  
  
  recordedEvents := func() []string {  
    close(recorder.Events)  
    var events []string  
    for event := range recorder.Events {  
      events = append(events, event)  
    }  
    return events  
  }  
  
  lastRecordedEvent := func() string {  
    events := recordedEvents()  
    if len(events) == 0 {  
      return ""  
    }  
    return events[0]  
  }
BeforeEach(func() {
    pod = newPod(podName, podNamespace, nodeName)
    node = newNode(nodeName)
    data := []client.Object{pod, node}
    mockCtrl = gomock.NewController(GinkgoT())
    scheme := runtime.NewScheme()
    Expect(coreV1.AddToScheme(scheme)).To(Succeed())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
    allotmentService = mocks.NewMockAllotmentService(mockCtrl)
    licensingClient = mocks.NewMockLicensingClient(mockCtrl)
    dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
    recorder = record.NewFakeRecorder(1024)
    reconciler = &v1.SmartLicenseReconciler{
        CoreClient: coreV1Client.New(fakeClient, context.Background),
        Licenser: licensingClient,
        Log: logf.NullLogger{},
        Recorder: recorder,
        Dispatcher: dispatcher,
    }
    licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
})

It("should revoke ASAc license after failing multiple attempts of registration", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(fmt.Errorf("test registration failure")).AnyTimes()
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().RevokeLicense().Times(1)
    numAttempts := 0
    for numAttempts < v1.MaxRetryAttempts {
        reconcileAndExpectFail()
        numAttempts += 1
        if numAttempts == 1 {
            // on the first attempt expect an event is recorded
            Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
        } else {
            Expect(lastRecordedEvent()).Should(BeEmpty())
        }
    }
    reconcileAndExpectFail()
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
})

ItReconcileSuccessfullyWithExpectedNumberOfCores := func(numCores uint32) {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil)
allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
    PoolName: podNamespace,
    Tenant:   tenant,
    NumCores: numCores, // this is the limit specified for the container
 })).Return(&clientagent.AllotmentRequestStatus{
    ContextId:          "test-context",
    Tenant:             tenant,
    NumCores:           numCores,
    SmartAccountName:   "test-domain",
    VirtualAccountName: "test-account",
    ExportControlled:   true,
}, nil)
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().GrantLicense(true)
reconcileAndExpectSuccess()
Expect(recordedEvents()).Should(ConsistOf(
HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),
HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),
HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified")))
}

It("should verify the license status and request on successful registration", func() {
    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
Name: "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
})
Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})

It("should revoke ASAc license after successful registration but fails to get a lease", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil).AnyTimes()
allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
    PoolName: podNamespace,
    Tenant:   tenant,
    NumCores: 2, // this is the limit specified for the container
 })).Return(nil, fmt.Errorf("test insufficient cores")).AnyTimes()

    numAttempts := 0
    for numAttempts < v1.MaxRetryAttempts {
reconcileAndExpectFail()
numAttempts += 1
if numAttempts == 1 {
    // on the first attempt expect an event is recorded
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
} else {
    Expect(lastRecordedEvent()).Should(BeEmpty())
}
reconcileAndExpectFail()
Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because it failed to obtain a license"))
}

It("should revoke ASAc license when server requests to the release the allotment", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
    ContextId: "test-context",
    Tenant:    tenant,
})).Return(nil)

ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
}):

Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license"))
}

It("should report the allotment it holds when the server requests so", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

    allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
        ContextId: "test-context",
        Tenant:    tenant,
        NumCores:  2,
    })).Return(nil)
ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_REPORT_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
})
Expect(lastRecordedEvent()).Should(BeEmpty())
}

It("should mark tenant as unregistered if license server is unavailable and retry again", func() {
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil,
    fmt.Errorf("some error occurs: %w", lca.ErrLicenseServerUnavailable))
res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
Expect(err).Should(BeNil())
Expect(res).ShouldNot(BeNil())
Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
})

AfterEach(func() {
    mockCtrl.Finish()
})

package controllers

import (
    "context"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
Open Source Used In kASA v1.5

```go
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/builder"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"

corePredicate "sigs.k8s.io/controller-runtime/pkg/predicate"
"sigs.k8s.io/controller-runtime/pkg/source"

v1 "css.cisco.com/kasa/license-broker/api/v1"
coreV1 "k8s.io/api/core/v1"
"time"
)

const SFCNProductId = "SFW"

const (  
  registrationReason   = "Registration"
  deregistrationReason = "Deregistration"
  FinalizerName        = "sfcn.cisco.com/license-degistration-finalizer"
)

// SmartLicenseReconciler reconciles a SmartLicense object
type SmartLicenseReconciler struct {  
  Client            client.Client  
  LicensingClient   licensing.LicensingClient  
  Log               logr.Logger  
  Recorder          record.EventRecorder  
  Scheme            *runtime.Scheme  
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
  return ctrl.NewControllerManagedBy(mgr).
    For(&v1.SmartLicense{}, builder.WithPredicates(&corePredicate.GenerationChangedPredicate{})).
    Watches(&source.Channel{Source: oobChangeNotifier}, &handler.EnqueueRequestForObject{}).
    Complete(r)
}

// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses,verbs=get;list;watch;create;update;patch;delete
// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses/status,verbs=get;update;patch
// +kubebuilder:rbac:groups=core,resources=secrets,verbs=get;list;watch
// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list;watch;update;delete
// +kubebuilder:rbac:groups=apps,resources=deployments,verbs=get;list;watch;update
// +kubebuilder:rbac:groups=apps,resources=replicasets,verbs=get;list;watch
// +kubebuilder:rbac:groups=autoscaling,resources=horizontalpodautoscalers,verbs=get;list;watch;update
```
func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := r.Log.WithValues("smartlicense", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    var license v1.SmartLicense
    if err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("SmartLicense does not exist, nothing to reconcile")
        }
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }

    if license.ObjectMeta.DeletionTimestamp.IsZero() {
        if err := r.addFinalizerIfMissing(&license); err != nil {
            return ctrl.Result{}, err
        }
    } else {
        // the license is being deleted, need to deregister it first
        return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
    }

    switch license.Spec.Action {
    case v1.Register:
        err := r.registerPlatform(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
        }

        err = r.scaleEntitlements(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
        }

        if err = r.recordSuccessAndUpdateStatus(&license, registrationReason); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
        }
        return ctrl.Result{}, nil

    case v1.Deregister:
        err := r.deregisterPlatform(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, deregistrationReason, err)
        }
        return ctrl.Result{}, nil
    }
}
func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
    if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
        r.licenseLogger(license).Info("added finalizer")
    }
    return nil
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    if containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        if license.Status.RegistrationState == v1.Registered {
            if err := r.deregisterPlatform(license); err != nil {
                return err
            }
            //TODO: return error and do not remove finalizer when corner cases are tested
            log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
        }
    } else {
        log.Info("removing finalizer without deregistration as platform is not registered")
    }
    license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
    if err := r.Client.Update(context.Background(), license); err != nil {
        return err
    }
    log.Info("removed finalizer")
    return nil
}
func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {
    licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
    log := r.licenseLogger(license)
    token, err := r.getToken(license)
    if err != nil {
        return fmt.Errorf("failed to retrieve licensing token: %w", err)
    }
    log.Info("trying to register platform", "platformName", licenseNsName.String())
    deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client,
        ctrl.Log.WithName("listeners").WithName("DeregistrationListener"), r.Recorder, oobChangeNotifier)
    registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
        Uuid:         string(license.UID),
        Name:         licenseNsName.String(),
        SerialNumber: serialNumber(licenseNsName.String()),
        ProductId:    SFCNProductId,
        PoolName:     license.Namespace,
    }, token, deregistrationListener)
    if err != nil {
        license.Status.RegistrationState = v1.RegistrationFailed
        license.Status.LicenseState = v1.Unlicensed
        return fmt.Errorf("failed to complete registration call: %w", err)
    }
    log.Info("registered the platform in CSSM", "registrationInfo", registration)
    license.Status.RegistrationState = v1.Registered
    // we don't want to change license state to Pending if a platform is already registered and a user just updates some field.
    if !registration.IsRegistered {
        license.Status.LicenseState = v1.PendingLicenseState
    }
    license.Status.AccountDomain = registration.SmartAccountName
    license.Status.AccountName = registration.VirtualAccountName
    license.Status.ContextId = registration.ContextId
    license.Status.ExportControlled = registration.ExportControlled

    entitlementListener := &listeners.EntitlementListener{
        Log:     ctrl.Log.WithName("listeners").WithName("EntitlementListener"),
        Client:  r.Client,
        LicenseNsName: licenseNsName,
    }
    if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
        if errors.Is(err, licensing.ErrDuplicateListener) {
            log.Info("entitlement listener is already added", "contextId", registration.ContextId)
            return nil
        }
        return fmt.Errorf("failed to subscribe to entitlement notifications: %w", err)
    }
}
log.Info("added entitlement listener", "contextId", registration.ContextId)
return nil
}

func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
if license.Status.RegistrationState != v1.Registered {
return fmt.Errorf("platform must be registered before license reservation")
}
log := r.licenseLogger(license)

log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
err := r.LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
ContextId:    license.Status.ContextId,
EntitlementId: license.Spec.LicenseType,
MinEntitlements: *license.Spec.MinLicenseCount,
MaxEntitlements: *license.Spec.MaxLicenseCount,
ScalingFactor:   *license.Spec.ScalingFactor,
})
if err != nil {
return fmt.Errorf("failed to enable licensing scaling: %w", err)
}
log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
log := r.licenseLogger(license)

state := license.Status.RegistrationState
if state == v1.Deregistered {
log.Info("platform is already deregistered, skipping deregistration")
return nil
}

err := r.LicensingClient.Registration().Deregister(license.Status.ContextId)
if err != nil {
license.Status.RegistrationState = v1.DeregistrationFailed
return fmt.Errorf("failed to complete deregistration call: %w", err)
}
log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
license.Status.RegistrationState = v1.Deregistered
license.Status.LicenseState = v1.Unlicensed
license.Status.EstimatedMaxReplicas = 0
license.Status.CoresPerLicense = 0
license.Status.LicenseNumber = 0
return nil
}
func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
    secretNamespacedName := types.NamespacedName{
        Namespace: license.Spec.TokenSecret.Namespace,
        Name:      license.Spec.TokenSecret.Name,
    }
    var tokenSecret coreV1.Secret
    if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
        return "", fmt.Errorf("failed to get token secret: %w", err)
    }
    return string(tokenSecret.Data[v1.TokenKeyName]), nil
}

func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error) {
    r.Recorder.Event(license, coreV1.EventTypeWarning, reason,
    fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
    license.Status.ErrorReason = err.Error()
    if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
        r.Log.Error(statusErr, "failed to update SmartLicense status")
    }
}

func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
    r.Recorder.Event(license, coreV1.EventTypeNormal, reason, "SmartLicense state updated.")
    license.Status.ErrorReason = ""
    if err := r.Client.Status().Update(context.Background(), license); err != nil {
        return err
    }
    return nil
}

func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
    return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
}

package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/registration.go css.cisco.com/licensing/client-agent RegistrationService
//go:generate mockgen -package=mocks -destination=./mocks/entitlement.go css.cisco.com/licensing/client-agent EntitlementService

const (  
    smartLicenseName = "license-sample"
    secretName = "secret-sample"
    defaultNs = "default"
    licenseType = "L-ASAV10S-STD"
    secretToken = "MTIz"
)

var (  
    minLicenseCount uint32 = 1
    maxLicenseCount uint32 = 5
    newMaxLicenseCount uint32 = 10
    scalingFactor uint32 = 2
)

var _ = Describe("SmartLicense Controller Test", func() {

    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

    var reconciler *controllers.SmartLicenseReconciler
    var fakeClient client.Client
    var mockCtrl *gomock.Controller

    var licensingClient *mocks.MockLicensingClient
    var registrationService *mocks.MockRegistrationService
    var entitlementService *mocks.MockEntitlementService

    var (  
        smartLicense *v1.SmartLicense
        secret     *corev1.Secret
    )
BeforeEach(func() {
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
registrationService = mocks.NewMockRegistrationService(mockCtrl)
entitlementService = mocks.NewMockEntitlementService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
reconciler = &controllers.SmartLicenseReconciler{
Client:
fakeClient,
LicensingClient: licensingClient,
Log:
logf.NullLogger{},
Recorder:
record.NewFakeRecorder(1024),
}
licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()
secret = &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},
Data:
map[string][]byte{"token": []byte(secretToken)},
}
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())
smartLicense = &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
Action: v1.Register,
TokenSecret: corev1.SecretReference{
Name:
secretName,
Namespace: defaultNs,
},
LicenseType: licenseType,
MinLicenseCount: &minLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,
},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())
})
AfterEach(func() {
mockCtrl.Finish()
})
Context("platform registration", func() {
It("should register platform in licensing system", func() {
registrationService.EXPECT().Register(&licensing.Platform{

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Uuid:      string(smartLicense.UID),
Name:      licenseNsName.String(),
SerialNumber: "8B201B63BB8",
ProductId: controllers.SFCNProductId,
PoolName:  defaultNs,
}, secretToken, gomock.Any()).Return(&licensing.Registration{
  ContextId:      "testContextId",
  SmartAccountName: "TestAccountName",
  VirtualAccountName: "TestVirtualName",
  ExportControlled: true,
  IsRegistered: false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
  ContextId:       "testContextId",
  EntitlementId:   licenseType,
  MinEntitlements: minLicenseCount,
  MaxEntitlements: maxLicenseCount,
  ScalingFactor:   scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))
})

It("should ignore ErrDuplicateListener error", func() {
  registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
  gomock.Any()).Return(&licensing.Registration{
    ContextId:      "testContextId",
    IsRegistered: false,
    }, nil)
  entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
  entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
    ContextId:       "testContextId",
    EntitlementId:   licenseType,
    MinEntitlements: minLicenseCount,
    MaxEntitlements: maxLicenseCount,
    ScalingFactor:   scalingFactor,
  }).Return(nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
}
}

Context("platform deregistration", func() {
    It("should deregister platform in licensing system", func() {
        Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
        smartLicense.Status.ContextId = "testContextId"
        smartLicense.Status.RegistrationState = v1.Registered
        Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
        registrationService.EXPECT().Deregister("testContextId").Return(nil)

        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
        Expect(err).To(BeNil())
    }
}

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0))))
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0))))
Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0))))
})

It("should skip deregistration if platform is already deregistered", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
}

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})

It("should deregister platform on resource deletion", func() {
    smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
    now := metav1.Now()
    smartLicense.DeletionTimestamp = &now
    smartLicense.Status.RegistrationState = v1.Registered
    smartLicense.Status.ContextId = "testContextId"
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
// cannot check finalizer removal due to a bug in fakeClient: https://github.com/kubernetes/client-go/issues/607
// Expect(smartLicense.Finalizers).ShouldNot(ContainElement(finalizerName))
})})

Context("smart license updating", func() {
It("license state should not be updated", func() {
Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
licenseStateBeforeUpdate := smartLicense.Status.LicenseState
smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

registrationService.EXPECT().Register(gomock.Any(), gomock.Any(), gomock.Any()).Return(&licensing.Registration{
    ContextId:    "testContextId",
    IsRegistered: true,
    }, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
    ContextId:       "testContextId",
    EntitlementId:   licenseType,
    MinEntitlements: minLicenseCount,
    MaxEntitlements: newMaxLicenseCount,
    ScalingFactor:   scalingFactor,
    }).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))
})})
})
}
package subscribers

import (licensing "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "github.com/go-logr/logr"
coreV1 "k8s.io/api/core/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"sigs.k8s.io/controller-runtime/pkg/event"
func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
    return &subscriptionListener{
        channel: channel,
        log:     log,
    }
}

type subscriptionListener struct {
    channel chan event.GenericEvent
    log     logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)

    switch e.Type {
    case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED,
        proto.AllotmentEvent_ALLOTMENT_DENIED:
        l.log.V(1).Info("scheduling event for PodLicenseReconciler")
        l.sendEventToChannel(e.Tenant.Name)
    }
}

func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
        Name:      namespacedName[1],
        Namespace: namespacedName[0],
    }}
    l.channel <- event.GenericEvent{Object: pod}
}

package listeners

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/licensing/client-agent/proto"
func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger, recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
    return &deregistrationListener{
        log:             log,
        client:          client,
        licenseNsName:   licenseNsName,
        recorder:        recorder,
        notifierChannel: notifierChannel,
        retries:         int
    }
}

const MaxRetries = 10

type deregistrationListener struct {
    log             logr.Logger
    client          client.Client
    licenseNsName   types.NamespacedName
    recorder        record.EventRecorder
    notifierChannel chan event.GenericEvent
    retries         int
}

// OnAutoDeregistration updates SmartLicense status to be in deregistered state.
//
// The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
    log := d.log.WithValues("smartlicense", d.licenseNsName)
    log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)

    if err := d.warnSmartLicenseDeregistered(msg); err != nil {
        if d.retries < MaxRetries {
            log.Error(err, "failed to process auto-deregistration event. retrying...")
            d.retries++
            time.Sleep(1 * time.Second)
        }
        d.OnAutoDeregistration(platform, msg)
        return
    }
}
log.Error(err, "failed to process auto-deregistration event")
return
}
d.retries = 0
log.V(1).Info("successfully processed auto-deregistration event")
}

func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
var license v1.SmartLicense
if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
if errors.IsNotFound(err) {
    d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
    return nil
}
return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
}
license.Status.RegistrationState = v1.Deregistered
license.Status.LicenseState = v1.Unlicensed
license.Status.LicenseNumber = 0
license.Status.CoresPerLicense = 0
license.Status.EstimatedMaxReplicas = 0
if err := d.client.Status().Update(context.Background(), &license); err != nil {
    return fmt.Errorf("failed to update SmartLicense status: %w", err)
}
d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
d.notifierChannel <- event.GenericEvent{Object: &license}
return nil
}

package controllers

import {
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/handlers"
  "css.cisco.com/kasa/pkg/predicates"
  "fmt"
  "github.com/go-logr/logr"
  appsv1 "k8s.io/api/apps/v1"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  corev1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/types"
//go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator
type ReplicasCalculator interface {
    CalculateMaxLicensedReplicas/licenses []v1.SmartLicense, deployment *appsV1.Deployment) (int32, error)
}

type DeploymentLicenseReconciler struct {
    client.Client
    Log       logr.Logger
    Recorder  record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&appsV1.Deployment{}, builder.WithPredicates(
            predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey: InitialReplicasNumberAnnotation})),
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.DeploymentHandler()).
        Complete(c)
}

// Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value
// when it exceeds the replicas allowed by licensing config.
func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := c.Log.WithValues("deployment", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()
    deployment := &appsV1.Deployment{
        if err != nil {
            if errors.IsNotFound(err) {
                log.Info("Deployment does not exist, nothing to reconcile")
            }
            return ctrl.Result{}, client.IgnoreNotFound(err)
        }
        // Continue with reconciliation logic...
    }
licenseList := v1.SmartLicenseList{ }
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("updated Deployment labels")
}

if len(deploymentLicenses) == 0 {
    log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
    c.Recorder.Event(deployment, corev1.EventTypeError, "DeploymentControlledByHPA", 
        fmt.Sprintf("%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", deployment.Name, hpa.Name, hpa.Name))
}

if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
    initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
if err != nil {
c.recorder.Event(corev1.EventTypeWarning, "WrongInitialReplicasNumber", fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
return ctrl.Result{}, err
}

log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
*deployment.Spec.Replicas = int32(initialReplicasCountInt)
// delete initial replicas number from Deployment annotations to don't back to initial number on each reconciliation
delete(deployment.Annotations, InitialReplicasNumberAnnotation)
if err = c.Client.Update(context.Background(), deployment); err != nil {
return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.recorder.Event(corev1.EventTypeNormal, "ScaledDeploymentToInitialReplicasNumber", fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))
}

if *deployment.Spec.Replicas > maxLicensedReplicas {
log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas", *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
*deployment.Spec.Replicas = maxLicensedReplicas
if err = c.Client.Update(context.Background(), deployment); err != nil {
return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.recorder.Event(corev1.EventTypeWarning, "DeploymentScaledDown", fmt.Sprintf("Decreased Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", maxLicensedReplicas))
log.Info("successfully scaled down deployment to max license limit", "updatedReplicas", *deployment.Spec.Replicas)
return ctrl.Result{}, nil
}

log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas", *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment *appsv1.Deployment) (*autoscalingv1.HorizontalPodAutoscaler, error) {

hpaList := &autoscalingv1.HorizontalPodAutoscalerList{}
if err != nil {
return nil, err
}
for _, hpa := range hpaList.Items {
        return &hpa, err
    }
}

return nil, err
}

package controllers

import {
    "context"
    "errors"
    "fmt"
    "strconv"
    "time"

ev1 "css.cisco.com/kasa/license-broker/api/v1"
"css.cisco.com/kasa/pkg/predicates"
licensing "css.cisco.com/licensing/client-agent"
"github.com/go-logr/logr"
appsv1 "k8s.io/api/apps/v1"
autoscalingv1 "k8s.io/api/autoscaling/v1"
coreV1 "k8s.io/api/core/v1"
coreV1 "k8s.io/api/core/v1"
apiErrors "k8s.io/apimachinery/pkg/api/errors"
"k8s.io/apimachinery/pkg/labels"
"k8s.io/apimachinery/pkg/selection"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/tools/record"
"k8s.io/utils/pointer"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/builder"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"
"sigs.k8s.io/controller-runtime/pkg/source"
}

type PodLicenseReconciler struct {
    client.Client
    LicensingClient licensing.LicensingClient
    Log logr.Logger
    Recorder record.EventRecorder
}

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent)
error {
  return ctrl.NewControllerManagedBy(mgr).
  For(&coreV1.Pod{}, builder.WithPredicates(
    &predicates.LabelExistsPredicate{Key: LicenseHolderLabel}).
  Watches(&source.Channel{Source: eventChannel}, &handler.EnqueueRequestForObject{}).
  Complete(c)
}

// Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
// a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
// On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
  log.V(1).Info("reconciliation started")
  start := time.Now()
  defer func() {
    log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
  }()

  pod := coreV1.Pod{}
  podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
  err := c.Client.Get(ctx, podNsName, &pod)
  if err != nil {
    if apiErrors.IsNotFound(err) {
      log.Info("Pod does not exist, releasing allotments it might still hold")
      return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
    }
    return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
  }

  status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
  if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
  }

  shouldHaveLicensingLabel := status != nil && status.NumCores != 0
  changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
  if changed {
    if err = c.Client.Update(ctx, &pod); err != nil {
      return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
    }
    log.Info("updated Pod labels")
  }

  deployment, err := c.findPodDeployment(&pod)
  if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
  }
}
if deployment == nil {
    log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
    if err := c.Client.Delete(context.Background(), &pod); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
    }
    c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration.
    "))
    log.Info("deleted orphan Pod")
    return ctrl.Result{}, nil
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

serviceRole := getDeploymentServiceRole(deployment)

serviceRoleIsRegistered, err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
}
if !serviceRoleIsRegistered {
    if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    } else {
        if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
            return ctrl.Result{}, err
        }
        if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
            return ctrl.Result{}, err
        }
    }
} else {
    if err := c.releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
        log := c.Log.WithValues("pod", nsName.String())
        tenant := &licensing.Tenant{Name: nsName.String()}
        status, err := c.LicensingClient.Allotment().Status(tenant)
if err != nil {
    if errors.Is(err, licensing.ErrNotRegistered) {
        log.Info("Pod tenant is not registered in license server, nothing to release")
        return nil
    }
    return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
}

if status != nil && status.NumCores != 0 {
    log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
    if err := c.LicensingClient.Allotment().ReleaseAllotment(&licensing.AllotmentRelease{
        ContextId: status.ContextId,
        Tenant:    tenant,
    }); err != nil {
        return fmt.Errorf("failed to release Pod allotments: %w", err)
    }
    log.Info("successfully released Pod allotments")
    return nil
}

log.Info("Pod does not hold any allotments, nothing to release")
return nil
}

func (c *PodLicenseReconciler) podLogger(pod *coreV1.Pod) logr.Logger {
}

func toLicenseTenant(pod coreV1.Pod) *licensing.Tenant {
    podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
    return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each
// service role
// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is
// scaled down.
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment,
    reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the
    namespace")

    trialDeploymentList := appsv1.DeploymentList{
    }
    labelSelector := labels.NewSelector()
    trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals,
        []string{"true"})
    if err == nil {

labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
}
serviceRole := getDeploymentServiceRole(deployment)
serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals, []string{serviceRole})
if err == nil {
    labelSelector = labelSelector.Add(*serviceLabelRequirement)
}
if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
    Namespace: deployment.Namespace,
    LabelSelector: labelSelector,
}); err != nil {
    return fmt.Errorf("failed to fetch Deployments with trial license label")
}
log.Info("Length of trial deployment list", "length", len(trialDeploymentList.Items))
var allowedReplicas int32 = 0
trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name == deployment.Name
if trialDeploymentIsAbsent || isDeploymentInTrial {
    log.Info("Deployment has to be marked as trial license holder")
    allowedReplicas = 1
}

trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
scaleDownRequired := *deployment.Spec.Replicas > allowedReplicas
if scaleDownRequired || trialLabelUpdated {
    initialReplicasNumber := strconv.Itoa(int(pointer.Int32PtrDerefOr(deployment.Spec.Replicas, 1)))
    log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
    deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
    deployment.Spec.Replicas = &allowedReplicas
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    if scaleDownRequired {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown", fmt.Sprintf("Decreased Deployment's Replicas to %d "+
            "as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. "+
            "Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas))
        log.Info("scaled Deployment", "replica count", allowedReplicas)
    }
}
return nil

// throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
// If a deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList
func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
    if err != nil {
        return fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }

    if !containsString(licensedDeploymentNames, deployment.Name) {
        log.Info("scaling down Pod's Deployment to 0 as it requested license but does not belong to any licensed EP deployment")
        *deployment.Spec.Replicas = 0
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment resource: %w", err)
        }
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
            fmt.Sprintf("Decreased Deployment's Replicas to 0 "+
                "as it requested license but does not belong to any licensed EP deployment. "+
                "Please, check SmartLicense resources to update licensing configuration."))
        log.Info("scaled down Pod's Deployment to 0")
        return nil
    }

    log.Info("verified that Pod belongs to the licensed Deployment")
    return nil
}

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
func (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment: %w", err)
        }
        log.Info("removed Deployment trial license label")
        return nil
    }

    // getLicensedDeploymentNames collects names of all Deployments that have a corresponding SmartLicense resource.
    func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
        var deploymentNames []string
        for _, license := range licenseList {
            switch license.Spec.ScalingRef.Kind {
            case v1.DeploymentKind:
                deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
            case v1.HPAKind:
                deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
            }
        }
        return deploymentNames, nil
    }
hpa := &autoscalingv1.HorizontalPodAutoscaler{}
hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
    return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
}
deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
default:
}
return deploymentNames, nil

// findPodDeployment tries to find Pod's Deployment if Pod is managed by Deployment.
// If Pod is not managed by Deployment controller, `nil` is returned.
func (c *PodLicenseReconciler) findPodDeployment(pod *coreV1.Pod) (*appsv1.Deployment, error) {
    log := c.podLogger(pod)
    if len(pod.OwnerReferences) != 1 || !*pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind != "ReplicaSet" {
        log.Info("pod is not owned by ReplicaSet")
        return nil, nil
    }

    replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
    replicaSet := &appsv1.ReplicaSet{}
    if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
        return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
    }

    if len(replicaSet.OwnerReferences) != 1 || *replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
        log.Info("pod's ReplicaSet is not owned by Deployment")
        return nil, nil
    }

    deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
    deployment := &appsv1.Deployment{}
    if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
        return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
    }
    return deployment, nil
}

// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in registeredLicenses.
// It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified

func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense, namespace string, serviceRole string) (bool, error) {
licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
if err != nil {
    return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
}
for _, deploymentName := range licensedDeploymentNames {
    deployment := &appsv1.Deployment{}
    deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
    err := c.Client.Get(context.Background(), deploymentNsName, deployment)
    if err != nil {
        return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
    }
    if getDeploymentServiceRole(deployment) == serviceRole {
        return true, nil
    }
}
return false, nil
}

func getDeploymentServiceRole(deployment *appsv1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: RegistrationService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {
    ctrl     *gomock.Controller
    recorder *MockRegistrationServiceMockRecorder
}
// MockRegistrationServiceMockRecorder is the mock recorder for MockRegistrationService
type MockRegistrationServiceMockRecorder struct {
    mock *MockRegistrationService
}

// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister",
        reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener) (*service.Registration, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
    ret0, _ := ret[0].(*service.Registration)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
        reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}
val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistriesTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val getPublicTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String, String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra

val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(";")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

tasks {
    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }
    named("dockerBuild") {
        doLast {
            exec {
                environment("DOCKER_BUILDKIT", 1)
                commandLine("docker build -f ./Dockerfile -t $imageNameForPush ../").split(" ")
            }
            val artifactoryUser = project.findProperty("artifactoryUser")!! as String
            val artifactoryApiKey = project.findProperty("artifactoryApiKey")!! as String
val saArtifactUrl = project.findProperty("saArtifactUrl")!! as String
val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
    exec {
        setWorkingDir("bin")
        commandLine = listOf(
            "bash", "-c",
            "curl -f -u $artifactoryUser:$artifactoryApiKey -O $downloadUrl"
        )
    }
}
exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}

named("promoteImage") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        val sourceTag: String? by project
        val sourceRepo: String? by project
        val imageTag: String? by project
        if (sourceTag == null || sourceRepo == null || imageTag == null) {
            val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please,
specify them with: -PsourceTag=<srcImageTag> -PsourceRepo=<sourceRepoName> -
PimageTag=<targetImageTag>"
            logger.error(msg)
            throw GradleException(msg)
        }
        val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
        val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split(':')?[0]
promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
    }
}

named("check") {
    doLast {
        execCommands(listOf(
            "go fmt ./...",
            "go vet ./..."
        ))
    }
}
named("test") {
    doLast {
        execCommands(listOf(
            "go test -coverpkg=./... -coverprofile cover.out ./...",
            "go tool cover -func=cover.out -o ${project.name}-cover.txt"
        ))
    }
}

named("publish") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        println(execCommand("docker push $serverImageNameForPush"))
    }
}

named("manifests") {
    dependsOn("controller-gen")
    description = "Generates manifests for k8s deployment using Helm"
    doLast {
        execHelmCommand("helm dependency update")
        val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")} . --namespace $systemNamespace --set nameOverride=licenseapi")
        buildDir.deleteRecursively()
        buildDir.mkdir()
        File("$buildDir/license-broker.yaml").writeText(stdOut)
    }
}

named<Copy>("generateValuesFile") {
    expand(
        "platform" to project.findProperty("platform")!!,
        "registry" to project.findProperty("dockerRegistry")!!,
        "artifactoryRepo" to project.findProperty("imageDirectory")!!,
        "controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
        "licenseServerImage" to getRegistrylessTaggedImage(project.findProperty("licenseServerImageName")!! as String),
        "defaultImagePullPolicy" to project.findProperty("imagePullPolicy")!!,
        "logLevel" to project.findProperty("logLevel")!!,)
"logFormat" to project.findProperty("logFormat")!!,
"licenseServerTransportUrl" to project.findProperty("licenseServerTransportUrl")!!
)
)

named("generateControllerGenFiles") {
  dependsOn("controller-gen")
  doLast {
    execCommand("$controllerGen $crdOpts rbac:roleName=broker-role webhook paths=./...
output:crd:artifacts:config=config/crd")
  }
}

register("generate") {
  dependsOn("controller-gen")
  description = "Executes code generators"
  doLast {
    execCommand("$controllerGen object:headerFile=./hack/boilerplate.go.txt paths=./...")
  }
}

register("uninstall") {
  description = "Removes k8s objects from the active cluster"
  dependsOn("manifests")
  doLast {
    exec {
      isIgnoreExitValue = true
      commandLine("kubectl delete -f $buildDir".split(" "))
    }
  }
}

named("deploy") {
  dependsOn(":installCertManager")
  dependsOn("manifests")
  doLast {
    exec {
      commandLine("kubectl apply -f $buildDir".split(" "))
    }
    createRegistrySecret(systemNamespace)
  }
}

named("loadImagesToKind") {
  doLast {
    val clusterName: String by project
    execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")
    execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
  }
}
execCommand("docker tag $imageNameForPush $imageNameForPull")
execCommand("kind load docker-image $imageNameForPull --name $clusterName")
}
}
}

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Cisco End User License Agreement

package integ_tests

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/rest"
    "path/filepath"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
    "sigs.k8s.io/controller-runtime/pkg/envtest/printer"
    "sigs.k8s.io/controller-runtime/pkg/log/zap"
    "strings"
    "testing"
    "time"

    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {  
    RegisterFailHandler(Fail)
    SetDefaultEventuallyTimeout(time.Minute)
    RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite",  
        []Reporter{printer.NewlineReporter{}})  
}

var _ = BeforeSuite(func(done Done) {  
    logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))
})
By("bootstrapping test environment")
apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
testEnv = &envtest.Environment{
  WebhookInstallOptions: envtest.WebhookInstallOptions{
    Paths: []string{filepath.Join("..", "config", "webhook")},
  },
  CRDDirectoryPaths:        []string{filepath.Join("..", "config", "crd")},
  KubeAPIServerFlags:       apiServerFlags,
  ControlPlaneStartTimeout: 100 * time.Second,
  ControlPlaneStopTimeout:  100 * time.Second,
}

var err error
cfg, err = testEnv.Start()
Expect(err).ToNot(HaveOccurred())
Expect(cfg).ToNot(BeNil())

err = v1.AddToScheme(scheme.Scheme)
Expect(err).NotTo(HaveOccurred())
k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
Expect(err).NotTo(HaveOccurred())
Expect(k8sClient).ToNot(BeNil())

By("running webhook server")
go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done)
}, envtest.StartTimeout)

var _ = AfterSuite(func(done Done) {
  By("tearing down the test environment")
cancelCtx()
  Expect(testEnv.Stop()).ToNot(HaveOccurred())

close(done)
}, envtest.StopTimeout)

func errCauses(err error) []string {
  var causes []string
  if statusError, ok := err.(*errors.StatusError); ok {
    for _, cause := range statusError.Status().Details.Causes {
      causes = append(causes, strings.Split(cause.Message, ": ") [2])
    }
  }
  return causes
  }
package v1

import (
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
)

const TokenKeyName = "token"

type RegistrationAction string

const (  
    Register    RegistrationAction = "REGISTER"
    Deregister RegistrationAction = "DEREGISTER"
)

// SmartLicenseSpec defines the desired state of SmartLicense
type SmartLicenseSpec struct {
    // Action is the desired state of the Smart Agent license registration.
    // +kubebuilder:validation:Enum=REGISTER;DEREGISTER
    // +optional
    Action RegistrationAction `json:"action"

    // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
    TokenSecret v1.SecretReference `json:"tokenSecret"

    // LicenseType defines the type of license to request/release, usually the SKU of the license.
    // The default value is a SFW license tag being able to handle 1vCPU.
    // +optional
    LicenseType string `json:"licenseType"

    // MinLicenseCount is a minimum number of licenses SFCN reserves for the product.
    // The default value is 1.
    // +optional
    MinLicenseCount *uint32 `json:"minLicenseCount,omitempty"

    // MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.
    // The default value is equal to MinLicenseCount.
    // +optional
    MaxLicenseCount *uint32 `json:"maxLicenseCount,omitempty"
// ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down.
// The default value is 1.
// +optional
ScalingFactor *uint32 `json:"scalingFactor,omitempty"

// ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
ScalingRef autoscalingv1.CrossVersionObjectReference `json:"scalingRef,omitempty"
}

type LicenseState string

const (  
PendingLicenseState LicenseState = "PENDING"
Unlicensed LicenseState = "UNLICENSED"
InCompliance LicenseState = "IN_COMPLIANCE"
OutOfCompliance LicenseState = "OUT_OF_COMPLIANCE"
Overage LicenseState = "OVERAGE"
)

const (  
DeploymentKind = "Deployment"
HPAKind = "HorizontalPodAutoscaler"
)

type RegistrationState string

const (  
PendingRegistrationState RegistrationState = "PENDING"
Registered RegistrationState = "REGISTERED"
RegistrationFailed RegistrationState = "REGISTRATION_FAILED"
Deregistered RegistrationState = "DEREGISTERED"
DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
)

// SmartLicenseStatus defines the observed state of SmartLicense

type SmartLicenseStatus struct {

// AccountDomain is the account domain in Cisco Software Central.
AccountDomain string `json:"accountDomain,omitempty"

// AccountName is the name of the virtual account in Cisco Software Central.
AccountName string `json:"accountName,omitempty"

// RegistrationState is the registration status of the SFCN product in Cisco Software Central.
// +kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DERE
GISTRATION_FAILED
RegistrationState RegistrationState `json:"registrationStateomitempty"

// LicenseState is the state of the reserved licenses.
// +kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVER AGE
LicenseState LicenseState `json:"licenseStateomitempty"

// ErrorReason specifies the error due to which the the SFCN product was not registered in Cisco Software Central.
ErrorReason string `json:"errorReasonomitempty"

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
LicenseNumber uint32 `json:"licenseNumberomitempty"

// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicenseomitempty"

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicasomitempty"

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while
// generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlledomitempty"

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextIdomitempty"

// +kubebuilder:object:root=true
// +kubebuilder:subresource:status
// +kubebuilder:printcolumn:name="Age",type=date,JSONPath=".metadata.creationTimestamp"
// +kubebuilder:printcolumn:name="Registration State",type=string,JSONPath=".status.registrationState"
// +kubebuilder:printcolumn:name="License State",type=string,JSONPath=".status.licenseState"
// +kubebuilder:printcolumn:name="License Number",type=integer,JSONPath=".status.licenseNumber"
// +kubebuilder:printcolumn:name="Domain",type=string,JSONPath=".status.accountDomain"
// +kubebuilder:printcolumn:name="Account",type=string,JSONPath=".status.accountName"

// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
    metav1.TypeMeta `json:"inline"
    metav1.ObjectMeta `json:"metadata,omitempty"

    Spec SmartLicenseSpec `json:"spec,omitempty"
    Status SmartLicenseStatus `json:"status,omitempty"
}

// +kubebuilder:object:root=true
// SmartLicenseList contains a list of SmartLicense

type SmartLicenseList struct {
  metav1.TypeMeta `json:"inline"`
  metav1.ListMeta `json:"metadata,omitempty"`
  Items []SmartLicense `json:"items"`
}

func init() {
  SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}

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// Package v1 contains API Schema definitions for the sfcn.cisco.com v1 API group
// +kubebuilder:object:generate=true
// +groupName=sfcn.cisco.com
package v1

import {
  "k8s.io/apiserver/pkg/apimachinery/scheme"
  "sigs.k8s.io/controller-runtime/pkg/scheme"
}

var {
  // GroupVersion is group version used to register these objects

  // SchemeBuilder is used to add go types to the GroupVersionKind scheme
  SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}

  // AddToScheme adds the types in this group-version to the given scheme.
  AddToScheme = SchemeBuilder.AddToScheme
}

domain: sfcn.cisco.com
repo: css.cisco.com/kasa/license-broker
resources:
- group: sfcn.cisco.com
  kind: SmartLicense
  version: v1
  version: "2"
package controllers

import {
  "crypto/md5"
const (  
LicenseHolderLabel = "sfcn.cisco.com/license-holder"
TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder"
ServiceRoleLabel = "sfcn.cisco.com/service-role"
// DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set
DefaultServiceRole = "default"
InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"
)

// serialNumber generates platform's Serial Number for SmartLicense resource.
// According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {  
return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName)))[0:11]  
}

func containsString(slice []string, s string) bool {  
for _, item := range slice {  
if item == s {  
return true  
}  
}  
return false  
}

func removeString(slice []string, s string) (result []string) {  
for _, item := range slice {  
if item == s {  
continue  
}  
result = append(result, item)  
}  
return  
}

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {  
var filteredLicenses []v1.SmartLicense
for _, license := range licenseList {  
if license.Status.RegistrationState == state {  
filteredLicenses = append(filteredLicenses, license)  
}  
}  
return  
}
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status.LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
        return true
    }
    if _, ok := meta.Labels[label]; ok && !shouldBePresent {
        delete(meta.Labels, label)
        return true
    }
    return false
}

package services

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    return &ReplicasCalculator{client, logger}
}

type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and calculates maximum amount of replicas based on licensing.
// If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    var maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 && deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods", 
            "deployment", deployment.Name)
        // it can be a scenario when we have spec.Replicas = 5, but Status.ReadyReplicas = 0. So, we just return desired replicas by a user.
        return *deployment.Spec.Replicas, nil
    }
    var err error
    if coresQuantity == 0 && deployment.Status.ReadyReplicas != 0 {
        coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
        if err != nil {
            return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
        }
    }
    r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores", 
        coresQuantity)
    for _, license := range licenses {
        if license.Status.LicenseState == v1.InCompliance {
maxLicensedReplicas := int32(maxLicensedCores / int(coresQuantity))

r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)

maxLimit += maxLicensedReplicas
license.Status.EstimatedMaxReplicas = maxLicensedReplicas

if err := r.Client.Status().Update(ctx, &license); err != nil {
    return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
}

// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil

func (r *ReplicasCalculator) getCoresQuantity(deployment *appsv1.Deployment) uint32 {
    coresQuantity := resource.MustParse("0")
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
            return 0
        }
        coresQuantity.Add(containerLimit)
    }
    return uint32(coresQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
    podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    if err != nil {
        return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
    }
    pods := corev1.PodList{}
    if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
        return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
    }
    // TODO: do not rely on the fact that all nodes have the same CPU limit
    pod := pods.Items[0]
    node := corev1.Node{}
nodeNsName := types.NamespacedName{Name: pod.Spec.NodeName}
if err := r.Client.Get(ctx, nodeNsName, &node); err != nil {
    return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
}

r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPULimit, nil

1.300 zstd 1.3.8+dfsg-3+deb10u2

1.300.1 Available under license :
Format: https://www.debian.org/doc/packaging-manuals/copyright-format/1.0/
Upstream-Name: Zstd
Source: https://github.com/facebook/zstd
Files-Excluded: appveyor.yml
   circle.yml
   build/*
   programs/windres/*
   .travis.yml
   .buckversion
   .buckconfig
   .circleci/*

Files: *
Copyright: 2013-2018, Yann Collet
    2016, Przemyslaw Skibinski
    2016-2018, Facebook, Inc.
License: BSD-3-clause and GPL-2
Comment: Starting from 1.3.1 zstd's patent claim is removed
see: https://github.com/facebook/zstd/pull/801

Files: zlibWrapper/examples/*.c
Copyright: 1995-2006, 2011 Jean-loup Gailly
License: zlib

Files: zlibWrapper/gz*.c
License: zlib

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Files: lib/dictBuilder/divsufsort.*
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Files: examples/*
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Files: debian/*
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1.301 json-c 0.15-r1
1.301.1 Available under license :

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1992 A. V. Le Blanc (LeBlanc@mcc.ac.uk)
1992-1997 Michael K. Johnson, johnsonm@redhat.com
2003, 2004, 2005, 2008 Theodore Ts'o <tytso@mit.edu>
1994 Kevin E. Martin (martin@cs.unc.edu)
1994 Salvatore Valente <svalente@mit.edu>
1994,1996 Alessandro Rubini (rubini@ipvvis.unipv.it)
1994-2005 Jeff Tranter (tranter@pobox.com)
1995, 1999, 2000 Andries E. Brouwer <aeb@cwi.nl>
1997-2005 Frodo Looijaard <frodo@frodo.looijaard.name>
1998 Danek Duvall <duvall@alumni.princeton.edu>
1999 Andreas Dilger
1999-2002 Transmeta Corporation
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2004-2006 Michael Holzt, kju -at- fqdn.org
2005 Adrian Bunk
2007-2014 Karel Zak <kzak@redhat.com>
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2008 Cai Qian <qcai@redhat.com>
2008 Hayden A. James (hayden.james@gmail.com)
2008 James Youngman <jay@gnu.org>
2008 Roy Peled, the.roy.peled -at- gmai.com
2009 Mikhail Gusarov <dottedmag@dottedmag.net>
2010, 2011, 2012 Davidlohr Bueso <dave@gnu.org>
2010 Jason Borden <jborden@bluehost.com>
2010 Hajime Taira <htaira@redhat.com>
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2012 Sami Kerola <kerolasa@iki.fi>
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Theodore Ts'o.
2001 Andreas Dilger (adilger@turbolinux.com)
2004-2008 Kay Sievers <kay.sievers@vrfy.org>
2008-2013 Karel Zak <kzak@redhat.com>
2009 Bastian Friedrich <bastian.friedrich@collax.com>
2009 Corentin Chary <corentincj@iksafi.net>
2009 Mike Hommey <mh@glandium.org>
2009 Red Hat, Inc.
2009-2010 Andreas Dilger <adilger@sun.com>
2010 Andrew Nayenko <resver@gmail.com>
2010 Jeroen Oortwijn <oortwijn@gmail.com>
2010 Jiro SEKIBA <jir@unicus.jp>
2011 Philipp Marek <philipp.marek@linbit.com>
2012 Milan Broz <mbroz@redhat.com>
2013 Alejandro Martinez Ruiz <alex@nowcomputing.com>
2013 Eric Sandeen <sandeen@redhat.com>
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Julian Seward, jseward@bzip.org
bzip2/libbzip2 version 1.0.6 of 6 September 2010

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@end enumerate

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@end c man end

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DRuntime: Runtime Library for the D Programming Language

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Version 3.1, 31 March 2009

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d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

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Preamble
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The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

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      (For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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b. Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
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<thead>
<tr>
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<tr>
<td>mach_override</td>
<td>lib/interception/mach_override</td>
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1.313 go-autorest-date v0.1.0

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1.314 mitchellh-mapstructure v1.1.2

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1.315 kasa-pkg-client-constants v0.0.0
1.315.1 Available under license :

```yaml
{{- $global := default (dict ) $.Values.global -}}
{{- $dataPlaneNamespace := include "aegis.namespace.dataPlaneNamespace" (list $) -}}
{{- if ($global.platform | eq "azure") }}
{{ include "kasa.licensebroker.storageAzureDisk" (list $ "azure-disk-sc") }}
{{- else if ($global.platform | ne "aws") | and ($global.platform | ne "eks") }}
{{ include "kasa.licensebroker.storageLocal" (list $ "broker") }}
{{- end }}
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: {{ template "aegis.metadata.fullname" (list $ "server") }}
labels: {{ include "aegis.metadata.standardLabels" (list $) | nindent 4 }}
spec:
  accessModes:
  - ReadWriteOnce
  volumeMode: Filesystem
{{- if ($global.platform | eq "aws") | or ($global.platform | eq "eks") }}
  storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */)}}
{{- else if ($global.platform | eq "azure") }}
  storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc") }} {{/* example yaml has 'managed-csi' as the name which is vague af */}}
{{- else if ($global.platform | eq "kind") }}
  storageClassName: "standard" {{/* Kind has a default 'standard' StorageClass so reusing it here */)}}
{{- else }}
  storageClassName: {{ include "aegis.metadata.fullname" (list $ "broker") }}
{{- end }}
resources:
  requests:
    storage: {{ $.Values.licenseServerStorage }}
---
{{- define "kasa.licensebroker.storageLocal" -}}
{{- $ := first . -}}
{{- $storageName := last . -}}
apiVersion: storage.k8s.io/v1
kind: StorageClass
```
{{ template "aegis.metadata.standard" (list $ $storageName) }}
provisioner: kubernetes.io/no-provisioner
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer

---

{{- define "kasa.licensebroker.storageAzureDisk" -}}
	{{- $ := first . -}}
	{{- $storageName := last . -}}
apiVersion: storage.k8s.io/v1
kind: StorageClass
{{ template "aegis.metadata.standard" (list $ $storageName) }}
provisioner: disk.csi.azure.com
parameters:
	{{- /* TODO: parameterize the sku and other params https://github.com/kubernetes-sigs/azuredisk-csi-driver/blob/v1.2.0/docs/driver-parameters.md */}}
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer
allowVolumeExpansion: true

{{- end -}}

{{- define "kasa.validate.eula" -}}
	{{- $ := first . -}}
	{{ $acceptValues := list "yes" "agree" }}
	{{ if $.Release.IsInstall | and (not ($acceptValues | has $.Values.global.acceptEULA)) -}}
		{{ $.Files.Get "eula/EULA.txt" }}
	{{- end -}}

{{- end -}}

package services_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
"k8s.io/client-go/kubernetes/scheme"
"testing"
. "github.com/onsi/ginkgo"
. "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
RegisterFailHandler(Fail)
RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
_ = v1.AddToScheme(scheme.Scheme)
package listeners_test

import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "css.cisco.com/kasa/license-broker/controllers/listeners"  licensing "css.cisco.com/licensing/client-agent"  "github.com/golang/mock/gomock"  . "github.com/onsi/ginkgo"  . "github.com/onsi/gomega"  corev1 "k8s.io/api/core/v1"  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  "k8s.io/apimachinery/pkg/types"  "k8s.io/client-go/kubernetes/scheme"  "k8s.io/client-go/tools/record"  "sigs.k8s.io/controller-runtime/pkg/client"  "sigs.k8s.io/controller-runtime/pkg/client/fake"  "sigs.k8s.io/controller-runtime/pkg/event"  logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var _ = Describe("Deregistration Listener Test", func() {

  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var listener licensing.DeregistrationListener
  var fakeClient client.Client
  var mockCtrl *gomock.Controller
  var recorder *record.FakeRecorder

  var smartLicense *v1.SmartLicense
  var notifier chan event.GenericEvent

  BeforeEach(func() {
    smartLicense = &v1.SmartLicense{  
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},  
      Spec: v1.SmartLicenseSpec{  
        Action: v1.Register,  
        LicenseType: licenseType,  
      },  
      Status: v1.SmartLicenseStatus{  
        RegistrationState: v1.Registered,  
        LicenseState: v1.InCompliance,  
        ErrorReason: "",  
      },  
    }
  })

})
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
notifier = make(chan event.GenericEvent, 10)

listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger{}, recorder, notifier)

AfterEach(func() {
    mockCtrl.Finish()
})

It("should update SmartLicense status on deregistration event", func() {
    listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
Reason: something happened"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response
to out-of-band event from License Server")))
    Expect(notifier).Should(Receive(&event.GenericEvent{
        Object: smartLicense,
    }))
})

package controllers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types""k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
const (  
    epHpaName           = "epHPA"  
    initialHPAMaxReplicas int32 = 3  
)  

var _ = Describe("HPA License Controller Test", func() {  

    hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}  
    var (  
        reconciler *controllers.HPALicenseReconciler  
        fakeClient client.Client  
        mockCtrl *gomock.Controller  
        hpa *autoscalingv1.HorizontalPodAutoscaler  
        smartLicense *v1.SmartLicense  
        recorder *record.FakeRecorder  
        replicasCalculatorMock *mocks.MockReplicasCalculator  
    )  

   BeforeEach(func() {  
        mockCtrl = gomock.NewController(GinkgoT())  
        fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
        recorder = record.NewFakeRecorder(1024)  
        replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)  

        reconciler = &controllers.HPALicenseReconciler{  
            Client:    fakeClient,  
            Log:       logf.NullLogger{},  
            Recorder:  recorder,  
            ReplicasCalculator: replicasCalculatorMock,  
        }  

        smartLicense = &v1.SmartLicense{  
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},  
            Spec: v1.SmartLicenseSpec{  
                Action:    v1.Register,  
                LicenseType: licenseType,  
                MinLicenseCount: &minLicenseCount,  
                MaxLicenseCount: &maxLicenseCount,  
                ScalingFactor: &scalingFactor,  
        })  

    })
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```
},
Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

deployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: "ep",
        Namespace: defaultNs,
    },
    Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

hpa = &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{
        Name: epHpaName,
        Namespace: defaultNs,
    },
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: initialHPAMaxReplicas,
    },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
})

It("should skip if HPA does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})

It("should skip if HPA SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
```
It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(initialHPAMaxReplicas, nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
    Expect(hpa.Spec.MinReplicas).Should(BeNil())
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas]
        to 2 ")))
})

It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
hpa.Spec.MaxReplicas = 10
hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Spec.MinReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPA\nScaledDown Decreased HPA's [MaxReplicas MinReplicas] to 2 ")))

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
smartLicense2 := &v1.SmartLicense{
Spec: smartLicense.Spec,
}
Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())
smartLicense3 := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
Spec: smartLicense.Spec,
Status: v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
}
Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPA\nScaledDown Decreased HPA's [MaxReplicas MinReplicas] to 2 ")))})
})

---

apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  annotations:
    controller-gen.kubebuilder.io/version: v0.4.1
  creationTimestamp: null
name: smartlicenses.sfcn.cisco.com
spec:
group: sfcn.cisco.com
names:
  kind: SmartLicense
  listKind: SmartLicenseList
  plural: smartlicenses
  singular: smartlicense
scope: Namespaced
versions:
  - additionalPrinterColumns:
      - jsonPath: .metadata.creationTimestamp
        name: Age
        type: date
      - jsonPath: .status.registrationState
        name: Registration State
        type: string
      - jsonPath: .status.licenseState
        name: License State
        type: string
      - jsonPath: .status.licenseNumber
        name: License Number
        type: integer
      - jsonPath: .status.accountDomain
        name: Domain
        priority: 1
        type: string
      - jsonPath: .status.accountName
        name: Account
        priority: 1
        type: string
    kind: CustomResourceDefinition
    metadata:
      annotations:
        controller-gen.kubebuilder.io/version: v0.4.1
      creationTimestamp: null
      name: smartlicenses.sfcn.cisco.com
    spec:
      group: sfcn.cisco.com
      names:
        kind: SmartLicense
        listKind: SmartLicenseList
        plural: smartlicenses
        singular: smartlicense
      scope: Namespaced
      versions:
        - additionalPrinterColumns:
            - jsonPath: .metadata.creationTimestamp
              name: Age
              type: date
            - jsonPath: .status.registrationState
              name: Registration State
              type: string
            - jsonPath: .status.licenseState
              name: License State
              type: string
            - jsonPath: .status.licenseNumber
              name: License Number
              type: integer
            - jsonPath: .status.accountDomain
              name: Domain
              priority: 1
              type: string
            - jsonPath: .status.accountName
              name: Account
              priority: 1
              type: string
          kind: CustomResourceDefinition
          metadata:
            annotations:
              controller-gen.kubebuilder.io/version: v0.4.1
            creationTimestamp: null
            name: smartlicenses.sfcn.cisco.com
          spec:
            group: sfcn.cisco.com
            names:
              kind: SmartLicense
              listKind: SmartLicenseList
              plural: smartlicenses
              singular: smartlicense
            scope: Namespaced
            versions:
description: 'Kind is a string value representing the REST resource this object represents. Servers may infer this from the endpoint the client submits requests to. Cannot be updated. In CamelCase. More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'
type: string
metadata:
type: object
spec:
description: SmartLicenseSpec defines the desired state of SmartLicense properties:
action:
description: Action is the desired state of the Smart Agent license registration.
enum:
- REGISTER
- DEREGISTER
type: string
licenseType:
description: LicenseType defines the type of license to request/release, usually the SKU of the license. The default value is a SFW license tag being able to handle 1vCPU.
type: string
maxLicenseCount:
description: MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product. The default value is equal to MinLicenseCount.
format: int32
type: integer
minLicenseCount:
description: MinLicenseCount is a minimum number of licenses SFCN reserves for the product. The default value is 1.
format: int32
type: integer
scalingFactor:
description: ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down. The default value is 1.
format: int32
type: integer
scalingRef:
description: ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
properties:
apiVersion:
description: API version of the referent
type: string
kind:
description: 'Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-
architecture/api-conventions.md#types-kinds"

```yaml
  type: string
  name:
    description: 'Name of the referent; More info: http://kubernetes.io/docs/user-guide/identifiers#names'
    type: string
  required:
    - kind
    - name
  type: object

tokenSecret:
  description: TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
  properties:
    name:
      description: Name is unique within a namespace to reference a secret resource.
      type: string
    namespace:
      description: Namespace defines the space within which the secret name must be unique.
      type: string
  required:
    - tokenSecret
  type: object

status:
  description: SmartLicenseStatus defines the observed state of SmartLicense
  properties:
    accountDomain:
      description: AccountDomain is the account domain in Cisco Software Central.
      type: string
    accountName:
      description: AccountName is the name of the virtual account in Cisco Software Central.
      type: string
    contextId:
      description: ContextId is an internal identifier uniquely defining platform registration.
      type: string
    coresPerLicense:
      description: CoresPerLicense is number of cores per one requested LicenseType.
      format: int32
      type: integer
    errorReason:
      description: ErrorReason specifies the error due to which the SFCN product was not registered in Cisco Software Central.
```
type: string

estimatedMaxReplicas:
    description: EstimatedMaxReplicas is maximum count of ep pod replicas.
    It is calculated based on MaxLicenseCount and CoresPerLicense.
    format: int32
    type: integer

exportControlled:
    description: ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
    type: boolean

licenseNumber:
    description: LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
    format: int32
    type: integer

licenseState:
    description: LicenseState is the state of the reserved licenses.
    enum:
        - PENDING
        - UNLICENSED
        - IN_COMPLIANCE
        - OUT_OF_COMPLIANCE
        - OVERAGE
    type: string

registrationState:
    description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.
    enum:
        - PENDING
        - REGISTERED
        - REGISTRATION_FAILED
        - Deregistered
        - Deregistration_FAILED
    type: string

served: true
storage: true
subresources:
status: {}
status:
acceptedNames:
    kind: ""
    plural: ""
conditions: []
storedVersions: []
FROM dockerhub.cisco.com/asac-dev-docker/css-golang:v1.16 as builder

WORKDIR /workspace
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"]
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates/"]

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ./pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api/ api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
# disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13

WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot
USER nonroot
ENTRYPOINT ["manager"]
package controllers_test

import (  
"context"  
"errors"  
"fmt"  
"strconv"

v1 "css.cisco.com/kasa/license-broker/api/v1"  
"css.cisco.com/kasa/license-broker/controllers"  
"css.cisco.com/kasa/license-broker/controllers/mocks"  
licensing "css.cisco.com/licensing/client-agent"  
"github.com/golang/mock/gomock"
const (  
epPodName = "epPod"  
redirectorEpPodName = "redirectorEpPod"  
defaultServiceRole = "default"  
vpnRedirectorServiceRole = "vpnredirector"  
deploymentName2 = "test-deployment-2"  
secondDefaultEpDeploymentName = "secondDefaultEpDeployment"  
redirectorEpDeploymentName = "vpnRedirectorEpDeployment"  
initialRedirectorDeploymentReplicas int32 = 2  
)

var controllerTrue = true

var _ = Describe("Pod License Controller Test", func() {

podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}  
redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}  
deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}  
redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: 
redirectorEpDeploymentName}  

var reconciler *controllers.PodLicenseReconciler  
var fakeClient client.Client  
var mockCtrl *gomock.Controller  
var recorder *record.FakeRecorder  

var licensingClient *mocks.MockLicensingClient  
var allotmentService *mocks.MockAllotmentService

//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent  
AllotmentService

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var pod *corev1.Pod
var deployment *appsv1.Deployment
var redirectorPod *corev1.Pod
var redirectorDeployment *appsv1.Deployment
var smartLicense *v1.SmartLicense

BeforeEach(func()) {

    pod = &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:            epPodName,
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue}}
        },
    }
}

replicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "epReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: epDeploymentName, Controller: &controllerTrue}}
    },
}

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        epDeploymentName,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

secondDefaultDeployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        secondDefaultEpDeploymentName,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

redirectorPod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{

Name:    redirectorEpPodName,
Namespace:  defaultNs,
OwnerReferences: []metav1.OwnerReference{ {Kind: "ReplicaSet", Name: "redirectorEpReplicaSet", Controller: &controllerTrue} },
}

redirectorReplicaSet := &appsv1.ReplicaSet{
  ObjectMeta: metav1.ObjectMeta{
    Name:            "redirectorEpReplicaSet",
    Namespace:       defaultNs,
    OwnerReferences: []metav1.OwnerReference{ {Kind: "Deployment", Name: redirectorEpDeploymentName, Controller: &controllerTrue} },
  },
}

redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
  ObjectMeta: metav1.ObjectMeta{
    Name:        redirectorEpDeploymentName,
    Namespace:   defaultNs,
    Labels:      map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
    Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
  },
  Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}

smartLicense = &v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
  Spec: v1.SmartLicenseSpec{
    Action:    v1.Register,
    LicenseType: licenseType,
  },
  Status: v1.SmartLicenseStatus{
    RegistrationState: v1.Registered,
  },
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(
deployment, replicaSet, pod, secondDefaultDeployment,
redirectorDeployment, redirectorReplicaSet, redirectorPod,
smartLicense).Build()
recorder = record.NewFakeRecorder(1024)

licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()

reconciler = &controllers.PodLicenseReconciler{
    Client: fakeClient,
    LicensingClient: licensingClient,
    Log: logf.NullLogger{},
    Recorder: recorder,
}
}

AfterEach(func() {
    mockCtrl.Finish()
})

It("should add the licensing label for licensed pod", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
    Expect(pod.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
})

It("should ensure one replica per service role without SmartLicense", func() {
    // initiate reconcile for the pod which is part of deployment with vpnredirector service role and without smart license
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
    Expect(err).To(BeNil())

    // expect the deployment to be scaled to 1 and mark it as trial license holder
    redirDeployment := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), redirectDeploymentNsName, &redirDeployment)).To(Succeed())
Expect(redirDeployment.Spec.Replicas).Should(Equal(int32(1)))
Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
Expect(redirDeployment.Annotations).Should(HaveKeyWithValue(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

// create another deployment with vpnredirector role
redirectorEpPodName2 := "redirectorEpPod2"
redirectorEpDeploymentName2 := "redirectorEpDeployment2"
replicaSetName2 := "redirectorEpReplicaSet2"
redirectorPod2 := &corev1.Pod{
  ObjectMeta: metav1.ObjectMeta{
    Name:            redirectorEpPodName2,
    Namespace:       defaultNs,
    OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}},
  },
}
Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
redirectorReplicaSet2 := &appsv1.ReplicaSet{
  ObjectMeta: metav1.ObjectMeta{
    Name:            replicaSetName2,
    Namespace:       defaultNs,
    OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName2, Controller: &controllerTrue}},
  },
}
Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
initialRedirector2Replicas := int32(3)
redirectorDeployment2 := &appsv1.Deployment{
  ObjectMeta: metav1.ObjectMeta{
    Name:        redirectorEpDeploymentName2,
    Namespace:   defaultNs,
    Labels:      map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
    Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
  },
  Spec: appsv1.DeploymentSpec{Replicas: &initialRedirector2Replicas},
}
Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

// initiate reconcile for the pod which is part of another deployment with vpnredirector service role and without smart license
redirector2PodNsName := types.NamespacedName{Name: redirectorEpPodName2, Namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirector2PodNsName.String()}).Return(nil, nil)
_, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
Expect(err).To(BeNil())
// expect the second vpnredirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2, Namespace: defaultNs}, &redirDeployment2)).To(Succeed())
Expect(*redirDeployment2.Spec.Replicas).Should(Equal(int32(0)))
Expect(redirDeployment2.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(redirDeployment2.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment2.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirector2Replicas))))
}

Context("on pod removal", func() {

It("should release licensing allotments", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
ContextId: "fooBar",
Tenant: &licensing.Tenant{Name: podNsName.String()},
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})

It("should requeue request if failed to release licensing allotments", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
ContextId: "fooBar",
Tenant: &licensing.Tenant{Name: podNsName.String()},
}).Return(errors.New("failed to release allotments"))

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(HaveOccurred())
})

It("should not release licensing allotments if tenant is not registered", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, fmt.Errorf("unknown tenant: %w", licensing.ErrNotRegistered))

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})
It("should not release licensing allotments when NumCores is 0", func() {
    Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
        Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
    Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
        Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
})

Context("for pod without corresponding SmartLicense", func() {

    It("should remove pod if not belong to any deployment", func() {
        pod.OwnerReferences = nil
        Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
            Return(nil, nil)

        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())

        err = fakeClient.Get(context.TODO(), podNsName, pod)
        Expect(err).NotTo(BeNil())
        Expect(apiErrors.IsNotFound(err)).To(BeTrue())
        Expect(recorder.Events).Should(HaveLen(1))
        Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license
but does not belong to any Deployment")))
    })

    It("should scale down pod's deployment", func() {
        smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
        Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
            Return(nil, nil)

        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())
    })

    It("should not release licensing allotments when status is nil", func() {
        Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
            Return(nil, nil)

        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())
    })
})
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
}
}

Context("without SmartLicense resources", func () {
  BeforeEach(func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
  })

  It("should scale down Deployment to 1 Replica and mark as trial", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
  })

  It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func() {
    var replicaCount int32 = 4
    var expectedInitialReplicasNumber int32 = 4

    createDeployment := func(name string, role string) *appsv1.Deployment {
      pod := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
          Name: fmt.Sprintf("pod-%s", name),
          Namespace: defaultNs,
          OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: fmt.Sprintf("rs-%s", name), Controller: &controllerTrue}},
        },
      }
      Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

      replicaSet := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
          Name: fmt.Sprintf("rs-%s", name),
          },
Name:            fmt.Sprintf("rs-%s", name),
Namespace:       defaultNs,
OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name),
Controller: &controllerTrue}},
},
}
Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

deployment := &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{
Name:        fmt.Sprintf("deployment-%s", name),
Namespace:   defaultNs,
Labels:      map[string]string{controllers.ServiceRoleLabel: role},
Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
},
Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
Expect(err).To(BeNil())

return deployment
}
deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", "")

assertScaledDown := func(d *appsv1.Deployment) {
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: d.Namespace, Name: d.Name},
    d)).To(Succeed())
Expect(*d.Spec.Replicas).Should(Equal(int32(0)))
Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(expectedInitialReplicasNumber)))
}

assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
})

It(“should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist”, func() {
    deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    var replicaCount int32 = 1
    pod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:            "deployment-test-2",
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())
    replicaSet2 := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
            Name:            "epReplicaSet2",
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: deploymentName2, Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())
    deployment2 := &appsv1.Deployment{
        ObjectMeta: metav1.ObjectMeta{
            Name:        deploymentName2,
            Namespace:   defaultNs,
            Labels:      map[string]string{controllers.ServiceRoleLabel: "new-service-role"},
            Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
        },
        Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
    }
    Expect(fakeClient.Create(context.TODO(), deployment2)).To(Succeed())
    pod2NsName := types.NamespacedName{Namespace: defaultNs, Name: "deployment-test-2"}
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: pod2NsName.String(), Attributes: pod.Labels}).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: pod2NsName})
Expect(err).To(BeNil())

deployment2Ns := types.NamespacedName{Namespace: defaultNs, Name: deploymentName2}
Expect(fakeClient.Get(context.TODO(), deployment2Ns, deployment2)).To(Succeed())
Expect(*deployment2.Spec.Replicas).Should(Equal(int32(1)))
Expect(deployment2.Labels).Should(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(recorder.Events).ShouldNot(HaveLen(1))

---
title: "Monitoring Status"
weight: 3
description: >
Learn how to monitor the ASA operational status and critical license events
---

### Smart License Status

When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

```
yaml [linenos=table,hl_lines=["18-25"]]
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: "" # omitted to use default value
  minLicenseCount: 1
  maxLicenseCount: 10
scalingRef:
  kind: Deployment
  name: sfcn-enforcer
```
### ASA Licensing State

The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are:

* AwaitingLicense (Warning)
* LicenseCommunicationFailed (Warning)
* LicenseGranted (Normal)
* LicenseVerified (Normal)
* LicenseRevoked (Warning)

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.

When the ASA comes up successfully, the Manager tries to obtain a license for the [number of cores]([[< relref "deployment/#core-calculation" > }]) the Pod uses. During this period, the Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For instance, when the ASA came up for the first time and operating at reduced throughput, this event would read something like:

```markdown
Warning AwaitingLicense ASA operating at reduced throughput because it was not licensed, requesting for a new license
```

And, if the ASA came up and operating at full potential, then:

```markdown
Warning AwaitingLicense ASA operating at full potential but not licensed, requesting for a new license
```

The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could not communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a...
LicenseCommunicationFailed warning event with the reasoning behind the failure.

```
```

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the license granted to it and on successful verification, emits a `LicenseVerified` event.

```
```

It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the licenses have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale down the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager emits a `LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be granted a license, or it will be removed by Kubernetes because the controller scaled down the cluster.

```
```

### Unauthorized Requests

License requests may be granted by the License Server to any pod capable of requesting a licensing, however the License Controller sees a grant as authorized only if that pod belonged to a Deployment/HPA specified in one of the Smart License resources otherwise it considers that pod as unauthorized and takes action to delete that pod and set the number of replicas to 0 on its owners to prevent the Kubernetes from creating such pods. The License Controller will emit an event on the pod that was deleted specifying the reason behind it. It then releases the license back to the License Server after the pod is killed.

```
```

Warning PodDeleted Deleted Pod as it requested a license but does not belong to any licensed EP deployment.
Please, check SmartLicense resources to update licensing configuration.

This might happen when you have an Enforcer deployment but did not specify that Deployment in a Smart License resource in the same namespace. To remedy that, simply add a Smart License resource with the desired configuration and specify the Deployment of the Enforcer in it.

### Identifying Licensed Pods

All licensed Deployments specified via the Smart License resources, and their Pods that have been granted a license will include a label `sfcn.cisco.com/license-holder=true`. You should be able to use `kubectl` to list all the pods in a namespace that are having this label to identify the pods currently holding a license.

```go
goingo: package handlers_test

import  
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/reconcile"

const (  
    defaultNamespace = "default"
    smartLicenseName = "smart-license"
    deploymentName = "ep-deployment"
    deploymentName2 = "ep-deployment2"
    hpaName = "ep-hpa"
    hpaName2 = "ep-hpa2"
)

var _ = Describe("DeploymentHandler", func() {  
    var handler handler.EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface

    BeforeEach(func() {  
        mockCtrl = gomock.NewController(GinkgoT())
    })

```
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
handler = handlers.DeploymentHandler()
}

AfterEach(func() {
    mockCtrl.Finish()
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
    })
    handler.Update(event.UpdateEvent{
        ObjectOld: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    })
})
var _ = Describe("HPAHandler", func() {
    var handler handler.EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface

   BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
        handler = handlers.HPAHandler()
    })

    AfterEach(func() {
        mockCtrl.Finish()
    })

    It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
        mockQueue.EXPECT().Add(reconcile.Request{
            NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
        })
    })
})
It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
    })
    handler.Update(event.UpdateEvent{
        ObjectOld: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
        ObjectNew: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with HPA kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
})
handler.Delete(event.DeleteEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
    mockQueue)
})

package listeners

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    licensing "css.cisco.com/licensing/client-agent"
    licensingProto "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "sigs.k8s.io/controller-runtime/pkg/client"
)

type EntitlementListener struct {
    Log           logr.Logger
    Client        client.Client
    LicenseNsName types.NamespacedName
}

func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
    log := l.Log.WithValues("smartlicense", l.LicenseNsName)
    log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)

    if err := l.processEvent(event); err != nil {
        log.Error(err, "failed to process entitlement event")
        return
    }
    log.V(1).Info("successfully processed entitlement event")
}

func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()

    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense",
        }
    }

    // Further processing logic...

    return nil
}
l.LicenseNsName)
    return nil
  }
return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
}
originalLicense := license.DeepCopy()

switch event.Type {
  case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
    license.Status.LicenseState = v1.OutOfCompliance
  case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
    license.Status.LicenseState = v1.Unlicensed
    license.Status.EstimatedMaxReplicas = 0
  case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
    license.Status.LicenseState = v1.InCompliance
  default:
    return fmt.Errorf("unknown event type: %s", event.Type.String())
}
license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
license.Status.LicenseNumber = uint32(event.EntitlementNumber)

// using patch to avoid conflict errors caused by version mismatch and optimistic lock
// as events from the server have the latest data, it is admissible to overwrite status without version check
if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
  return fmt.Errorf("failed to patch SmartLicense status: %w", err)
}
return nil

# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.
global:
  platform: $platform
  imageCredentials:
    # the url to the docker registry, for example dockerhub.cisco.com
    registry: $registry
    artifactoryRepo: $artifactoryRepo
  apiGroup: sfcn.cisco.com
  fullnamePrefix: sfcn-license-

  # Docker image for the controller that manages licensing CRDs and their reconciliation
  controllerImage: $controllerImage

  # Docker image for the server-agent license server
  licenseServerImage: $licenseServerImage

  # licenseServerPort is the port where the server-agent license server is listening for requests
licenseServerPort: 17051

# licenseServerTransportUrl is the http transport to make use of to connect to CSSM
licenseServerTransportUrl: $licenseServerTransportUrl

# Default image policy that is used by all pod containers unless being explicitly overwritten
defaultImagePullPolicy: $defaultImagePullPolicy

# log verbosity
logLevel: $logLevel

# zap log encoder
# options: console, json
logFormat: $logFormat

# managerMemoryRequest specifies the amount of memory to allocate per request for manager container
managerMemoryRequest: "20Mi"

# managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
managerCoreRequest: "100m"

# managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
managerMemoryLimit: "100Mi"

# managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
managerCoreLimit: "100m"

# metricsPort is the port the metric endpoint binds to
metricsPort: 17080

# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"

# licenseServerXms specifies the amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory
licenseServerXms: "128M"

# licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container
licenseServerCoreRequest: "100m"

# licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container
licenseServerMemoryLimit: "768Mi"
# licenseServerXmx specifies the maximum amount of memory to allocate for license-server process.
The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory
licenseServerXmx: "512M"

# licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container
licenseServerCoreLimit: "300m"

# licenseServerStorage specifies the persistent volume size to use for storing licensing data
licenseServerStorage: "1Gi"

# disktype for dynamic azure disk storage on azure platform
# options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
azureDiskStorageAccountType: "Standard_LRS"

package handlers

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"
  "fmt"
  "k8s.io/apimachinery/pkg/types"
  ctrl "sigs.k8s.io/controller-runtime"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue

RateLimitingInterface

var log = ctrl.Log.WithName("handlers").WithName("SmartLicense")

// DeploymentHandler handles SmartLicense changes and queues up events for the Deployment that the
SmartLicense manages.
func DeploymentHandler() handler.EventHandler {
  return handlerWithScalingRefKind(v1.DeploymentKind)
}

// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
  return handlerWithScalingRefKind(v1.HPAKind)
}

func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
  return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
    smartLicense, ok := obj.(*v1.SmartLicense)
    if !ok {
      log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
      return []}
    ctrl.Request{
      smartLicense, ok := obj.(*v1.SmartLicense)
      if !ok {
        log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
        return []}
      ctrl.Request{
      smartLicense, ok := obj.(*v1.SmartLicense)
      if !ok {
        log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
        return []}
      ctrl.Request{
      smartLicense, ok := obj.(*v1.SmartLicense)
      if !ok {
        log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
        return []}
if smartLicense.Spec.ScalingRef.Kind != scalingRefKind {
    return []ctrl.Request{}
}

return []ctrl.Request{{NamespacedName: types.NamespacedName{
    Namespace: smartLicense.Namespace,
    Name:      smartLicense.Spec.ScalingRef.Name,
}}}

package v1

import (  
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/reconcile"
    "strings"
    "time"
)

const (  
    RetryDuration      = 15 * time.Second
    MaxWaitingDuration = 5 * time.Minute
    MaxRetryAttempts   = int(MaxWaitingDuration / RetryDuration)
    LicenseCmd         = "show license feature"
    UnlicensedResponse = "Licensing Status : Unlicensed"
    LicensedResponse   = "Licensing Status : Licensed"
)
type licenseEvent int

const (  
Revoked licenseEvent = iota + 1  
Awaiting  
Granted  
Verified  
CommunicationFailed
)

func (l licenseEvent) reasonCode() string {  
switch l {  
case Revoked:  
return "LicenseRevoked"  
case Awaiting:  
return "AwaitingLicense"  
case Granted:  
return "LicenseGranted"  
case Verified:  
return "LicenseVerified"  
case CommunicationFailed:  
return "LicenseCommunicationFailed"  
}  
return "LicenseActivity"
}

func (l licenseEvent) eventType() string {  
switch l {  
case Awaiting, Revoked, CommunicationFailed:  
return coreV1.EventTypeWarning  
default:  
return coreV1.EventTypeNormal  
}  
}

type SmartLicenseReconciler struct {  
Log logr.Logger  
CoreClient *coreV1Client.CoreV1Client  
Licenser lca.LicensingClient  
Dispatcher dispatcher.GatewayClient  
Recorder record.EventRecorder  
tenant *lca.Tenant  
numRetriedAttempts int  
allotment *lca.AllotmentRequestStatus // needed to report the allotment held to server on request  
requiredNumCores uint32  
isRegistered bool  
lastRecordedEvent licenseEvent // needed to avoid reporting the same event repeatedly  
notificationChan chan event.GenericEvent
func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher) *SmartLicenseReconciler {
    s.notificationChan = make(chan event.GenericEvent)
lsp.AddListener(s)
    return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
pod := &coreV1.Pod{
}
s.Log.Info("lina (re)started, initiating license reconciliation")
s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
podName := os.Getenv("POD_NAME")
podNamespace := os.Getenv("POD_NAMESPACE")
return ctrl.NewControllerManagedBy(mgr).
    Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{}).
    For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{
        Name:      podName,
        Namespace: podNamespace,
    })).Complete(s)
}

func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result, error) {
s.Log.Info("reconciling license status", "pod", request)
errResult := reconcile.Result{RequeueAfter: RetryDuration}
pod, err := s.CoreClient.Pods().Get(request.NamespacedName)
if err != nil {
    s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NamespacedName)
    return errResult, err
}
if s.lastRecordedEvent == 0 {
    licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
    if err != nil {
        s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
        return errResult, nil
    }

    if strings.Contains(licenseResponse, LicensedResponse) {
        s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
    }
}
s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
} else if strings.Contains(licenseResponse, UnlicensedResponse) {
  s.recordEvent(pod, Awaiting, "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
}

if pod.DeletionTimestamp == nil {
  s.computeRequiredNumCores(pod)
  // (re)register with the license server
  err := s.registerTenantWithLicenseServer(pod)
  if err != nil {
    return errResult, nil
  }
  // registration successful, fetch or request allotment of this tenant
  err = s.syncAllotmentStatus(pod)
  if err != nil {
    return errResult, nil
  }
  err = s.grantASAcLicenseToOperate(pod)
  if err != nil {
    return errResult, nil
  }
  } else {
    err := s.releaseAllotment()
    if err != nil {
      s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
      return errResult, nil
    }
  }

  return reconcile.Result{}, nil
}

func (s *SmartLicenseReconciler) recordEvent(pod *coreV1.Pod, event licenseEvent, description string) {
  if s.lastRecordedEvent != event || event == Verified { // always record verified events
    s.lastRecordedEvent = event
    s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
  }
}

func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *coreV1.Pod) {
  requiredCoresQuantity := resource.MustParse("0")
  var containerCores = make(map[string]float64)
  for _, container := range pod.Spec.Containers {
    containerLimit := *container.Resources.Limits.Cpu()
    if containerLimit.Value() == 0 {
      s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container",
  ...
if err != nil {
    s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
    // continue further to compute other containers
    continue
}

// set the required core quantities directly to the capacity of the node
requiredCoresQuantity = *node.Status.Capacity.Cpu()
break
}

requiredCoresQuantity.Add(containerLimit)
}
s.requiredNumCores = uint32(requiredCoresQuantity.Value())
if len(pod.Spec.Containers) == len(containerCores) {
    s.Log.Info("computed resources usage", "cpu", containerCores)
}

s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
}

func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *coreV1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}.String(),
            Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            s.numRetriedAttempts = s.numRetriedAttempts + 1
            if s.numRetriedAttempts > MaxRetryAttempts {
                s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                    "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
                s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
                    communication failure (%s), "+
                    "retrying communication", err.Error()))
                _ = s.revokeASAcLicenseAndRetry()
                return err
            }
            s.Log.Info(fmt.Sprintf("failed to register with licensing server, will retry (reason: %s)", err.Error()),
                "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
            return err
        }
        s.recordEvent(pod, Awaiting, "successfully registered the ASA with license server, awaiting a license")
        s.isRegistered = true
    }
    return nil
}

func (s *SmartLicenseReconciler) revokeASAcLicenseAndRetry() error {

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *coreV1.Pod) error {
allotmentStatus, err := s.Licenser.Allotment().Status(s.tenant)
if err != nil {
if errors.Is(err, lca.ErrLicenseServerUnavailable) {
   s.Log.Info("licensing server is unavailable, unregistering the tenant")
   s.isRegistered = false
}
   s.numRetriedAttempts = s.numRetriedAttempts + 1
   if s.numRetriedAttempts > MaxRetryAttempts {
      s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
      "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
      s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
      communication failure (%s), "+
      "retrying communication", err.Error()))
   return err
      }
   }
   s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)", err.Error()),
      "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
   return err
}

if allotmentStatus == nil {
   s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
   // no allotment was made to this tenant, requesting one
   allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
      PoolName: pod.Namespace,
      Tenant:   s.tenant,
      NumCores: s.requiredNumCores,
   })
   if err != nil {
      s.numRetriedAttempts = s.numRetriedAttempts + 1
      if s.numRetriedAttempts > MaxRetryAttempts {
         s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
         "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
         s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
         communication failure (%s), "+
         "retrying communication", err.Error()))
         return err
         }
      }
   }
   s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)", err.Error()),
      "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
   return err
}

reason, err := s.Dispatcher.RevokeLicense()
if err != nil {
   s.Log.Error(err, "failed to revoke license")
   return err
}
if reason != ""
   err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
   return err
}

s.Log.Info("successfully revoked ASAc license")
s.numRetriedAttempts = 0
return nil
}
func (s *SmartLicenseReconciler) grantASAcLicenseToOperate(pod *coreV1.Pod) error {
    if s.allotment != nil {
        s.Log.Info("license status verified, communicating the status to ASA")
        s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
        reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
        if err != nil {
            s.Log.Error(err, "failed to grant license")
            return err
        }
        if reason != "" {
            err = fmt.Errorf("ASAc failed to set license : %v", reason)
            return err
        }
        s.numRetriedAttempts = 0
        s.Log.Info("successfully granted license to ASA")
    } else {
        s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")
    }
    return nil
}

func (s *SmartLicenseReconciler) releaseAllotment() error {
    _, err := s.revokeASAcLicenseAndRetry()
    if s.allotment != nil {
        err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
            Tenant: s.allotment.Tenant.Name,
            VirtualAccountName: s.allotment.VirtualAccountName,
            SmartAccountName: s.allotment.SmartAccountName,
            Domain: s.allotment.ExportControlled,
            Context: s.allotment.ContextId,
            Cores: s.allotment.NumCores,
            Reason: s.allotment.Status.Verified, // s.numRetriedAttempts, s.numRetriedAttempts
        })
        if err != nil {
            s.Log.Error(err, "failed to release allotment")
            return err
        }
        s.Log.Info("Successfully released allotment")
        return nil
    }
    return nil
}
ContextId: s.allotment.ContextId,
Tenant: s.tenant,
})
if err != nil {
  s.Log.Error(err, "failed to release the allotment to server")
  return err
}
  s.allotment = nil
  return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
podName := types.NamespacedName{
  Namespace: os.Getenv("POD_NAMESPACE"),
  Name:      os.Getenv("POD_NAME"),
}
pod, err := s.CoreClient.Pods().Get(podName)
if err != nil {
  s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
  return nil
}
switch event.Type {
  case proto.AllotmentEvent_RELEASE_ALLOTMENT:
    s.Log.Info("license requested to be released by the server, un-licensing ASA")
    if err == nil {
      s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying to acquire")
      _ = s.releaseAllotment()
    }
  case proto.AllotmentEvent_REPORT_ALLOTMENT:
    s.Log.Info("license requested to be reported to the server")
    _ = s.reportAllotment()
}

func (s *SmartLicenseReconciler) reportAllotment() error {
  if s.allotment != nil {
  }
  err := s.Licenser.Allotment().ReportAllotment(allotment)
  if err != nil {
    s.Log.Error(err, "failed to report the allotment to server")
    return err
  }
}
// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import (
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
    time "time"
)

// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl     *gomock.Controller
    recorder *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
}

// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}

// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
}

// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add", reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}
// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddRateLimited",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
func (m *MockRateLimitingInterface) Done(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
func (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Done",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}

// Forget mocks base method
func (m *MockRateLimitingInterface) Forget(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
func (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Forget", reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
func (m *MockRateLimitingInterface) Get() (interface{}, bool) {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Get")
  ret0, _ := ret[0].(interface{})
  ret1, _ := ret[1].(bool)
  return ret0, ret1
}

// Get indicates an expected call of Get
func (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Get", reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Len")
  ret0, _ := ret[0].(int)
  return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len", reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}

// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "NumRequeues", arg0)
  ret0, _ := ret[0].(int)
  return ret0
}

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues", reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}

// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShuttingDown))
}

---

apiVersion: v1
kind: SmartLicense
metadata:
    name: sfcn-enforcer
    namespace: sfcn-system
spec:
    action: "REGISTER"
    tokenSecret:

apiVersion: sfcn.cisco.com/v1
kind: Secret
metadata:
    name: cssm-token
    namespace: sfcn-system
stringData:
    # this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
token: "NGVmN2EwNjctMzRhZS00M2ZkLTkyODktYjlmMjBmNThiNjJkLTE2NDYyMTIx%0AOTU2NjF8UnBHL3Nz
TUU5S1daeDJiSmNBYStBMTVyK05qQlBzTHJJSkk0TE9r%0ARUg4WT0%3D%0A"
---
name: cssm-token
namespace: sfcn-system
minLicenseCount: 1
maxLicenseCount: 12
scalingFactor: 4
scalingRef:
  kind: Deployment
  name: sfcn-enforcer
FROM gcr.io/distroless/java-debian10:nonroot

WORKDIR /
COPY license-broker/bin/sa-server-*:all.jar sa-server-all.jar

ENTRYPOINT ["java", "-jar", "sa-server-all.jar"]

package listeners_test

import (
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"

  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
)

const (smartLicenseName = "license-sample"
  defaultNs = "default"
  licenseType = "L-ASAV10S-STD"
)

func TestListeners(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Listeners Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

package listeners_test

import (
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensingProto "css.cisco.com/licensing/client-agent/proto"
  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
const (  
    epDeploymentName = "epDeployment"  
    entitlementNumber = 4  
    coresPerLicenseType = 2  
)  

var _ = Describe("Entitlement Listener Test", func() {  

    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}  
    var listener *listeners.EntitlementListener  
    var fakeClient client.Client  
    var smartLicense *v1.SmartLicense  

   BeforeEach(func() {  

        var defaultLicenseCount uint32 = 1  
        var maxLicenseCount uint32 = 3  
        smartLicense = &v1.SmartLicense{  
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},  
            Spec: v1.SmartLicenseSpec{  
                Action:          v1.Register,  
                LicenseType:     licenseType,  
                MinLicenseCount: &defaultLicenseCount,  
                MaxLicenseCount: &maxLicenseCount,  
                ScalingFactor:   &defaultLicenseCount,  
            },  
        }  

        fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()  

        listener = &listeners.EntitlementListener{  
            Log:     logf.NullLogger{},  
            Client:  fakeClient,  
            LicenseNsName: licenseNsName,  
        }  
    })
It("should update license status on OUT_OF_COMPLIANCE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:     licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
        Message:  "entitlement is out of compliance",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
    event := licensingProto.EntitlementEvent{
        Type:     licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
        Message:  "granted new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:     licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
        Message:  "failed to reserve a new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: smartlicense-redirector
  namespace: sfcn-system
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: sfcn-system
  minLicenseCount: 1
  maxLicenseCount: 4
  scalingRef:
    kind: Deployment
    name: sfcn-vpnredirector-enforcer

// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac89-96bb5a8def84"

var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1
// log is for logging in this package.
var smartlicenselog = logf.Log.WithName("smartlicense-resource")
var webhookClient client.Client

func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {
    webhookClient = mgr.GetClient()
    return ctrl.NewWebhookManagedBy(mgr).
    For(r).
    Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io
var _ webhook.Defaulter = &SmartLicense{
}

// Default implements webhook.Defaulter so a webhook will be registered for the type
func (r *SmartLicense) Default() {
    log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)

    if r.Spec.Action == "" {
        r.Spec.Action = Register
    }
    if r.Spec.LicenseType == "" {
        r.Spec.LicenseType = SFWLicenceTag
    }
    if r.Spec.MinLicenseCount == nil {
        r.Spec.MinLicenseCount = &defaultMinLicenseCount
    }
    if r.Spec.MaxLicenseCount == nil {
        r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
    }
    if r.Spec.ScalingFactor == nil {
        r.Spec.ScalingFactor = &defaultScalingFactor
    }

    log.V(1).Info("updated SmartLicense default values")
}

// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io
var _ webhook.Validator = &SmartLicense{
}

// ValidateCreate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateCreate() error {

smartlicenselog.V(1).Info("validate create", "name", r.Name)

var allErrs field.ErrorList
r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)
r.validateMinimum(1, r.Spec.ScalingFactor, "scalingFactor", &allErrs)
r.requireRegisterAction(&allErrs)
r.validateLicenseCount(&allErrs)
r.validateToken(&allErrs)
r.validateScalingRef(&allErrs)

if len(allErrs) == 0 {
    return nil
}
return allErrs.ToAggregate()
}

// ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
    smartlicenselog.V(1).Info("validate update", "name", r.Name)

    var allErrs field.ErrorList
    r.validateLicenseCount(&allErrs)

    // avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
    if r.GetDeletionTimestamp() == nil {
        r.validateToken(&allErrs)
        r.validateScalingRef(&allErrs)
    }

    oldObj := old.(*SmartLicense)
    r.requireNoLicenseTypeChange(&allErrs, oldObj)

    if len(allErrs) == 0 {
        return nil
    }
    return allErrs.ToAggregate()
}

// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}
func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
    if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
        *errs = append(*errs, field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
    }
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")
    if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount < *r.Spec.MinLicenseCount {
        *errs = append(*errs, field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum license count"))
    }
}

func (r *SmartLicense) validateToken(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("tokenSecret")
    secret := &v1.Secret{}
    if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "token secret is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
            return
        }
    }
    if len(secret.Data[TokenKeyName]) == 0 {
        *errs = append(*errs, field.Required(path.Child("data").Child(TokenKeyName), "cannot be empty"))
    }
}

func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("scalingRef")
    if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == "" {
        *errs = append(*errs, field.Required(path, "kind or name of referenced object cannot be empty"))
        return
    }
key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
var obj client.Object
switch r.Spec.ScalingRef.Kind {
case DeploymentKind:
    obj = &appsv1.Deployment{}
    default:
        return
}
if err := webhookClient.Get(context.TODO(), key, obj); err != nil {
    if errors.IsNotFound(err) {
        *errs = append(*errs, field.Required(path, "referenced object is not found"))
        return
    } else {
        *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: \%w", err)))
        return
    }
}
func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
    if val == nil || *val < min {
        path := field.NewPath("spec").Child(path)
        *errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to \%d", min))
    }
}
// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/kasa/license-broker/controllers (interfaces: ReplicasCalculator)

// Package mocks is a generated GoMock package.
package mocks
import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    gomock "github.com/golang/mock/gomock"
    v10 "k8s.io/api/apps/v1"
    reflect "reflect"
)

// MockReplicasCalculator is a mock of ReplicasCalculator interface
type MockReplicasCalculator struct {
    ctrl     *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}
// MockReplicasCalculatorMockRecorder is the mock recorder for MockReplicasCalculator
type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

// NewMockReplicasCalculator creates a new mock instance
func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

// CalculateMaxLicensedReplicas mocks base method
func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1 *v10.Deployment) (int32, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
    ret0, _ := ret[0].(int32)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "CalculateMaxLicensedReplicas", reflect.TypeOf((*MockReplicasCalculator)(nil).CalculateMaxLicensedReplicas), arg0, arg1)
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import {
    clientagent "css.cisco.com/licensing/client-agent"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
}

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
    ctrl     *gomock.Controller
    recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
    mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
    mock := &MockLicensingClient{ctrl: ctrl}
    mock.recorder = &MockLicensingClientMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
    return m.recorder
}

// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Allotment")
    ret0, _ := ret[0].(clientagent.AllotmentService)
    return ret0
}

// Allotment indicates an expected call of Allotment
func (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "clientagent.MockLicensingClient.Allotment",
        reflect.TypeOf((*MockLicensingClient)(nil).Allotment))
}

// Entitlement mocks base method
func (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Entitlement")
    ret0, _ := ret[0].(clientagent.EntitlementService)
    return ret0
}

// Entitlement indicates an expected call of Entitlement
func (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "clientagent.MockLicensingClient.Entitlement",
        reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Entitlement",
  reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
func (m *MockLicensingClient) Registration() clientagent.RegistrationService {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Registration")
  ret0, _ := ret[0].(clientagent.RegistrationService)
  return ret0
}

// Registration indicates an expected call of Registration
func (mr *MockLicensingClientMockRecorder) Registration() *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Registration",
  reflect.TypeOf((*MockLicensingClient)(nil).Registration))
}

// Subscription mocks base method
func (m *MockLicensingClient) Subscription() clientagent.SubscriptionService {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Subscription")
  ret0, _ := ret[0].(clientagent.SubscriptionService)
  return ret0
}

// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
  reflect.TypeOf((*MockLicensingClient)(nil).Subscription))
}

package services_test

import {
  "context"
  "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/services"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
  appsV1 "k8s.io/api/apps/v1"
  autoscalingV1 "k8s.io/api/autoscaling/v1"
  coreV1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/resource"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
const (  
    smartLicenseName = "license-sample"  
    defaultNs = "default"  
    licenseType = "L-ASAV10S-STD"  
)  

var (  
    minLicenseCount uint32 = 1  
    maxLicenseCount uint32 = 5  
    scalingFactor uint32 = 2  
)  

var _ = Describe("ReplicasCalculator Service Test", func() {  
    var (  
        deployment *appsv1.Deployment  
        licenses []v1.SmartLicense  
        fakeClient client.Client  
        replicasCalculator *services.ReplicasCalculator  
        smartLicense v1.SmartLicense  
        node *corev1.Node  
    )  

    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}  
   BeforeEach(func() {  
        licenses = []v1.SmartLicense{}  
        fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
        replicasCalculator = services.NewReplicasCalculator(fakeClient, logf.NullLogger{})  
    })  

    var replicaCount int32 = 1  
    deployment = &appsv1.Deployment{  
        ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},  
        Spec: appsv1.DeploymentSpec{  
            Replicas: &appsv1.ReplicaCount,  
            Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},  
            Template: corev1.PodTemplateSpec{  
                    Name: "ep-container",  
                    Resources: corev1.ResourceRequirements{  
                        Limits: map[corev1.ResourceName]resource.Quantity{  
                            "cpu": resource.MustParse("2000m"),  
                        },  
                    },  
                },  
            },  
        },  
    }  

    var _ = Describe("ReplicasCalculator Service Test", func() {  
        var (  
            deployment *appsv1.Deployment  
            licenses []v1.SmartLicense  
            fakeClient client.Client  
            replicasCalculator *services.ReplicasCalculator  
            smartLicense v1.SmartLicense  
            node *corev1.Node  
        )  

        licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}  
       BeforeEach(func() {  
            licenses = []v1.SmartLicense{}  
            fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
            replicasCalculator = services.NewReplicasCalculator(fakeClient, logf.NullLogger{})  
        })  

        var replicaCount int32 = 1  
        deployment = &appsv1.Deployment{  
            ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},  
            Spec: appsv1.DeploymentSpec{  
                Replicas: &appsv1.ReplicaCount,  
                Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},  
                Template: corev1.PodTemplateSpec{  
                        Name: "ep-container",  
                        Resources: corev1.ResourceRequirements{  
                            Limits: map[corev1.ResourceName]resource.Quantity{  
                                "cpu": resource.MustParse("2000m"),  
                            },  
                        },  
                    },  
                },  
            },  
        }  
    })
pod := &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name: "ep-pod",
        Namespace: defaultNs,
        Labels: map[string]string{"role": "enforcer"},
    },
    Spec: corev1.PodSpec{NodeName: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

node = &corev1.Node{
    ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), node)).To(Succeed())

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

smartLicense = v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor: &scalingFactor,
    },
}
Expect(fakeClient.Create(context.TODO(), &smartLicense)).To(Succeed())

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{ })).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Pod{ })).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Node{ })).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{ })).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{ })).To(Succeed())
})
It("should return default value because license state is not in compliance", func() {
    smartLicense.Status.LicenseState = v1.OutOfCompliance
    Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())

    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(2)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should calculate max limits based on 2 smart licenses", func() {
    smartLicense2 := v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action: v1.Register,
            LicenseType: licenseType,
            MinLicenseCount: &minLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor: &scalingFactor,
        },
        Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance, CoresPerLicense: 1},
    }

    Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
    licenses = append(licenses, smartLicense2, smartLicense)

    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(4)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense2)).ShouldNot(HaveOccurred())
    Expect(smartLicense2.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})
It("should look at node limits if pod containers do not have limits defined", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{}
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(int32(1)))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
})

It("should return default value if pod containers do not have limits defined and deployment ready replicas is 0", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{}
  deployment.Status.ReadyReplicas = 0
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(*deployment.Spec.Replicas))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

It("should return default value if there is no node defined in pod spec", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{}
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  Expect(fakeClient.Delete(context.TODO(), node)).To(Succeed())
  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).Should(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
  Expect(maxReplicas).Should(Equal(int32(0)))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

})
---

{{- define "kasa.licensebroker.config" -}}

{{- $ := first . -}}

{{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") -}}

{{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName -}}

apiVersion: v1
kind: ConfigMap
data:
  server-id.json: |
    |
    "name": "{{ $licenseServerName }}",
    "hostname": "{{ $hostname }}",
    {{/* Empty string hides an IP address from being visible on CSSM */}}
    "ipAddress": "",
    "productId": "SFW",
    "softwareTag": "regid.2021-01.com.cisco.SFW,1.0_6f4891e2-97a4-443b-ad9a-9675b85b504f",
    {{/* Serial number must consist of 11 upper-case letters according to CSSM */}}
    "serialNumber": "{{ $hostname | sha256sum | trunc 11 | upper }}",
    "storagePath": "/home/nonroot/licensing/{{ $.Release.Namespace }}",
    "transportHttpUrl": "{{ $.Values.licenseServerTransportUrl }}"

{{- end -}}

package controllers
import {
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/handlers"
  "css.cisco.com/kasa/pkg/predicates"
  "fmt"
  "github.com/go-logr/logr"
  appsv1 "k8s.io/api/apps/v1"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  "k8s.io/api/autoscaling/v2beta1"
  corev1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/tools/record"
  ctrl "sigs.k8s.io/controller-runtime"
  "sigs.k8s.io/controller-runtime/pkg/builder"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "time"
}

type HPALicenseReconciler struct {
  client.Client
func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(
            &predicates.LabelExistsPredicate{Key: LicenseHolderLabel}).
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).
        Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    hpa := &autoscalingv1.HorizontalPodAutoscaler{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("HPA does not exist, nothing to reconcile")
        }
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }

    licenseList := v1.SmartLicenseList{}
        return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
    }

    registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
    hpaLicenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

    labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpaLicenses) != 0)
    if labelsChanged {
        if err = c.Client.Update(ctx, hpa); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)
        }
        log.Info("updated HPA labels")
    }

    if len(hpaLicenses) == 0 {
log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")
return ctrl.Result{}, nil
}

if pendingLicenseExists(hpaLicenses) {
log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")
return ctrl.Result{}, nil
}

log.Info("scaled resource is not deployment")
return ctrl.Result{}, nil
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)
if err != nil {
return ctrl.Result{}, err
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpaLicenses, deployment)
if err != nil {
return ctrl.Result{}, err
}

if hpa.Spec.MaxReplicas > maxLicensedReplicas {
}

changedFields := []string{"MaxReplicas"}

changedFields = append(changedFields, "MinReplicas")
}

if err = c.Client.Update(context.Background(), hpa); err != nil {
return ctrl.Result{}, fmt.Errorf("failed to update HPA resource: %w", err)
}

c.Recorder.Event(hpa, corev1.EventTypeWarning, "HPAScaledDown", fmt.Sprintf("Decreased HPA's %s to %d as it is the maximum EP replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", changedFields, maxLicensedReplicas))
log.Info(fmt.Sprintf("successfully decreased HPA's %s to max license limit", changedFields), "updatedHPAMaxReplicas", hpa.Spec.MaxReplicas)
return ctrl.Result{}, nil
}

log.Info("skipping HPA update, system has enough licenses to have all HPA's MaxReplicas running", "hpaMaxReplicas", hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa *autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
    deploymentName := hpa.Spec.ScaleTargetRef.Name
    deployment := &appsv1.Deployment{
    }
    deployment)
    if err != nil {
        return nil, err
    }
    return deployment, err
}

---
apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
    creationTimestamp: null
    name: mutating-webhook-configuration
webhooks:
    - admissionReviewVersions:
    - v1
        clientConfig:
            service:
                name: webhook-service
                namespace: system
                path: /mutate-sfcn-cisco-com-v1-smartlicense
        failurePolicy: Fail
        name: msmartlicense.kb.io
        rules:
            - apiGroups:
            - sfcn.cisco.com
                apiVersions:
                    - v1
                operations:
                    - CREATE
                    - UPDATE
                resources:
                    - smartlicenses
                sideEffects: None

---
apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
    creationTimestamp: null
    name: validating-webhook-configuration
webhooks:
  - admissionReviewVersions:
    - v1
clientConfig:
  service:
    name: webhook-service
    namespace: system
    path: /validate-sfcn-cisco-com-v1-smartlicense
  failurePolicy: Fail
name: vsmartlicense.kb.io
rules:
  - apiGroups:
    - sfcn.cisco.com
    apiVersions:
      - v1
    operations:
      - CREATE
      - UPDATE
    resources:
      - smartlicenses
    sideEffects: None
// +build !ignore_autogenerated

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// Unauthorized redistribution prohibited.
*******************************************************************************/

// Code generated by controller-gen. DO NOT EDIT.

package v1

import (
  "k8s.io/apimachinery/pkg/runtime"
)

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {
  *out = *in
  out.TypeMeta = in.TypeMeta
  in.Spec.DeepCopyInto(&out.Spec)
  out.Status = in.Status
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicense.
func (in *SmartLicense) DeepCopy() *SmartLicense {
if in == nil {
    return nil
}
out := new(SmartLicense)
in.DeepCopyInto(out)
return out

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicense) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.ListMeta.DeepCopyInto(&out.ListMeta)
    if in.Items != nil {
        in, out := &in.Items, &out.Items
        *out = make([]SmartLicense, len(*in))
        for i := range *in {
            (*in)[i].DeepCopyInto(&(*out)[i])
        }
    }
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}

func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {
    *out = *in
}

func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
    in.DeepCopyInto(out)
    return out
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseSpec)
    in.DeepCopyInto(out)
    return out
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseStatus.
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
    in.DeepCopyInto(out)
    return out
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: EntitlementService)
// Package mocks is a generated GoMock package.
package mocks

import {
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
}

// MockEntitlementService is a mock of EntitlementService interface
type MockEntitlementService struct {
    ctrl     *gomock.Controller
    recorder *MockEntitlementServiceMockRecorder
}

// MockEntitlementServiceMockRecorder is the mock recorder for MockEntitlementService
type MockEntitlementServiceMockRecorder struct {
    mock *MockEntitlementService
}

// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
    mock.recorder = &MockEntitlementServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}

// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Notify", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify", reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}
// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement",
        reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/reconcile"
)

const (
    secretName = "secretTest"
)

var _ = Describe("SecretHandler", func() {
    var handler handler.EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface
    var coreClient client.Client

   BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
handler = handlers.SecretHandler(coreClient)
}

AfterEach(func() {
mockCtrl.Finish()
})

It("should do nothing where there are no smart license objects", func() {
handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})

It("should not add request because secret is not used in SmartLicense object", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name: ",some_secret",
Namespace: defaultNamespace,
},
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.RegistrationFailed,
},
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))
handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})

It("should not add request because SmartLicense is registered", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name: smartLicenseName,
Namespace: defaultNamespace,
},
},
Status: v1.SmartLicenseStatus{
  RegistrationState: v1.Registered,
},
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

handler.Update(event.UpdateEvent{
  ObjectNew: &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
  },
}, mockQueue)
})

It("should not add request because SmartLicense is deregistered", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name: smartLicenseName,
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.Deregistered,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))

  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
      ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
  }, mockQueue)
})

It("should add request because SmartLicense status is registration failed", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name: secretName,
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.RegistrationFailed,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))

  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
      ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
  }, mockQueue)
})
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

driver.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})
)

It("should add request for SmartLicense even if secret is in different namespace", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name: secretName,
Namespace: "test-namespace",
},
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.RegistrationFailed,
},
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: "test-namespace"},
},
}, mockQueue)
})
})
}

# License Broker

License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).
## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:
```
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```
image: [( include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) )]
command: ['sh', '-c', 'chown -R 65532:65532 /home/nonroot']
volumeMounts:
  - mountPath: /home/nonroot
    name: disk
securityContext:
  # Files or directories created with HostPath on the host are only writable by root. Which means, you either
  # need to run your container process as root or modify the file permissions on the host to be writable by
  # non-root user.
  runAsUser: 0
capabilities:
  add:
    - DAC_OVERRIDE
    - FOWNER

containers:
  - name: manager
    image: [( include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) )]
    imagePullPolicy: [{ $.Values.defaultImagePullPolicy }]
    env:
      - include "aegis.containers.standardEnv" (list $)
    args:
      - --zap-log-level={$.Values.logLevel}
      - --zap-encoder={$.Values.logFormat}
      - --webhook-port={$.Values.webhookPort}
      - --metrics-port={$.Values.metricsPort}
      - --license-server-port={$.Values.licenseServerPort}
    ports:
      - containerPort: {$.Values.webhookPort}
        name: webhook-server
        protocol: TCP
    resources:
      requests:
        cpu: {$.Values.managerCoreRequest}
        memory: {$.Values.managerMemoryRequest}
    limits:
      cpu: {$.Values.managerCoreLimit}
      memory: {$.Values.managerMemoryLimit}
    securityContext:
      allowPrivilegeEscalation: false
    - name: license-server
      image: [( include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) )]
      imagePullPolicy: [{ $.Values.defaultImagePullPolicy }]
      command:
        - "java"
        - "-Xms{$.Values.licenseServerXms}"
        - "-Xmx{$.Values.licenseServerXmx}"
        - "-jar"
- "sa-server-all.jar"
- "--configFile"
- "/etc/licensing/server-id.json"
- "--port"
- {{ $.Values.licenseServerPort | quote }}

ports:
  - containerPort: {{ $.Values.licenseServerPort }}
    protocol: TCP

securityContext:
  # 65532 is ID of nonroot user
  runAsUser: 65532
  allowPrivilegeEscalation: false

env:
  {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}

resources:
  requests:
    cpu: {{ $.Values.licenseServerCoreRequest }}
    memory: {{ $.Values.licenseServerMemoryRequest }}
  limits:
    cpu: {{ $.Values.licenseServerCoreLimit }}
    memory: {{ $.Values.licenseServerMemoryLimit }}

volumeMounts:
  - mountPath: /home/nonroot
    name: disk
  - mountPath: /etc/licensing/server-id.json
    name: license-config
    subPath: server-id.json

volumes:
  - name: disk
    persistentVolumeClaim:
      claimName: {{ include "aegis.metadata.fullname" (list $ "server") }}
  - name: license-config
    configMap:
      name: {{ include "aegis.metadata.fullname" (list $ "config") }}

{{- if ne $global.platform "kind" }}

imagePullSecrets:
  - name: regsfcn

terminationGracePeriodSeconds: 10

{{- end }}
---


{{ include "aegis.services.deployment" (list $ "configurer" "kasa.licensebroker.server") -}}

{{- define "kasa.licensebroker.server" -}}

{{- $ := first . -}}
apiversion: v1
kind: Service
metadata:
  name: {{ include "aegis.metadata.fullname" (list $ "server") }}
spec:
  ports:
  - protocol: TCP
    port: 80
    targetPort: {{ $.Values.licenseServerPort }}
type: ClusterIP

```yml
cloud.google.com/go v0.26.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLick0CImMTw=
cloud.google.com/go v0.34.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLick0CImMTw=
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```
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h1:n7NCudcB/nExzVGmLbDwDY5pfWLTLqBcC2KZ6jyyVvM4mQ=
golang.org/x/tools v0.0.0-20190125232054-f727befe758c/go.mod
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golang.org/x/tools v0.0.0-20190311212946-1955173bddd/go.mod
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golang.org/x/tools v0.0.0-20190312170243-e65039ee4138/go.mod
h1:LCzVG0aR6xoXOjkQ3onu1FJEFr0SW1gC7cKk1uF8kGRs= golang.org/x/tools v0.0.0-20190425150028-36563e24a262/go.mod
h1:RgiU9mgBXZiqYHBnxXauZ1Gv1EHHAz9KJViQ78xBX0Q= golang.org/x/tools v0.0.0-20190506145303-2d16b83fe98c/go.mod
h1:RgiU9mgBXZiqYHBnxXauZ1Gv1EHHAz9KJViQ78xBX0Q= golang.org/x/tools v0.0.0-20190524140312-2c0ae7006135/go.mod
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h1:/rFqwRUd4F7ZHNgwSSTFct+R/Kf4OFW1sUzUTQQTgfc= golang.org/x/tools v0.0.0-20190617190820-da514acc4774/go.mod
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h1:+b2E5dAYhXwXZwtZ6UAqB128+e2cm9otk0dWdXHAEO= golang.org/x/tools v0.0.0-20190911174233-4f2ddba30aff/go.mod
h1:+b2E5dAYhXwXZwtZ6UAqB128+e2cm9otk0dWdXHAEO= golang.org/x/tools v0.0.0-20190911174233-4f2ddba30aff/go.mod
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h1:+b2E5dAYhXwXZwtZ6UAqB128+e2cm9otk0dWdXHAEO= golang.org/x/tools v0.0.0-20191029014327-9cc4af7d6b2c/go.mod
h1:+b2E5dAYhXwXZwtZ6UAqB128+e2cm9otk0dWdXHAEO= golang.org/x/tools v0.0.0-20191029014327-9cc4af7d6b2c/go.mod
h1:+b2E5dAYhXwXZwtZ6UAqB128+e2cm9otk0dWdXHAEO= golang.org/x/tools v0.0.0-20191029014327-9cc4af7d6b2c/go.mod
h1:+b2E5dAYhXwXZwtZ6UAqB128+e2cm9otk0dWdXHAEO= golang.org/x/tools v0.0.0-20191029014327-9cc4af7d6b2c/go.mod
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h1:HHHeAlu5H9b7IC+Ftx0K+1dGgVFN1DMj/wz4aoGOA5qS8= golang.org/x/tools v0.0.0-20200616133436-c1934bf7d5054/go.mod
h1:EkVYQZoAsY45+roYkvkgYkb4xsh/qiqgUK9TdY2XT94GE= golang.org/x/xerrors v0.0.0-20190717185122-a985d3407aa7/go.mod
h1:i135fs98sm9nK8tJe9KMc8qJ2OPfmY0= golang.org/x/xerrors v0.0.0-20190717185122-a985d3407aa7/go.mod
h1:155fs98sm9nK8tJe9KMc8qJ2OPfmY0= golang.org/x/xerrors v0.0.0-20190717185122-a985d3407aa7/go.mod
h1:DFci5gLjBEciE7Vtevhslf46CRTquxDuWxQuvQQe0uz8=
google.golang.org/protobuf v0.0.0-20200221191635-4d8936d0db64/go.mod
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google.golang.org/protobuf v1.22.0/go.mod h1:EGpADcykh3NcUnDUJc1+ZksZNG86OYog2l/sGQuuU=
google.golang.org/protobuf v1.23.0/go.mod h1:EGpADcykh3NcUnDUJc1+ZksZNG86OYog2l/sGQuuU=
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google.golang.org/protobuf v1.24.0/go.mod h1:z5tXBNIzEhYS91OUVjXDlt8tc493IdKGjUteUXehe4=
google.golang.org/protobuf v1.25.0 h1:Ejsksq+Eyp0bKw+U1u0JMMtmHCgJPJ/qWTx8qpp+R4c=
google.golang.org/protobuf v1.25.0/go.mod h1:9JNX74DMeImyA3hb4di1ymwJUzt21/x1lbuqjzgsN7c=
gopkg.in/alecthomas/kingpin.v2 v2.2.6/go.mod h1:FhLv+mEhP44yOT+4EOQTLFTRGQOQ1FBLkJstjWtayDe5gw=
gopkg.in/check.v1 v1.0.0-20161208183125-20d25e280405/go.mod
h1:Co6i6VJAznaAkq8huTwLJQCU2016j0/chbNRVW5Yz0=
gopkg.in/check.v1 v1.0.0-20180628173108-788fd7840127/go.mod
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gopkg.in/check.v1 v1.0.0-20190920208050-21f0d43ba15
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gopkg.in/check.v1 v1.0.0-20190920208050-21f0d43ba15/go.mod
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gopkg.in/errg.v2 v2.1.0/go.mod h1:hnStI1EY+bozCKY1yp966pM3vJbqLJn88ws8XvFDN=
gopkg.in/fsnotify.v1 v1.4.7/go.mod h1:7zl8NjZHkW78fsQdbUlxijBTcgA1z1m8ZHf0WmKuAhMys=
gopkg.in/inf.v0 v0.9.9 h1:73M5CoZyi3ZLMOyDIQh03IxC69N9D121Vf176EADAgDc=
gopkg.in/inf.v0 v0.9.1/go.mod h1:eWUdDTGiYYaXcco+Dcufb5Vn6eGp2YChqWtbsRXe0mXw=
gopkg.in/natefinch/lumberjack.v2 v2.0.0/go.mod h1:lonDDW77gZlRNNwBG7wST/UCcT4T24xpd6X8LsFeU+k=
gopkg.in/resty.v1 v1.12.0/go.mod h1:md40p5u5j5dWRML875/a/NmxYqAIA73dvijTavzXQvo=
gopkg.in/square/go-jose.v2 v2.2.2/go.mod h1:M9dMbHiYLoDGQRrXy7OpDJDWkIUs/h+vD76mk0e1AI=
gopkg.in/tomb.v1 v1.0.0-20141021435613-dd632973f1e7
h1:uRGIcdiOfHaEhrze2W8Q3AKkepLTh2bOtoT7a+7czfdQk=
gopkg.in/tomb.v1 v1.0.0-20141021435613-dd632973f1e7/go.mod
h1:dt/Zhp58z54L8KrSDwMTeBk165Dw0HsyHuEv1X15mw=
gopkg.in/yaml.v2 v2.0.0-20170812216006-e1b3733d160e7/go.mod
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gopkg.in/yaml.v2 v2.2.2/go.mod h1:hL93XBmkqTisBFMUTm0b8Fm+jr3Dg11NNxqwp+5A1VGul=
gopkg.in/yaml.v2 v2.2.2.4/go.mod h1:hL93XBmkqTisBFMUTm0b8Fm+jr3Dg11NNxqwp+5A1VGul=
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gopkg.in/yaml.v2 v2.3.0/go.mod h1:hL93XBmkqTisBFMUTm0b8Fm+jr3Dg11NNxqwp+5A1VGul=
gopkg.in/yaml.v3 v3.0.0-20200615113413-eeeca48fe776
h1:QYlpjDBoyREyB9XMu+nnTclpTYz22FM+zxLJFO4gQ=
gopkg.in/yaml.v3 v3.0.0-20200615113413-eeeca48fe776/go.mod
package controllers

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "strings"
)

var _ = Describe("Common Test", func () {
    It("serialNumber", func () {
        serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())
        Expect(len(serialNum)).Should(Equal(11))
        Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))
        Expect(serialNum).Should(Equal("F0529A6CDD9"))
    })

    It("containsString", func () {
        list := []string{"one", "two", "three"}
        Expect(containsString(list, "three")).Should(BeTrue())
        Expect(containsString(list, "four")).Should(BeFalse())
    })

    It("removeString", func () {
        list := []string{"one", "two", "three"}
        Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
        Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
    })

    It("filterLicensesByState", func () {
        licenses := []v1.SmartLicense{
        }
    })
})
"filterLicensesByState": filterLicensesByState(licenses, v1.Deregistered)
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{
    Name: "license1",
  },
  Status: v1.SmartLicenseStatus{
    RegistrationState: v1.Deregistered,
  },
})))

filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
Expect(filteredLicenses).Should(BeEmpty())
})

It("filterLicensesByKind", func() {
  var licenses v1.SmartLicenseList
  licenses.Items = []v1.SmartLicense{
    {
      Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
      },
    },
    {
      Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
      },
    },
    {
      Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName1"},
      },
    },
  }
  filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")
  Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
    Spec: v1.SmartLicenseSpec{
      ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
    },
  },
  }))
  filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
Expect(filteredLicenses).Should(BeNil())

filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
Spec: v1.SmartLicenseSpec{
}}))
)

It("pendingLicenseExists", func() {
  licenses := []v1.SmartLicense{
    {
      Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance},
    },
    {
    },
  }

  Expect(pendingLicenseExists(licenses)).Should(BeFalse())
  licenses = append(licenses, v1.SmartLicense{
    Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState},
  })

  Expect(pendingLicenseExists(licenses)).Should(BeTrue())
})

It("setLicenseLabel", func() {
  meta := metav1.ObjectMeta{}
  res := setLicenseLabel(&meta, LicenseHolderLabel, true)
  Expect(res).Should(BeTrue())
  val, ok := meta.Labels[LicenseHolderLabel]
  Expect(ok).Should(BeTrue())
  Expect(val).Should(Equal("true"))

  res = setLicenseLabel(&meta, LicenseHolderLabel, true)
  Expect(res).Should(BeFalse())

  res = setLicenseLabel(&meta, LicenseHolderLabel, false)
  Expect(res).Should(BeTrue())

  _, ok = meta.Labels[LicenseHolderLabel]
  Expect(ok).Should(BeFalse())
})
)
Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing.

There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.

# Smart Licensing

* Licensing a kASA cluster involves licensing every ASA instance running in the cluster. Since the ASA instances are ephemeral, a license server runs locally in your cluster to manage the license lifecycle of these ASA instances. This server is responsible for registering the set of ASA instances you license with the Cisco Smart Software Manager, obtain or release the licenses based on the number of cores those instances use, and releasing all the licenses back to your Smart account when you deregister the cluster.

* After kASA bundle is successfully installed with licensing enabled, to license the cluster, you need a token from your Smart Account that has Secure Firewall (SFW) licenses. Go to [www.software.cisco.com](http://www.software.cisco.com) and navigate to Smart Software Licensing. Find `asac-dev` virtual account that has the SFW licenses and generate a token from it. For development purposes, we have created a token that you can use:

```
YTRkNWFlM2MtZWEzYi00MWEzLWI2MDEtZmIzMDdjZGQ2ODJiLTIwMDgzMjc5%0AODU2MDN8bGpoZExXdGNxSDkvY0h3cndkUjFpVmpGbEZ2YVBwTTdUUEI0MWhZ%0AAMStTRT0%3D%0A
```

If this token has expired, please send an email to sfcn-controlplane@cisco.com

* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc) and a service type (e.g. `Deployment` or `HorizontalPodAutoscaler`).

* Examples of the secret and the Smart License object are located
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
creationTimestamp: null
name: broker-role
rules:
- apiGroups:
  - apps
resources:
  - deployments
verbs:
  - get
  - list
  - update
  - watch
- apiGroups:
  - apps
resources:
  - replicasets
verbs:
  - get
  - list
  - watch
- apiGroups:
  - autoscaling
resources:
  - horizontalpodautoscalers
verbs:
  - get
  - list
  - update
  - watch
- apiGroups:
  - ""
resources:
  - pods
verbs:
  - delete
  - get
  - list
  - update
  - watch
- apiGroups:
  - ""
resources:
Licensing setup comprises two components - the License Server, and the License Controller. References to Server and Controller in this document mean the License Server and License Controller.

User creates a Smart License resource and applies it to the Kubernetes API Server
2. Kubernetes API Server sends a notification to License Controller.
3. License Controller inspects the configuration in the Smart License resource

1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server,
which then talks to CSSM to reserve the licenses and responds back to the Controller

2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server

4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.
5. The License Server checks its pool to see if it has sufficient licenses to grant the request

1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates this status to ASAc.
2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.

## Packaging

Licensing components are packaged into two Kubernetes Deployment resources targeting different namespaces and distributed via Helm as part of the `sfcn-bundle` Helm chart

### License Broker

The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

License Broker is set to be deployed once per Cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode).

The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.

### License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the [Controller](#license-controller), sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the
cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.

## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the License Server([{{< relref "#license-server" >}}]). It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests]({{< relref "monitoring#unauthorized-"}})
requests" >}) for
more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the
form of events on that resource.

### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart
License resource in the same namespace.

Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows
```
yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
# license type can be blank or not set explicitly to let the system use the default value
# At present, there is only one license type for kASA, so this field is reserved for future use.
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by
obtaining a token from the [Virtual Account](<relref "terminology#smart-and-virtual-accounts">)) and doing a base64
encoding of that text. This can be done from a shell as follows
```
shell
echo "your-token" | base64
```

And, use that content in the Secret as follows
```
yaml
apiVersion: v1
```
kind: Secret
metadata:
  name: cssm-token
namespace: cisco-systems
data:
  # this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
token:
  "TXpJMk1UVXhOV1V0Tm1Jd1ppMDBORFUzTFRnd09ETXRNamMyWm1JMVltWTRORGhtTFRFTMk16YzBNamcyJTBBTVRMky16QjhVSwFE1U25WVGNHbEpRMEZEU2paSk5FeDRZbHAIxYnpkdGFHcGFZblJQVDFGWFoyMURjR3h4JTBBVFUxVxk9EMCUzRCUwQQ=="

{{% alert title="Note" color="primary" %}}
The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual account as you are expecting the number of vCPUs in your cluster namespace.
{{% /alert %}}

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`. The resource specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a minimum of 1 license and upto 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA license type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request for upto 10 vCPUs. Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing configuration thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

{{% alert title="Warning" color="warning" %}}
Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the License Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the license configuration.
In the example here, the Deployment replica count would be set to 2.
{{% /alert %}}

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more...
replicas, the license
Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to
the account.
Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.

### Using the Scaling Factor

When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient
number of
licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to
retry the
operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the
`scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or
down, it
reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may
ask the
pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the
pod is
assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its
pool.
Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the
virtual
account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following
configuration, the
Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this
number
to the number of vCPUs the enforcer pods will be using.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
# scaling factor of 4 implies the license reservations change in increments/decrements of 4
  scalingFactor: 4
```
### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates unregistration and on successfully unregistering from the virtual account, the Controller deletes the resource.

### The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

{ { % alert title="Note" color="primary" % }}

It is recommended that a CPU limit be specified on all the containers where the ASA is running. If you prefer to take advantage of burstable CPU of the Node, be advised that the licensed cores would be that of the Node rather than the Pod.

{ { % /alert % }}

### Licensing ASA

When the ASA comes up, it does not hold a license and therefore runs at a low-bandwidth mode, typically 100kbps and has very restricted capabilities and features it supports. The Manager tries to get a license from the License Server and if successful communicates the status to ASA. Once licensed, ASA runs at its full potential.
The Manager periodically verifies the status of the license it obtained, with the License Server, and if the license is not valid anymore either because the License Server has insufficient licenses, or the Manager failed to verify the validity despite several retries, it will revoke the license of ASA and keeps retrying to fetch the license.

apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into versioned archives to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They're included as a dependency of application charts to inject those utilities and functions into the rendering pipeline. Library charts do not define any templates and therefore cannot be deployed.
type: application

# This is the chart version. This version number should be incremented each time you make changes to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
version: 0.1.0

# This is the version number of the application being deployed. This version number should be incremented each time you make changes to the application. Versions are not expected to follow Semantic Versioning. They should reflect the version the application is using.
appVersion: 1.16.0

dependencies:
  - name: aegis-common
    version: "0.1.0"
    repository: "file://../aegis-common"
module css.cisco.com/kasa/license-broker

go 1.14

require ( css.cisco.com/kasa/pkg/predicates v0.0.0 css.cisco.com/licensing/client-agent v0.1.11 github.com/go-logr/logr v0.3.0 github.com/golang/mock v1.3.1 github.com/onsi/ginkgo v1.14.1 github.com/onsi/gomega v1.10.2 k8s.io/api v0.19.2 k8s.io/apimachinery v0.19.2 k8s.io/client-go v0.19.2 k8s.io/utils v0.0.0-20200912215256-4140de9c8800
package mocks

import {
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
}

// MockAllotmentService is a mock of AllotmentService interface
type MockAllotmentService struct {
    ctrl  *gomock.Controller
    recorder *MockAllotmentServiceMockRecorder
}

// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService
type MockAllotmentServiceMockRecorder struct {
    mock *MockAllotmentService
}

// NewMockAllotmentService creates a new mock instance
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {
    mock := &MockAllotmentService{ctrl: ctrl}
    mock.recorder = &MockAllotmentServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {
    return m.recorder
}

// LeaseAllotment mocks base method
func (m *MockAllotmentService) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "LeaseAllotment", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}
// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
        reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
}

// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReleaseAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReleaseAllotment), arg0)
}

// ReportAllotment mocks base method
func (m *MockAllotmentService) ReportAllotment(arg0 *proto.AllotmentReport) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReportAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReportAllotment indicates an expected call of ReportAllotment
func (mr *MockAllotmentServiceMockRecorder) ReportAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReportAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReportAllotment), arg0)
}
func (mr *MockAllotmentServiceMockRecorder) ReportAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReportAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReportAllotment), arg0)
}

// Status mocks base method
func (m *MockAllotmentService) Status(arg0 *proto.Tenant) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Status", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Status indicates an expected call of Status
func (mr *MockAllotmentServiceMockRecorder) Status(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Status",
        reflect.TypeOf((*MockAllotmentService)(nil).Status), arg0)
}

---

### Cisco Smart Software Manager (CSSM)

Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any licensing activity outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed [here](https://software-stage.cisco.com).

There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html) often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.
kASA Licensing currently supports only direct access to CSSM. The system is NOT tested for accessing CSSM from behind an HTTPs proxy or via Satellite, and the behavior is unknown; though, in theory, it may work.

### Smart License

Smart License is the license that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that license from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).

### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.

Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited to. The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you
purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account. You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased. This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation

License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product. The reservation process requires connectivity to internet and only on successful reservation can you use the product in Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR). PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does
not mean the product supports it. You should check the product documentation to verify the support for license reservation

```{% alert title="Warning" color="warning" %}

kASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.

{% /alert %}

### References

If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

/*
 * Copyright (c) 2020 Cisco Systems, Inc.
 * All rights reserved.
 * Unauthorized redistribution prohibited.
 */

package integ_tests

import (  
   "context"
   v1 "css.cisco.com/kasa/license-broker/api/v1"  
   . "github.com/onsi/ginkgo"
   . "github.com/onsi/gomega"
   autoscalingv1 "k8s.io/api/autoscaling/v1"
   corev1 "k8s.io/api/core/v1"
   metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
   "k8s.io/apimachinery/pkg/types"
)

var _ = Describe("SmartLicense Webhook Test", func() {
   const defaultNamespace = "default"

   var defaultCount uint32 = 1

   var secret *corev1.Secret
   var hpa *autoscalingv1.HorizontalPodAutoscaler

  BeforeEach(func() {
      secret = &corev1.Secret{
         Data: map[string][]byte{"token": []byte("MTIz")},
      }
      Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())

      hpa = &autoscalingv1.HorizontalPodAutoscaler{
         Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MinReplicas: defaultCount,
            MaxReplicas: defaultCount,
            TargetCPUUtilizationPercentage: 80,
            Metrics: []autoscalingv1.HorizontalPodAutoscalerMetricSource{
               {
                  Resource: autoscalingv1.ResourceCPU,
               },
            },
            ScaleTargetRef: &corev1.ObjectReference{
               Name: "secret",
               Namespace: defaultNamespace,
            }
         }
      }
      Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
   })

   It("succeeds for correct resource", func() {
      var pod corev1.Pod
      pod = &corev1.Pod{
         Metadata: metav1.ObjectMeta{...
      }
      Expect(k8sClient.Create(context.TODO(), pod)).To(Succeed())

      Expect(k8sClient.Get(context.TODO(), k8sClient.ObjectKeyFromObject(pod)), errors.IsNotFound, true)
      Expect(k8sClient.Get(context.TODO(), k8sClient.ObjectKeyFromObject(hpa)), errors.IsNotFound, true)
      Expect(k8sClient.Get(context.TODO(), k8sClient.ObjectKeyFromObject(secret)), errors.IsNotFound, true)
   })

   It("fails for invalid resource", func() {
      var pod corev1.Pod
      pod = &corev1.Pod{
         Metadata: metav1.ObjectMeta{...
      }
      Expect(k8sClient.Create(context.TODO(), pod)).To(Succeed())

      Expect(k8sClient.Get(context.TODO(), k8sClient.ObjectKeyFromObject(pod)), errors.IsNotFound, true)
      Expect(k8sClient.Get(context.TODO(), k8sClient.ObjectKeyFromObject(hpa)), errors.IsNotFound, true)
      Expect(k8sClient.Get(context.TODO(), k8sClient.ObjectKeyFromObject(secret)), errors.IsNotFound, true)
   })
})
hpa := &autoscalingv1.HorizontalPodAutoscaler{
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: 3,
    },
}
Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
})

AfterEach(func() {
    Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
    Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
})

Context("Mutating Webhook", func() {
    It("should fill in values on creation", func() {
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
            },
        }
        err := k8sClient.Create(testCtx, license)
        Expect(err).ShouldNot(HaveOccurred())
        err = k8sClient.Get(testCtx, types.NamespacedName{
            Namespace: defaultNamespace,
            Name: "foo",
        }, license)
        Expect(err).ShouldNot(HaveOccurred())
        Expect(license.Spec.Action).To(Equal(v1.Register))
        Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
        Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
        Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
        Expect(license.Spec.ScalingFactor).To(Equal(&defaultCount))
    })
})

Context("Validating Webhook", func() {
    It("should pass for valid object", func() {
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
            },
        }
    })
})
It("has fields validations", func() {
    //given
    var zeroLicenses uint32 = 0
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            MinLicenseCount: &zeroLicenses,
            MaxLicenseCount: &zeroLicenses,
            ScalingFactor:   &zeroLicenses,
        },
    }
    //when
    err := k8sClient.Create(testCtx, license)
    //then
    Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: " +
        "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " +
        "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " +
        "spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1"])
})

It("should return error if max value is less then min value", func() {
    //given
    var minLicenses uint32 = 5
    var maxLicenses uint32 = 3
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            MinLicenseCount: &minLicenses,
            MaxLicenseCount: &maxLicenses,
        },
    }
    //when
    err := k8sClient.Create(context.TODO(), license)
    //then
    Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: " +
        "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " +
        "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1"])
})
It("should return error when creating license with non-REGISTER action", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action: v1.Deregister,
        },
    }
    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))
})

It("should return error when secret does not exist", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
})

It("should return error when secret does not token key", func() {
    //given
    secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
    Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
})
Spec: v1.SmartLicenseSpec{
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))

It("should return error when invalid scalingRef kind is specified", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.scalingRef.kind: Unsupported value: "Pod": supported values:
    "Deployment", "HorizontalPodAutoscaler"))
})

It("should return error when scalingRef does not exist", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)
//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found"))
}
}

It("should not allow changing licenseType after registration", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }
    Expect(k8sClient.Create(context.TODO(), license)).To(Succeed())
    license.Status.RegistrationState = v1.Registered
    Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())

    //when
    license.Spec.LicenseType = "buzz"
    err := k8sClient.Update(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})
})
})
}

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
    name: broker-role-binding
roleRef:
    apiGroup: rbac.authorization.k8s.io
    kind: ClusterRole
    name: broker-role
subjects:
    - kind: ServiceAccount
      name: default
      namespace: system

package controllers_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1" "k8s.io/client-go/kubernetes/scheme" "testing"

Open Source Used In kASA v1.5 4383
func TestControllers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})
package handlers_test

import {
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"

    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
}

func TestHandlers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {
    Expect(v1.AddToScheme(scheme.Scheme)).To(Succeed())
})

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***********************************************************************************/

package integ_tests

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "github.com/go-logr/logr"
    "github.com/onsi/ginkgo"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/client-go/rest"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))

    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }

    close(done)
    if err := mgr.Start(ctx); err != nil {
        return err
    }

    return nil
}

package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
const (  
    epDeploymentName = "epDeployment"  
    initialDeploymentReplicas int32 = 3  
)  

var _ = Describe("Deployment License Controller Test", func() {  
  deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}  
  var (  
    reconciler *controllers.DeploymentLicenseReconciler  
    fakeClient client.Client  
    mockCtrl *gomock.Controller  
    deployment *appsv1.Deployment  
    smartLicense *v1.SmartLicense  
    recorder *record.FakeRecorder  
    replicasCalculatorMock *mocks.MockReplicasCalculator  
  )  
  
 BeforeEach(func() {  
    mockCtrl = gomock.NewController(GinkgoT())  
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
    recorder = record.NewFakeRecorder(1024)  
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)  
    reconciler = &controllers.DeploymentLicenseReconciler{  
      Client: fakeClient,  
      Log: logf.NullLogger{},  
      Recorder: recorder,  
      ReplicasCalculator: replicasCalculatorMock,  
    }  
  })  
  
  smartLicense = &v1.SmartLicense{  
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},  
    Spec: v1.SmartLicenseSpec{  
      Action: v1.Register,  
      LicenseType: licenseType,  
      MinLicenseCount: &minLicenseCount,  
      MaxLicenseCount: &maxLicenseCount,  
      ScalingFactor: &scalingFactor,  
    },  
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},  
  }  
  
  Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())
replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:      epDeploymentName,
        Namespace: defaultNs,
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
        },
    },
    Spec: appsv1.DeploymentSpec{
        Replicas: &replicas,
    }
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())
}

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
    mockCtrl.Finish()
})

It("should skip if Deployment does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})

It("should skip if Deployment SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})
It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(4), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(2))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's
Replicas to 2")))
})

It("should an event if initial replica number annotation is incorrect", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)

    deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(HaveOccurred())
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial-
replicas-count label is not correct. Please, update it to correct number.")))
})
It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
    *deployment.Spec.Replicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(25), nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
        Deployment to initial replicas number 3")))
})

It("should send a warning if deployment controlled by HPA", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(4), nil)
    hpa := &autoscalingv1.HorizontalPodAutoscaler{
        ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: initialHPAMaxReplicas,
        },
    }
    Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
    Expect(recorder.Events).Should(HaveLen(2))
    Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf("Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license
        resource to point to %s HPA", epDeploymentName, epHpaName, epHpaName))))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
        Deployment to initial replicas number 3")))
})
})

package v1_test

import {
    v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService

var _ = Describe("SmartLicense Controller Test", func() {

    const (
        podName = "sfcn-enforcer"
        podNamespace = "sfcn-system"
        nodeName = "aws-eks-node0"
    )

    var tenant, podNamespacedName = &clientagent.Tenant{
        Name: podNamespace + "/" + podName,
        Attributes: map[string]string{
            "role": "license-requestor",
        },
        }, types.NamespacedName{
            Namespace: podNamespace,
            Name: podName,
        }

    newPod := func(name, namespace, nodeName string) *corev1.Pod {


return &coreV1.Pod{
  TypeMeta: metaV1.TypeMeta{
    Kind: "Pod",
    APIVersion: "v1",
  },
  ObjectMeta: metaV1.ObjectMeta{
    Name: name,
    Namespace: namespace,
    Labels: tenant.Attributes,
  },
  Spec: coreV1.PodSpec{
    NodeName: nodeName,
    Containers: []coreV1.Container{
      {
        Name: "ep-container",
        Resources: coreV1.ResourceRequirements{
          Limits: map[coreV1.ResourceName]resource.Quantity{
            "cpu": resource.MustParse("2000m"),
          },
        },
      },
    },
  }
}

newNode := func(name string) *coreV1.Node {
  return &coreV1.Node{
    TypeMeta: metaV1.TypeMeta{
      Kind: "Node",
      APIVersion: "v1"},
    ObjectMeta: metaV1.ObjectMeta{
      Name: name,
    },
    Status: coreV1.NodeStatus{
      Capacity: map[coreV1.ResourceName]resource.Quantity{
        "cpu": resource.MustParse("4"),
      },
    }
  }
}

var (
  pod              *coreV1.Pod
  node             *coreV1.Node
  reconciler       *v1.SmartLicenseReconciler
  fakeClient       client.Client
  mockCtrl         *gomock.Controller
  licensingClient  *mocks.MockLicensingClient
  allotmentService *mocks.MockAllotmentService
  dispatcher       *dispatcherMock.MockGatewayClient
  recorder         *record.FakeRecorder
)

resetRecorder := func() {
  recorder = record.NewFakeRecorder(1024)
  reconciler.Recorder = recorder
reconcileAndExpectFail := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred()) // failure is determined by requeue after duration
    Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration}))
}

reconcileAndExpectSuccess := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred())
    Expect(result).To(Equal(ctrl.Result{}))
}

recordedEvents := func() []string {
    close(recorder.Events)
    var events []string
    for event := range recorder.Events {
        events = append(events, event)
    }
    return events
}

lastRecordedEvent := func() string {
    events := recordedEvents()
    if len(events) == 0 {
        return ""
    }
    return events[0]
}

BeforeEach(func() {
    pod = newPod(podName, podNamespace, nodeName)
    node = newNode(nodeName)
    data := []client.Object{pod, node}
    mockCtrl = gomock.NewController(GinkgoT())
    scheme := runtime.NewScheme()
    Expect(coreV1.AddToScheme(scheme)).To(Succeed())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
    allotmentService = mocks.NewMockAllotmentService(mockCtrl)
    licensingClient = mocks.NewMockLicensingClient(mockCtrl)
    dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
    recorder = record.NewFakeRecorder(1024)
    reconciler = &v1.SmartLicenseReconciler{
        CoreClient: coreV1Client.New(fakeClient, context.Background),
        Licenser:   licensingClient,
    }
})
Log: logf.NullLogger{},
Recorder: recorder,
Dispatcher: dispatcher,
}
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
}

It("should revoke ASAc license after failing multiple attempts of registration", func() {
  allocationService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(fmt.Errorf("test registration failure")).AnyTimes()
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().RevokeLicense().Times(1)
numAttempts := 0
for numAttempts < v1.MaxRetryAttempts {
  reconcileAndExpectFail()
  numAttempts += 1
  if numAttempts == 1 {
    // on the first attempt expect an event is recorded
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
  } else {
    Expect(lastRecordedEvent()).Should(BeEmpty())
  }
  reconcileAndExpectFail()
}
Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
})

ItReconcileSuccessfullyWithExpectedNumberOfCores := func(numCores uint32) {
  allocationService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
  allocationService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil)
  allocationService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
    PoolName: podNamespace,
    Tenant: tenant,
    NumCores: numCores, // this is the limit specified for the container
  })).Return(&clientagent.AllotmentRequestStatus{
    ContextId:  "test-context",
    Tenant:   tenant,
    NumCores: numCores,
    SmartAccountName: "test-domain",
    VirtualAccountName: "test-account",
    ExportControlled: true,
  }, nil)
  dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
  dispatcher.EXPECT().GrantLicense(true)
reconcileAndExpectSuccess()
Expect(recordedEvents()).Should(ConsistOf(
HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),
HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),
HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified"))
}

It("should verify the license status and request on successful registration", func() {
ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
Name: "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
})
Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})

It("should revoke ASAc license after successful registration but fails to get a lease", func() {
allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil).AnyTimes()
allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
PoolName: podNamespace,
Tenant: tenant,
NumCores: 2, // this is the limit specified for the container
})).Return(nil, fmt.Errorf("test insufficient cores")).AnyTimes()

numAttempts := 0
for numAttempts < v1.MaxRetryAttempts {
reconcileAndExpectFail()
numAttempts += 1
if numAttempts == 1 {
// on the first attempt expect an event is recorded
Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
} else {
Expect(lastRecordedEvent()).Should(BeEmpty())
}
reconcileAndExpectFail()
Expect(lastRecordedEvent()).Should(HasPrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because it failed to obtain a license"))
})
It("should revoke ASAc license when server requests to the release the allotment", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
    ContextId: "test-context",
    Tenant:    tenant,
})).Return(nil)

ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
})

Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license"))
})

It("should report the allotment it holds when the server requests so", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

    allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
        ContextId: "test-context",
        Tenant:    tenant,
        NumCores:  2,
    })).Return(nil)

    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
    resetRecorder()
    reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
        ContextId: "test-context",
        Type:      proto.AllotmentEvent_REPORT_ALLOTMENT,
        Message:   "testing release allotment request",
        Tenant:    tenant,
    })
    Expect(lastRecordedEvent()).Should(BeEmpty())
})

It("should mark tenant as unregistered if license server is unavailable and retry again", func() {
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil),
})
fmt.Errorf("some error occurs: %w", lca.ErrLicenseServerUnavailable))
res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})

Expect(err).Should(BeNil())
Expect(res).ShouldNot(BeNil())
Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
)

AfterEach(func() {
mockCtrl.Finish()
})
}

package handlers

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
coreV1 "k8s.io/api/core/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/util/workqueue"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
    return handler.Funcs{
        UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
            if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
                licenseList := v1.SmartLicenseList{}
                err := c.List(context.TODO(), &licenseList)
                if err != nil {
                    secretLog.Error(err,
                        "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
                    panic(err.Error())
                }
                for _, smartLicense := range licenseList.Items {
                    if smartLicense.Spec.TokenSecret.Name == secret.Name &&
                        if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
                    }
                }
            }
        }
    }
}

smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
    q.Add(ctrl.Request{
        NamespacedName: types.NamespacedName{
            Namespace: smartLicense.Namespace,
            Name:      smartLicense.Name,
        } })
} else {
    secretLog.Error(fmt.Errorf("cannot cast %T to Secret", evt.ObjectNew), "event is ignored")
}
}
}

package controllers

import {
    "context"
    "css.cisco.com/kasa/license-broker/controllers(handlers"
    "css.cisco.com/kasa/license-broker/controllers(listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    corePredicate "sigs.k8s.io/controller-runtime/pkg/predicate"
    "sigs.k8s.io/controller-runtime/pkg/source"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    coreV1 "k8s.io/api/core/v1"
    "time"
}
const SFCNProductId = "SFW"

const {
    registrationReason   = "Registration"
    deregistrationReason = "Deregistration"
    FinalizerName        = "sfcn.cisco.com/license-degistration-finalizer"
}

// SmartLicenseReconciler reconciles a SmartLicense object
type SmartLicenseReconciler struct {
    Client            client.Client
    LicensingClient   licensing.LicensingClient
    Log               logr.Logger
    Recorder          record.EventRecorder
    Scheme            *runtime.Scheme
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v1.SmartLicense{}, builder.WithPredicates(&corePredicate.GenerationChangedPredicate{})).
        Watches(&source.Channel{Source: oobChangeNotifier}, &handler.EnqueueRequestForObject{}).
        Complete(r)
}

func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := r.Log.WithValues("smartlicense", req.NamespacedName)

    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    var license v1.SmartLicense
    if err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("SmartLicense does not exist, nothing to reconcile")
        }
    }
}
return ctrl.Result{}, client.IgnoreNotFound(err)
}

if license.ObjectMeta.DeletionTimestamp.IsZero() {
    if err := r.addFinalizerIfMissing(&license); err != nil {
        return ctrl.Result{}, err
    }
} else {
    // the license is being deleted, need to deregister it first
    return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
}

switch license.Spec.Action {
    case v1.Register:
        err := r.registerPlatform(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
        }

        err = r.scaleEntitlements(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
        }

        if err = r.recordSuccessAndUpdateStatus(&license, registrationReason); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
        }
        return ctrl.Result{}, nil

    case v1.Deregister:
        err := r.deregisterPlatform(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, deregistrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to deregister the platform: %w", err)
        }

        if err = r.recordSuccessAndUpdateStatus(&license, deregistrationReason); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
        }
        return ctrl.Result{}, nil

    default:
        // should not happen due to CRD validation, but not returning an error as subsequent reconciliations will not fix the issue anyway
}
func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
if err := r.Client.Update(context.Background(), license); err != nil {
    return err
}
}
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    if containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        if license.Status.RegistrationState == v1.Registered {
            //TODO: return error and do not remove finalizer when corner cases are tested
            log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
        } else {
            log.Info("removing finalizer without deregistration as platform is not registered")
        }
    }
    license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
    if err := r.Client.Update(context.Background(), license); err != nil {
        return err
    }
    log.Info("removed finalizer")
}

func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {
    licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
    log := r.licenseLogger(license)
    token, err := r.getToken(license)
    if err != nil {
        return fmt.Errorf("failed to retrieve licensing token: %w", err)
    }
    log.Info("trying to register platform", "platformName", licenseNsName.String())
    deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client, 
        ctrl.Log.WithName("listeners").WithName("DeregistrationListener"), r.Recorder, oobChangeNotifier)
    registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
        Token:  
    })
    if err != nil {
        return fmt.Errorf("failed to register platform: %w", err)
    }
    log.Info("registered")
    return nil
}
Uuid:           string(license.UID),
Name:           licenseNsName.String(),
SerialNumber:   serialNumber(licenseNsName.String()),
ProductId:      SFCNProductId,
PoolName:       license.Namespace,
}, token, deregistrationListener)
if err != nil {
    license.Status.RegistrationState = v1.RegistrationFailed
    license.Status.LicenseState = v1.Unlicensed
    return fmt.Errorf("failed to complete registration call: %w", err)
} 
log.Info("registered the platform in CSSM", "registrationInfo", registration)
license.Status.RegistrationState = v1.Registered
// we don't want to change license state to Pending if a platform is already registered and a user just updates some field.
if !registration.IsRegistered {
    license.Status.LicenseState = v1.PendingLicenseState
} 
license.Status.AccountDomain = registration.SmartAccountName
license.Status.AccountName = registration.VirtualAccountName
license.Status.ContextId = registration.ContextId
license.Status.ExportControlled = registration.ExportControlled

entitlementListener := &listeners.EntitlementListener{
    Log:           ctrl.Log.WithName("listeners").WithName("EntitlementListener"),
    Client:        r.Client,
    LicenseNsName: licenseNsName,
} 
if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
    if errors.Is(err, licensing.ErrDuplicateListener) {
        log.Info("entitlement listener is already added", "contextId", registration.ContextId)
        return nil
    } 
    return fmt.Errorf("failed to subscribe to entitlement notifications: %w", err)
} 
log.Info("added entitlement listener", "contextId", registration.ContextId)
return nil

func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
    if license.Status.RegistrationState != v1.Registered {
        return fmt.Errorf("platform must be registered before license reservation")
    } 
    log := r.licenseLogger(license)

    log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
    err := r.LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
        ContextId: license.Status.ContextId,
    })
    if err != nil {
        return fmt.Errorf("failed to scale entitlements: %w", err)
    }
    return nil
}
EntitlementId:  license.Spec.LicenseType,
MinEntitlements:  *license.Spec.MinLicenseCount,
MaxEntitlements:  *license.Spec.MaxLicenseCount,
ScalingFactor:  *license.Spec.ScalingFactor,
}
if err != nil {
    return fmt.Errorf("failed to enable licensing scaling: %w", err)
}

log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)

    state := license.Status.RegistrationState
    if state == v1.Deregistered {
        log.Info("platform is already deregistered, skipping deregistration")
        return nil
    }

    err := r.LicensingClient.Registration().Deregister(license.Status.ContextId)
    if err != nil {
        license.Status.RegistrationState = v1.DeregistrationFailed
        return fmt.Errorf("failed to complete deregistration call: %w", err)
    }

    log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.EstimatedMaxReplicas = 0
    license.Status.CoresPerLicense = 0
    license.Status.LicenseNumber = 0
    return nil
}

func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
    secretNamespacedName := types.NamespacedName{
        Namespace: license.Spec.TokenSecret.Namespace,
        Name:      license.Spec.TokenSecret.Name,
    }
    var tokenSecret coreV1.Secret
    if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
        return "", fmt.Errorf("failed to get token secret: %w", err)
    }
    return string(tokenSecret.Data[v1.TokenKeyName]), nil
}
func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error) {
    r.Recorder.Event(license, coreV1.EventTypeWarning, reason, 
    fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
    license.Status.ErrorReason = err.Error()
    if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
        r.Log.Error(statusErr, "failed to update SmartLicense status")
    }
}

func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
    r.Recorder.Event(license, coreV1.EventTypeNormal, reason, "SmartLicense state updated.")
    license.Status.ErrorReason = ""
    if err := r.Client.Status().Update(context.Background(), license); err != nil {
        return err
    }
    return nil
}

func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
    return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
}

package controllers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/registration.go css.cisco.com/licensing/client-agent
RegistrationService

//go:generate mockgen -package=mocks -destination=./mocks/entitlement.go css.cisco.com/licensing/client-agent
EntitlementService

const (  
  smartLicenseName = "license-sample"
  secretName = "secret-sample"
  defaultNs = "default"
  licenseType = "L-ASAV10S-STD"
  secretToken = "MTIz"
)

var (  
  minLicenseCount uint32 = 1
  maxLicenseCount uint32 = 5
  newMaxLicenseCount uint32 = 10
  scalingFactor uint32 = 2
)

var _ = Describe("SmartLicense Controller Test", func() {  
  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var reconciler *controllers.SmartLicenseReconciler
  var fakeClient client.Client
  var mockCtrl *gomock.Controller

  var licensingClient *mocks.MockLicensingClient
  var registrationService *mocks.MockRegistrationService
  var entitlementService *mocks.MockEntitlementService

  var (  
    smartLicense *v1.SmartLicense
    secret *corev1.Secret
  )

 BeforeEach(func() {  
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    
    registrationService = mocks.NewMockRegistrationService(mockCtrl)
    entitlementService = mocks.NewMockEntitlementService(mockCtrl)
    licensingClient = mocks.NewMockLicensingClient(mockCtrl)
    reconciler = &controllers.SmartLicenseReconciler{  
      Client: fakeClient,
      LicensingClient: licensingClient,
      Log: logf.NullLogger{},
      Recorder: record.NewFakeRecorder(1024),
    }})
licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()

secret = &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},
Data:       map[string][]byte{“token”: []byte(secretToken)},
}
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())

smartLicense = &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
Action: v1.Register,
TokenSecret: corev1.SecretReference{
Name:      secretName,
Namespace: defaultNs,
},
LicenseType: licenseType,
MinLicenseCount: &minLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,
},

}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())
}

AfterEach(func() {
mockCtrl.Finish()
})

Context(“platform registration”, func() {
It(“should register platform in licensing system”, func() {
registrationService.EXPECT().Register(&licensing.Platform{
Uuid:         string(smartLicense.UID),
Name:         licenseNsName.String(),
SerialNumber: “8B201B63BB8”,
ProductId:    controllers.SFCNProductId,
PoolName:     defaultNs,
}, secretToken, gomock.Any()).Return(&licensing.Registration{
ContextId:          “testContextId”,
SmartAccountName:   “TestAccountName”,
VirtualAccountName: “TestVirtualName”,
ExportControlled:   true,
IsRegistered:       false,
}, nil)
entitlementService.EXPECT().Notify(“testContextId”, gomock.Any()).Return(nil)
})
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
    ContextId: "testContextId",
    EntitlementId: licenseType,
    MinEntitlements: minLicenseCount,
    MaxEntitlements: maxLicenseCount,
    ScalingFactor: scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))
})

It("should ignore ErrDuplicateListener error", func() {
    registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
gomock.Any()).Return(&licensing.Registration{
        ContextId: "testContextId",
        IsRegistered: false,
    }, nil)
    entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(
        fmt.Errorf("entitlement listener already exists: %w", licensing.ErrDuplicateListener))
    entitlementService.EXPECT().ScaleEntitlement(gomock.Any()).Return(nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
    Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
    Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
})

Context("platform deregistration", func() {
    It("should deregister platform in licensing system", func() {
        Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
        smartLicense.Status.ContextId = "testContextId"
        smartLicense.Status.RegistrationState = v1.Registered
        Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    })
})

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registrationService.EXPECT().Deregister("testContextId").Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
}

It("should skip deregistration if platform is already deregistered", func() {
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  smartLicense.Status.RegistrationState = v1.Deregistered
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
}

It("should deregister platform on resource deletion", func() {
  smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
  now := metav1.Now()
  smartLicense.DeletionTimestamp = &now
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  smartLicense.Status.RegistrationState = v1.Registered
  smartLicense.Status.ContextId = "testContextId"
  registrationService.EXPECT().Deregister("testContextId").Return(nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  // cannot check finalizer removal due to a bug in fakeClient: https://github.com/kubernetes/client-go/issues/607
  // Expect(smartLicense.Finalizers).ShouldNot(ContainElement(finalizerName))
}

Context("smart license updating", func() {

  It("license state should not be updated", func() {
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
licenseStateBeforeUpdate := smartLicense.Status.LicenseState
smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

registrationService.EXPECT().Register(gmock.Any(), gmock.Any(),
  gmock.Any(),).Return(&licensing.Registration{
  ContextId: "testContextId",
  IsRegistered: true,
}).

entitlementService.EXPECT().Notify("testContextId", gmock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
  ContextId: "testContextId",
  EntitlementId: licenseType,
  MinEntitlements: minLicenseCount,
  MaxEntitlements: newMaxLicenseCount,
  ScalingFactor: scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))

package subscribers

import (
  licensing "css.cisco.com/licensing/client-agent"
  "css.cisco.com/licensing/client-agent/proto"
  "github.com/go-logr/logr"
  coreV1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "sigs.k8s.io/controller-runtime/pkg/apis/meta/v1"
  "strings"
)

func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
  return &subscriptionListener{
    channel: channel,
    log:     log,
  }
}

type subscriptionListener struct {
  channel chan event.GenericEvent
  log      logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)
    switch e.Type {
    case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED, proto.AllotmentEvent_ALLOTMENT_DENIED:
        l.log.V(1).Info("scheduling event for PodLicenseReconciler")
        l.sendEventToChannel(e.Tenant.Name)
    }
}

func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
        Name:      namespacedName[1],
        Namespace: namespacedName[0],
    }}
    l.channel <- event.GenericEvent{Object: pod}
}

package listeners

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "time"
)

func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger, recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
    // code here
}
return &deregistrationListener{
    log:      log,
    client:   client,
    licenseNsName: licenseNsName,
    recorder:  recorder,
    notifierChannel: notifierChannel,
}

const MaxRetries = 10

type deregistrationListener struct {
    log      logr.Logger
    client   client.Client
    licenseNsName types.NamespacedName
    recorder record.EventRecorder
    notifierChannel chan event.GenericEvent
    retries   int
}

// OnAutoDeregistration updates SmartLicense status to be in deregistered state.
//
// The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
    log := d.log.WithValues("smartlicense", d.licenseNsName)
    log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)

    if err := d.warnSmartLicenseDeregistered(msg); err != nil {
        if d.retries < MaxRetries {
            log.Error(err, "failed to process auto-deregistration event. retrying...")
            d.retries++
            time.Sleep(1 * time.Second)
            d.OnAutoDeregistration(platform, msg)
            return
        }
        log.Error(err, "failed to process auto-deregistration event")
    }
    d.retries = 0
    log.V(1).Info("successfully processed auto-deregistration event")
}

func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
    var license v1.SmartLicense
    if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
            return nil
        }
        return err
    }
    return d.warnSmartLicenseDeregistered(msg)
}
return nil
}
return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
}

license.Status.RegistrationState = v1.Deregistered
license.Status.LicenseState = v1.Unlicensed
license.Status.LicenseNumber = 0
license.Status.CoresPerLicense = 0
license.Status.EstimatedMaxReplicas = 0

if err := d.client.Status().Update(context.Background(), &license); err != nil {
return fmt.Errorf("failed to update SmartLicense status: %w", err)
}
d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
d.notifierChannel <- event.GenericEvent{Object: &license}
return nil
}

package controllers

import {
"context"
"errors"
"fmt"
"strconv"
"time"

v1 "css.cisco.com/kasa/license-broker/api/v1"
"css.cisco.com/kasa/pkg/predicates"
licensing "css.cisco.com/licensing/client-agent"
"github.com/go-logr/logr"
appsv1 "k8s.io/api/apps/v1"
autoscalingv1 "k8s.io/api/autoscaling/v1"
coreV1 "k8s.io/api/core/v1"
corev1 "k8s.io/api/core/v1"
apiErrors "k8s.io/apimachinery/pkg/api/errors"
"k8s.io/apimachinery/pkg/labels"
"k8s.io/apimachinery/pkg/selection"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/tools/record"
"k8s.io/utils/pointer"
crl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/builder"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/event"
type PodLicenseReconciler struct {
    client.Client
    LicensingClient licensing.LicensingClient
    Log             logr.Logger
    Recorder        record.EventRecorder
}

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&coreV1.Pod{}, builder.WithPredicates(
            &predicates.LabelExistsPredicate{Key: LicenseHolderLabel})).
        Watches(&source.Channel{Source: eventChannel}, &handler.EnqueueRequestForObject{}).
        Complete(c)
}

// Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
// a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
// On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    pod := coreV1.Pod{}
    podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
    err := c.Client.Get(ctx, podNsName, &pod)
    if err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("Pod does not exist, releasing allotments it might still hold")
            return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
        }
        return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
    }

    status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    shouldHaveLicensingLabel := status != nil && status.NumCores != 0
changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
if changed {
    if err = c.Client.Update(ctx, &pod); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
    }
    log.Info("updated Pod labels")
}

deployment, err := c.findPodDeployment(&pod)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
}

if deployment == nil {
    log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
    if err := c.Client.Delete(ctx, &pod); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
    }
    c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration."))
    log.Info("deleted orphan Pod")
    return ctrl.Result{}, nil
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

serviceRole := getDeploymentServiceRole(deployment)

serviceRoleIsRegistered, err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
}
if !serviceRoleIsRegistered {
    if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
} else {
    if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
    if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
}
// releaseAllotmentsIfAny releases licensing allotments that Pod held in the licence-server
func (c *PodLicenseReconciler) releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
    log := c.Log.WithValues("pod", nsName.String())

    tenant := &licensing.Tenant{Name: nsName.String()}
    status, err := c.LicensingClient.Allotment().Status(tenant)
    if err != nil {
        if errors.Is(err, licensing.ErrNotRegistered) {
            log.Info("Pod tenant is not registered in license server, nothing to release")
            return nil
        }
        return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    if status != nil && status.NumCores != 0 {
        log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
        if err := c.LicensingClient.Allotment().ReleaseAllotment(&licensing.AllotmentRelease{
            ContextId: status.ContextId,
            Tenant:    tenant,
        }); err != nil {
            return fmt.Errorf("failed to release Pod allotments: %w", err)
        }
        log.Info("successfully released Pod allotments")
        return nil
    }

    log.Info("Pod does not hold any allotments, nothing to release")
    return nil
}

func (c *PodLicenseReconciler) podLogger(pod *coreV1.Pod) logr.Logger {
}

func toLicenseTenant(pod coreV1.Pod) *licensing.Tenant {
    podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
    return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each
// service role
// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the namespace")

    trialDeploymentList := appsv1.DeploymentList{
        Items: []appsv1.Deployment{},
    }
    labelSelector := labels.NewSelector()
    trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals, []string{"true"})
    if err != nil {
        labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
    }
    serviceRole := getDeploymentServiceRole(deployment)
    serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals, []string{serviceRole})
    if err != nil {
        labelSelector = labelSelector.Add(*serviceLabelRequirement)
    }
    if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
        Namespace:     deployment.Namespace,
        LabelSelector: labelSelector,
    }); err != nil {
        return fmt.Errorf("failed to fetch Deployments with trial license label")
    }
    log.Info("Length of trial deployment list", "length", len(trialDeploymentList.Items))
    var allowedReplicas int32 = 0
    trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
    isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name == deployment.Name
    if trialDeploymentIsAbsent || isDeploymentInTrial {
        log.Info("Deployment has to be marked as trial license holder")
        allowedReplicas = 1
    }
    trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
    scaleDownRequired := *deployment.Spec.Replicas > allowedReplicas
    if scaleDownRequired || trialLabelUpdated {
        initialReplicasNumber := strconv.Itoa(int(pointer.Int32PtrDerefOr(deployment.Spec.Replicas, 1)))
        log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
        deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
        deployment.Spec.Replicas = &allowedReplicas
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment resource: %w", err)
        }
        if scaleDownRequired {
        }
    }
}

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fmt.Sprintf("Decreased Deployment's Replicas to %d "+
"as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. "+
"Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas))
log.Info("scaled Deployment", "replica count", allowedReplicas)
}
}
return nil
}

// throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
// If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList []v1.SmartLicense, reconciledName types.NamespacedName) error {
log := c.Log.WithValues("pod", reconciledName.String())
licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
if err != nil {
return fmt.Errorf("failed to determine licensed deployment names: %w", err)
}
if !containsString(licensedDeploymentNames, deployment.Name) {
log.Info("scaling down Pod's Deployment to 0 as it requested license but does not belong to any licensed EP deployment")
*deployment.Spec.Replicas = 0
if err := c.Client.Update(context.Background(), deployment); err != nil {
return fmt.Errorf("failed to update Deployment resource: %w", err)
}
c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
fmt.Sprintf("Decreased Deployment's Replicas to 0 "+
"as it requested license but does not belong to any licensed EP deployment. "+
"Please, check SmartLicense resources to update licensing configuration."))
log.Info("scaled down Pod's Deployment to 0")
return nil
}

log.Info("verified that Pod belongs to the licensed Deployment")
return nil
}

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
func (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
log := c.Log.WithValues("pod", reconciledName.String())
if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
if err := c.Client.Update(context.Background(), deployment); err != nil {
return fmt.Errorf("failed to update Deployment: %w", err)
}
log.Info("removed Deployment trial license label")
}
func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
    var deploymentNames []string
    for _, license := range licenseList {
        switch license.Spec.ScalingRef.Kind {
        case v1.DeploymentKind:
            deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
        case v1.HPAKind:
            hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
            hpa := &autoscalingv1.HorizontalPodAutoScaler{}
            if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
                return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
            }
            deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
        default:
        }
    }
    return deploymentNames, nil
}

func (c *PodLicenseReconciler) findPodDeployment(pod *coreV1.Pod) (*appsv1.Deployment, error) {
    log := c.podLogger(pod)
    if len(pod.OwnerReferences) != 1 || !*pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind != "ReplicaSet" {
        log.Info("pod is not owned by ReplicaSet")
        return nil, nil
    }
    replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
    replicaSet := &appsv1.ReplicaSet{}
    if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
        return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
    }
    if len(replicaSet.OwnerReferences) != 1 || !*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
        log.Info("pod's ReplicaSet is not owned by Deployment")
        return nil, nil
    }
    return nil, nil
}
deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
deployment := &appsv1.Deployment{}
if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
    return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
}
return deployment, nil

// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in registeredLicenses.
// It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified service role label.
func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense, namespace string, serviceRole string) (bool, error) {
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
    if err != nil {
        return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }
    for _, deploymentName := range licensedDeploymentNames {
        deployment := &appsv1.Deployment{}
        deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
        err := c.Client.Get(context.Background(), deploymentNsName, deployment)
        if err != nil {
            return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
        }
        if getDeploymentServiceRole(deployment) == serviceRole {
            return true, nil
        }
    }
    return false, nil
}

func getDeploymentServiceRole(deployment *appsv1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

package controllers

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/pkg/predicates"
"fmt"
"github.com/go-logr/logr"
appsv1 "k8s.io/api/apps/v1"
autoscalingv1 "k8s.io/api/autoscaling/v1"
corev1 "k8s.io/api/core/v1"
"k8s.io/apimachinery/pkg/api/errors"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/tools/record"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/builder"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/source"
"strconv"
"time"
)

// go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator

type ReplicasCalculator interface {
    CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error)
}

type DeploymentLicenseReconciler struct {
    client.Client
    Log                logr.Logger
    Recorder           record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&appsv1.Deployment{}, builder.WithPredicates(&predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey: InitialReplicasNumberAnnotation})).
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.DeploymentHandler()).
        Complete(c)
}

// Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value
// when it exceeds the replicas allowed by licensing config.
func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := c.Log.WithValues("deployment", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    deployment := &appsv1.Deployment{}
if err != nil {
    if errors.IsNotFound(err) {
        log.Info("Deployment does not exist, nothing to reconcile")
    }
    return ctrl.Result{}, client.IgnoreNotFound(err)
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("updated Deployment labels")
}

if len(deploymentLicenses) == 0 {
    log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentControlledByHPA",
fmt.Sprintf("%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s
HPA", deployment.Name, hpa.Name, hpa.Name))
}

if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
if err != nil {
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "WrongInitialReplicasNumber",
fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
    return ctrl.Result{}, err
}
log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
*deployment.Spec.Replicas = int32(initialReplicasCountInt)
// delete initial replicas number from Deployment annotations to don't back to initial number on each reconciliation
delete(deployment.Annotations, InitialReplicasNumberAnnotation)
if err = c.Client.Update(context.Background(), deployment); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.Recorder.Event(deployment, corev1.EventTypeNormal, "ScaledDeploymentToInitialReplicasNumber",
fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))
}

if *deployment.Spec.Replicas > maxLicensedReplicas {
    log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas",
*deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
*deployment.Spec.Replicas = maxLicensedReplicas

if err = c.Client.Update(context.Background(), deployment); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check
SmartLicense resource to increase the limit.", maxLicensedReplicas))
log.Info("successfully scaled down deployment to max license limit", "updatedReplicas",
*deployment.Spec.Replicas)
return ctrl.Result{}, nil
}

log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas",
*deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment
*appsv1.Deployment) (
*autoscalingv1.HorizontalPodAutoscaler, error) {

hpaList := &autoscalingv1.HorizontalPodAutoscalerList{ }
if err != nil {
    return nil, err
}

for _, hpa := range hpaList.Items {
        return &hpa, err
    }
}

return nil, err
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: RegistrationService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {
    ctrl *gomock.Controller
    recorder *MockRegistrationServiceMockRecorder
}

// MockRegistrationServiceMockRecorder is the mock recorder for MockRegistrationService
type MockRegistrationServiceMockRecorder struct {
    mock *MockRegistrationService
}

// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister",
        reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener)
(*service.Registration, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
    ret0, _ := ret[0].(*service.Registration)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
        reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}

val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistrylessTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val getPublicTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String, String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra
val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(":")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

ext {
    set("publishImages", listOf(
        project.findProperty("imageName") as String,
        project.findProperty("licenseServerImageName") as String
    ))
}

tasks {

    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }

    named("dockerBuild") {
        doLast {
            exec {
                environment("DOCKER_BUILDKIT", 1)
                commandLine("docker build -f ./Dockerfile -t $imageNameForPush ../".split(" "))
            }
            val artifactoryUser = project.findProperty("artifactoryUser")!! as String
            val artifactoryApiKey = project.findProperty("artifactoryApiKey")!! as String
            val saArtifactoryUrl = project.findProperty("saArtifactoryUrl")!! as String
            val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
            if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
                exec {
                    setWorkingDir("bin")
                    commandLine = listOf(
                        "bash", "-c",
                        "curl -f -u $artifactoryUser:$artifactoryApiKey -O $downloadUrl"
                    )
                }
            }
        }
    }
}
exec {
  environment("DOCKER_BUILDKIT", 1)
  commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}

named("promoteImage") {
  val licenseServerImageName: String? by project
  onlyIf {
    licenseServerImageName != null
  }
  doLast {
    val sourceTag: String? by project
    val sourceRepo: String? by project
    val imageTag: String? by project
    if (sourceTag == null || sourceRepo == null || imageTag == null) {
      val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please, specify them with: -PsourceTag=<srcImageTag> -PsourceRepo=<sourceRepoName> -PimageTag=<targetImageTag>"
      logger.error(msg)
      throw GradleException(msg)
    }
    val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
    val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split(':')[0]
    promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
  }
}

named("check") {
  doLast {
    execCommands(listOf(
      "go fmt ./...",
      "go vet ./..."
    ))
  }
}

named("test") {
  doLast {
    execCommands(listOf(
      "go test -coverpkg=./... -coverprofile cover.out ./...",
      "go tool cover -func=cover.out -o ${project.name}-cover.txt"
    ))
  }
}
named("publish") {
  val licenseServerImageName: String? by project
  onlyIf {
    licenseServerImageName != null
  }
  doLast {
    println(execCommand("docker push $serverImageNameForPush"))
  }
}

named("manifests") {
  dependsOn("controller-gen")
  description = "Generates manifests for k8s deployment using Helm"
  doLast {
    execHelmCommand("helm dependency update")
    val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")}. --namespace $systemNamespace --set nameOverride=licenseapi")

    buildDir.deleteRecursively()
    buildDir.mkdir()
    File("$buildDir/license-broker.yaml").writeText(stdOut)
  }
}

named<Copy>("generateValuesFile") {
  expand{
    "platform" to project.findProperty("platform")!!,
    "registry" to project.findProperty("dockerRegistry")!!,
    "artifactoryRepo" to project.findProperty("imageDirectory")!!,
    "controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
    "licenseServerImage" to getRegistrylessTaggedImage(project.findProperty("licenseServerImageName")!! as String),
    "defaultImagePullPolicy" to project.findProperty("imagePullPolicy")!!,
    "logLevel" to project.findProperty("logLevel")!!,
    "logFormat" to project.findProperty("logFormat")!!,
    "licenseServerTransportUrl" to project.findProperty("licenseServerTransportUrl")!!
  }
}

named("generateControllerGenFiles") {
  dependsOn("controller-gen")
  doLast {
    execCommand("$controllerGen $crdOpts rbac:roleName=broker-role webhook paths=./...
    output:crd:artifacts:config=config/crd")
  }
}
register("generate") {
    dependsOn("controller-gen")
    description = "Executes code generators"
    doLast {
        execCommand("$controllerGen object:headerFile=./hack/boilerplate.go.txt paths=./...")
    }
}

register("uninstall") {
    description = "Removes k8s objects from the active cluster"
    dependsOn("manifests")
    doLast {
        exec {
            isIgnoreExitValue = true
            commandLine("kubectl delete -f $buildDir".split(" "))
        }
    }
}

named("deploy") {
    dependsOn(":installCertManager")
    dependsOn("manifests")
    doLast {
        exec {
            commandLine("kubectl apply -f $buildDir".split(" "))
        }
        createRegistrySecret(systemNamespace)
    }
}

named("loadImagesToKind") {
    doLast {
        val clusterName: String by project
        execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")
        execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
        execCommand("docker tag $imageNameForPush $imageNameForPull")
        execCommand("kind load docker-image $imageNameForPull --name $clusterName")
    }
}

Please review the EULA agreement and set the flag '--set global.acceptEULA=[yes, or agree]' for acknowledgement.

Cisco End User License Agreement
package integ_tests

import (
"context"

v1 "css.cisco.com/kasa/license-broker/api/v1"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/client-go/kubernetes/scheme"
  "k8s.io/client-go/rest"
  "path/filepath"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/envtest"
  "sigs.k8s.io/controller-runtime/pkg/envtest/printer"
  "sigs.k8s.io/controller-runtime/pkg/log/zap"
  "strings"
  "testing"
  "time"

logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {
  RegisterFailHandler(Fail)
  SetDefaultEventuallyTimeout(time.Minute)
  RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite",
          []Reporter{printer.NewlineReporter{}})
}

var _ = BeforeSuite(func(done Done) {
  logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))

  By("bootstrapping test environment")
  apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
  apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
  testEnv = &envtest.Environment{
    WebhookInstallOptions: envtest.WebhookInstallOptions{
      Paths: []string{filepath.Join("..", "config", "webhook")},
    },
    CRDDirectoryPaths: []string{filepath.Join("..", "config", "crd")},
    KubeAPIServerFlags: apiServerFlags,
    ControlPlaneStartTimeout: 100 * time.Second,
    ControlPlaneStopTimeout: 100 * time.Second,
  }
}
var err error
cfg, err = testEnv.Start()
Expect(err).ToNot(HaveOccurred())
Expect(cfg).ToNot(BeNil())

er = v1.AddToScheme(scheme.Scheme)
Expect(err).NotTo(HaveOccurred())

k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
Expect(err).ToNot(HaveOccurred())
Expect(k8sClient).ToNot(BeNil())

By("running webhook server")
go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done)
}, envtest.StartTimeout)

var _ = AfterSuite(func(done Done) {
By("tearing down the test environment")
cancelCtx()
Expect(testEnv.Stop()).ToNot(HaveOccurred())

close(done)
}, envtest.StopTimeout)

func errCauses(err error) []string {
var causes []string
if statusError, ok := err.(*errors.StatusError); ok {
for _, cause := range statusError.Status().Details.Causes {
causes = append(causes, strings.Split(cause.Message, ": ")[2])
}
}
return causes
}

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 *************************************************************************/

package v1

import ( autoscalingv1 "k8s.io/api/autoscaling/v1" v1 "k8s.io/api/core/v1" metav1 "k8s.io/apimachinery/pkg/apis/meta/v1" )
const TokenKeyName = "token"

type RegistrationAction string

cst (  
  Register RegistrationAction = "REGISTER"  
  Deregister RegistrationAction = "DEREGISTER"  
)

// SmartLicenseSpec defines the desired state of SmartLicense
type SmartLicenseSpec struct {
  // Action is the desired state of the Smart Agent license registration.
  // +kubebuilder:validation:Enum=REGISTER;DEREGISTER
  // +optional
  Action RegistrationAction `json:"action"

  // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
  TokenSecret v1.SecretReference `json:"tokenSecret"

  // LicenseType defines the type of license to request/release, usually the SKU of the license.
  // The default value is a SFW license tag being able to handle 1vCPU.
  // +optional
  LicenseType string `json:"licenseType"

  // MinLicenseCount is a minimum number of licenses SFCN reserves for the product.
  // The default value is 1.
  // +optional
  MinLicenseCount *uint32 `json:"minLicenseCount,omitempty"

  // MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.
  // The default value is equal to MinLicenseCount.
  // +optional
  MaxLicenseCount *uint32 `json:"maxLicenseCount,omitempty"

  // ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down.
  // The default value is 1.
  // +optional
  ScalingFactor *uint32 `json:"scalingFactor,omitempty"

  // ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
  ScalingRef autoscalingv1.CrossVersionObjectReference `json:"scalingRef,omitempty"
}

type LicenseState string
const (  
PendingLicenseState LicenseState = "PENDING"  
Unlicensed LicenseState = "UNLICENSED"  
InCompliance LicenseState = "IN_COMPLIANCE"  
OutOfCompliance LicenseState = "OUT_OF_COMPLIANCE"  
Overage LicenseState = "OVERAGE"
)

const (  
DeploymentKind = "Deployment"  
HPAKind = "HorizontalPodAutoscaler"
)

type RegistrationState string

const (  
PendingRegistrationState RegistrationState = "PENDING"  
Registered RegistrationState = "REGISTERED"  
RegistrationFailed RegistrationState = "REGISTRATION_FAILED"  
Deregistered RegistrationState = "DEREGISTERED"  
DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
)

// SmartLicenseStatus defines the observed state of SmartLicense  
type SmartLicenseStatus struct {

// AccountDomain is the account domain in Cisco Software Central.  
AccountDomain string `json:"accountDomain,omitempty"

// AccountName is the name of the virtual account in Cisco Software Central.  
AccountName string `json:"accountName,omitempty"

// RegistrationState is the registration status of the SFCN product in Cisco Software Central.  
//+kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DEREGISTRATION_FAILED  
RegistrationState RegistrationState `json:"registrationState,omitempty"

// LicenseState is the state of the reserved licenses.  
//+kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVERAGE  
LicenseState LicenseState `json:"licenseState,omitempty"

// ErrorReason specifies the error due to which the the SFCN product was not registered in Cisco Software Central.  
ErrorReason string `json:"errorReason,omitempty"

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.  
LicenseNumber uint32 `json:"licenseNumber,omitempty"
// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicense,omitempty"

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and
CoresPerLicense.
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicas,omitempty"

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while
// generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlled,omitempty"

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextId,omitempty"

// +kubebuilder:object:root=true
// +kubebuilder:subresource:status
// +kubebuilder:printcolumn:name="Age",type="date",JSONPath=".metadata.creationTimestamp"
// +kubebuilder:printcolumn:name="Registration State",type="string",JSONPath=".status.registrationState"
// +kubebuilder:printcolumn:name="License State",type="string",JSONPath=".status.licenseState"
// +kubebuilder:printcolumn:name="License Number",type="integer",JSONPath=".status.licenseNumber"
// +kubebuilder:printcolumn:name="Domain",type="string",priority=1,JSONPath=".status.accountDomain"
// +kubebuilder:printcolumn:name="Account",type="string",priority=1,JSONPath=".status.accountName"

// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
    metav1.TypeMeta `json:"",inline"
    metav1.ObjectMeta `json:"metadata,omitempty"

    Spec SmartLicenseSpec `json:"spec,omitempty"
    Status SmartLicenseStatus `json:"status,omitempty"

    }

// +kubebuilder:object:root=true
// SmartLicenseList contains a list of SmartLicense
type SmartLicenseList struct {
    metav1.TypeMeta `json:"",inline"
    metav1.ListMeta `json:"metadata,omitempty"
    Items []SmartLicense `json:"items"

    }

func init() {
    SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}

// SmartLicenseList contains a list of SmartLicense
type SmartLicenseList struct {
    metav1.TypeMeta `json:"",inline"
    metav1.ListMeta `json:"metadata,omitempty"
    Items []SmartLicense `json:"items"

    }

func init() {
    SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}

/* Copyright (c) 2021 Cisco Systems, Inc.
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// Package v1 contains API Schema definitions for the sfcn.cisco.com v1 API group
// +kubebuilder:object:generate=true
// +groupName=sfcn.cisco.com
package v1

import (
    "k8s.io/apimachinery/pkg/runtime/schema"
    "sigs.k8s.io/controller-runtime/pkg/scheme"
)

var (  
    // GroupVersion is group version used to register these objects
)

// SchemeBuilder is used to add go types to the GroupVersionKind scheme
SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}

// AddToScheme adds the types in this group-version to the given scheme.
AddToScheme = SchemeBuilder.AddToScheme

package controllers

import (  
    "crypto/md5"
    "fmt"
)

v1 "css.cisco.com/kasa/license-broker/api/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"

const (  
    LicenseHolderLabel = "sfcn.cisco.com/license-holder"
    TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder"
    ServiceRoleLabel = "sfcn.cisco.com/service-role"
    // DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set
    DefaultServiceRole = "default"
    InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"
)
// serialNumber generates platform's Serial Number for SmartLicense resource. // According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {
    return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName)))[0:11]
}

func containsString(slice []string, s string) bool {
    for _, item := range slice {
        if item == s {
            return true
        }
    }
    return false
}

func removeString(slice []string, s string) (result []string) {
    for _, item := range slice {
        if item == s {
            continue
        }
        result = append(result, item)
    }
    return
}

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Status.RegistrationState == state {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// filterLicensesByKind filters SmartLicenses by given kind and name properties of ScalingRef field and returns the result.
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}
// pendingLicenseExists returns true if any license in the list is in Pending state.
func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status.LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

// setLicenseLabel makes sure that the licensing label is present when `shouldBePresent` is `true`
// and that the label is absent when `shouldBePresent` is `false`.
func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
        return true
    }
    if _, ok := meta.Labels[label]; ok && !shouldBePresent {
        delete(meta.Labels, label)
        return true
    }
    return false
}

package services

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "math"
    "sigs.k8s.io/controller-runtime/pkg/client"
)

    return &ReplicasCalculator{client, logger}
}
type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and
calculates maximum amount of replicas based on licensing.
// If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment
*appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    var maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 && deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods",
        "deployment", deployment.Name)
        // it can be a scenario when we have spec.Replicas = 5, but Status.ReadyReplicas = 0. So, we just return desired
        // replicas by a user.
        return *deployment.Spec.Replicas, nil
    }
    var err error
    if coresQuantity == 0 && deployment.Status.ReadyReplicas != 0 {
        coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
        if err != nil {
            return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
        }
    }
    r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores",
    coresQuantity)
    for _, license := range licenses {
        if license.Status.LicenseState == v1.InCompliance {
            maxLicensedCores := int(*license.Spec.MaxLicenseCount) * int(license.Status.CoresPerLicense)
            maxLicensedReplicas := int32(maxLicensedCores / int(coresQuantity))
            r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)
            maxLimit += maxLicensedReplicas
            license.Status.EstimatedMaxReplicas = maxLicensedReplicas
            if err := r.Client.Status().Update(ctx, &license); err != nil {
                return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
            }
        }
    }
}

if r.Log.Info("Open Source Used in kASA v1.5 4436"); err != nil {
    return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
}
// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil
}

func (r *ReplicasCalculator) getReplicasQuantity(deployment *appsv1.Deployment) uint32 {
coresQuantity := resource.MustParse("0")
containerLimit := *container.Resources.Limits.Cpu()
if containerLimit.Value() == 0 {
    r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
    return 0
}
coreQuantity.Add(containerLimit)
}
return uint32(coreQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    if err != nil {
        return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
    }
pods := corev1.PodList{}
    if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
        return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
    }

    // TODO: do not rely on the fact that all nodes have the same CPU limit
    pod := pods.Items[0]

    node := corev1.Node{}
    nodeNsName := types.NamespacedName{Name: pod.Spec.NodeName}
    if err := r.Client.Get(ctx, nodeNsName, &node); err != nil {
        return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
    }

r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPULimit, nil
}

1.316 go-autorest-adal v0.9.4
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1.317 errors v0.8.1

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1.318 netty-transport 4.1.61.Final

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Manifest-Version: 1.0
Implementation-Title: Netty/Transport
Bundle-Description: Netty is an asynchronous event-driven network appli-
cation framework for rapid development of maintainable high perfo-
rance protocol servers and clients.
Automatic-Module-Name: io.netty.transport
Bundle-License: https://www.apache.org/licenses/LICENSE-2.0
Bundle-SymbolicName: io.netty.transport
Implementation-Version: 4.1.61.Final
Built-By: norman
Bnd-LastModified: 161709666373
Bundle-ManifestVersion: 2
Implementation-Vendor-Id: io.netty
Bundle-DocURL: https://netty.io/
Bundle-Vendor: The Netty Project

Import-Package: io.netty.buffer;version="[4.1,5)",io.netty.resolver;version="[4.1,5)",io.netty.util;version="[4.1,5)",io.netty.util.concurrent;version="[4.1,5)",io.netty.util.internal;version="[4.1,5)",io.netty.util.logging;version="[4.1,5)",sun.nio.ch;resolution:=optional,org.eclipse.jetty.npn;version="[1,2)";resolution:=optional,org.eclipse.jetty.alpn;version="[1,2)";resolution:=optional

Require-Capability: osgi.ee;filter:="(&(osgi.ee=JavaSE)(version=1.6))"

Tool: Bnd-2.4.1.201501161923
Implementation-Vendor: The Netty Project


Bundle-Name: Netty/Transport
Bundle-Version: 4.1.61.Final
Created-By: Apache Maven Bundle Plugin
Build-Jdk: 1.8.0_252
Implementation-URL: https://netty.io/netty-transport/

Found in path(s):
* /opt/cola/permits/1153055898_1618392532.14/0/netty-transport-4-1-61-final-jar/META-INF/MANIFEST.MF

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* /opt/cola/permits/1153055898_1618392532.14/0/netty-transport-4-1-61-final-jar/META-INF/native-image/io.netty/transport/native-image.properties

1.319 go-oidc v2.1.0+incompatible

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* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/CharacterIterator.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/RE.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/recompile.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/RESyntaxException.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/REProgram.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/REUtil.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/REDebugCompiler.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/REDemo.java
* /opt/cola/permits/1134796780_1613422074.14/0/archive-259-zip/StringCharacterIterator.java

1.321 godo v1.58.0

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======================
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1.322 base-files 10.3+deb10u9

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### 1.328 go-immutable-radix v1.0.0

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1.329 kasa-aws-lb-endpoint v0.0.0

1.329.1 Available under license:

```yaml
---
apiVersion: v1
kind: PersistentVolume
metadata:
  name: {{ template "aegis.metadata.fullname" (list $ "server") }}
labels: {{ include "aegis.metadata.standardLabels" (list $) | nindent 4 }}
spec:
  accessModes:
  - ReadWriteOnce
  volumeMode: Filesystem
  {{- if ($global.platform | eq "aws") | or ($global.platform | eq "eks") }}
  storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */}}
  {{- else if ($global.platform | eq "azure") }}
  storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc") }} {{/* example yaml has 'managed-csi' as the name which is vague af */}}
  {{- else if ($global.platform | eq "kind") }}
  storageClassName: "standard" {{/* Kind has a default 'standard' StorageClass so reusing it here */}}
```
{{- else }}
storageClassName: (include "aegis.metadata.fullname" $broker)
{{- end }}

resources:
  requests:
    storage: $licenseServerStorage

---

{{- define "kasa.licensebroker.storageLocal" -}}
  $storageName := last .
apiVersion: storage.k8s.io/v1
kind: StorageClass
{{ template "aegis.metadata.standard" $storageName }}
provisioner: kubernetes.io/no-provisioner
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer
{{- end -}}

---

{{- define "kasa.licensebroker.storageAzureDisk" -}}
  $storageName := last .
apiVersion: storage.k8s.io/v1
kind: StorageClass
{{ template "aegis.metadata.standard" $storageName }}
provisioner: disk.csi.azure.com
parameters:
  skuName: $azureDiskStorageAccountType # alias: storageaccounttype, available values: Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer
allowVolumeExpansion: true
{{- end -}}

{{- define "kasa.validate.eula" -}}
  $acceptValues := list "yes" "agree"

if $Release.IsInstall and (not ($acceptValues | has $Values.global.acceptEULA))
  $Files.Get "eula/EULA.txt"
{{- end -}}

package services_test
import (v1 "css.cisco.com/kasa/license-broker/api/v1"
"k8s.io/client-go/kubernetes/scheme"
"testing"
func TestControllers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})

package listeners_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"

corev1 "k8s.io/api/core/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/kubernetes/scheme"
"k8s.io/client-go/tools/record"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
"sigs.k8s.io/controller-runtime/pkg/record"
logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var _ = Describe("Deregistration Listener Test", func() {
    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

    var listener licensing.DeregistrationListener
    var fakeClient client.Client
    var mockCtrl *gomock.Controller
    var recorder *record.FakeRecorder

    var smartLicense *v1.SmartLicense
    var notifier chan event.GenericEvent

    BeforeEach(func() {
        smartLicense = &v1.SmartLicense{}}
```

ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
  Action: v1.Register,
  LicenseType: licenseType,
},
Status: v1.SmartLicenseStatus{
  RegistrationState: v1.Registered,
  LicenseState: v1.InCompliance,
  ErrorReason: "",
},
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
notifier = make(chan event.GenericEvent, 10)

listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger[ ], recorder, notifier)

AfterEach(func() {
  mockCtrl.Finish()
})

It("should update SmartLicense status on deregistration event", func() {
  listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")
  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
  Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
Reason: something happened"))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response to out-of-band event from License Server")))
  Expect(notifier).Should(Receive(&event.GenericEvent{
    Object: smartLicense,
    }))
})
```

---

```
package controllers_test

import {
  "context"
}
const (  
epHpaName                   = "epHPA"  
initialHPAMaxReplicas int32 = 3  
)  

var _ = Describe("HPA License Controller Test", func() {  
  hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}  
  var  
    reconciler *controllers.HPALicenseReconciler  
    fakeClient client.Client  
    mockCtrl   *gomock.Controller  
    hpa        *autoscalingv1.HorizontalPodAutoscaler  
    smartLicense   *v1.SmartLicense  
    recorder    *record.FakeRecorder  
    replicasCalculatorMock *mocks.MockReplicasCalculator  
  )  
  
 BeforeEach(func() {  
    mockCtrl = gomock.NewController(GinkgoT())  
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
    recorder = record.NewFakeRecorder(1024)  
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)  
  })  
  
  reconciler = &controllers.HPALicenseReconciler{  
    Client: fakeClient,  
    Log:    logf.NullLogger{},  
    Recorder: recorder,  
    ReplicasCalculator: replicasCalculatorMock,  
  }
smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:          v1.Register,
        LicenseType:     licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor:   &scalingFactor,
    },
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

deployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:      "ep",
        Namespace: defaultNs,
    },
    Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

hpa = &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{
        Name:      epHpaName,
        Namespace: defaultNs,
    },
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: initialHPAMaxReplicas,
    },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
})

It("should skip if HPA does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())
    Expect(fakeClient.Delete(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.Delete(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
})
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
})

It("should skip if HPA SmartLicense does not exist", func() {
Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if SmartLicense is in deregistered state", func() {
smartLicense.Status.RegistrationState = v1.Deregistered
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if registered SmartLicense has enough licenses", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(initialHPAMaxReplicas, nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
})
Expect(hpa.Spec.MinReplicas).Should(BeNil())
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))}

It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    hpa.Spec.MaxReplicas = 10
    hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
    Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
    Expect(*hpa.Spec.MinReplicas).Should(Equal(int32(2)))
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas MinReplicas] to 2 ")))}

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    smartLicense2 := &v1.SmartLicense{
        Spec: smartLicense.Spec,
    }
    Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())

    smartLicense3 := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
        Spec: smartLicense.Spec,
        Status: v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
    }
    Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))
)
)}
}
---
apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  annotations:
    controller-gen.kubebuilder.io/version: v0.4.1
creationTimestamp: null
name: smartlicenses.sfcn.cisco.com
spec:
group: sfcn.cisco.com
names:
  kind: SmartLicense
  listKind: SmartLicenseList
  plural: smartlicenses
  singular: smartlicense
scope: Namespaced
versions:
- additionalPrinterColumns:
  - jsonPath: .metadata.creationTimestamp
    name: Age
    type: date
  - jsonPath: .status.registrationState
    name: Registration State
    type: string
  - jsonPath: .status.licenseState
    name: License State
    type: string
  - jsonPath: .status.licenseNumber
    name: License Number
    type: integer
  - jsonPath: .status.accountDomain
    name: Domain
    priority: 1
    type: string
  - jsonPath: .status.accountName
    name: Account
    priority: 1
    type: string
name: v1

schema:

openAPIV3Schema:

description: SmartLicense is the Schema for the smartlicenses API

properties:

apiVersion:

description: 'APIVersion defines the versioned schema of this representation
of an object. Servers should convert recognized schemas to the latest
internal value, and may reject unrecognized values. More info:
https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#resources'

type: string

kind:

description: 'Kind is a string value representing the REST resource this
object represents. Servers may infer this from the endpoint the client
submits requests to. Cannot be updated. In CamelCase. More info:
https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'

type: string

metadata:

type: object

spec:

description: SmartLicenseSpec defines the desired state of SmartLicense

properties:

action:

description: Action is the desired state of the Smart Agent license
registration.

description: '[REGISTER, DEREGISTER]'

type: string

licenseType:

description: LicenseType defines the type of license to request/release,
usually the SKU of the license. The default value is a SFW license
tag being able to handle 1vCPU.

type: string

maxLicenseCount:

description: MaxLicenseCount is an optional value, the maximum number
of licenses SFCN can reserve for the product. The default value
is equal to MinLicenseCount.

format: int32

type: integer

minLicenseCount:

description: MinLicenseCount is a minimum number of licenses SFCN
reserves for the product. The default value is 1.

format: int32

type: integer

scalingFactor:

description: ScalingFactor is a factor to increment or decrement the
number of licenses SFCN reserves for the product when scaling up
or down. The default value is 1.

format: int32
type: integer

scalingRef:
  description: ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
  properties:
    apiVersion:
      description: API version of the referent
type: string
    kind:
      description: Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds"
type: string
    name:
      description: Name is unique within a namespace to reference a secret resource.
type: string
  required:
  - kind
  - name
type: object

tokenSecret:
  description: TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
  properties:
    name:
      description: Name is unique within a namespace to reference a secret resource.
type: string
    namespace:
      description: Namespace defines the space within which the secret name must be unique.
type: string
  required:
  - tokenSecret
type: object

status:
  description: SmartLicenseStatus defines the observed state of SmartLicense
  properties:
    accountDomain:
      description: AccountDomain is the account domain in Cisco Software Central.
type: string
    accountName:
      description: AccountName is the name of the virtual account in Cisco Software Central.
type: string
contextId:
  description: ContextId is an internal identifier uniquely defining platform registration.
  type: string
coresPerLicense:
  description: CoresPerLicense is number of cores per one requested LicenseType.
  format: int32
  type: integer
errorReason:
  description: ErrorReason specifies the error due to which the SFCN product was not registered in Cisco Software Central.
  type: string
estimatedMaxReplicas:
  description: EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
  format: int32
  type: integer
exportControlled:
  description: ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
  type: boolean
licenseNumber:
  description: LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
  format: int32
  type: integer
licenseState:
  description: LicenseState is the state of the reserved licenses.
  enum:
  - PENDING
  - UNLICENSED
  - IN_COMPLIANCE
  - OUT_OF_COMPLIANCE
  - OVERAGE
  type: string
registrationState:
  description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.
  enum:
  - PENDING
  - REGISTERED
  - REGISTRATION_FAILED
  - DEREGISTERED
  - DEREGISTRATION_FAILED
  type: string
package controllers_test

import (  
"context"
"errors"
"fmt"
"strconv"

v1 "css.cisco.com/kasa/license-broker/api/v1"
"css.cisco.com/kasa/license-broker/controllers"
"css.cisco.com/kasa/license-broker/controllers/mocks"
licensing "css.cisco.com/licensing/client-agent"
"github.com/golang/mock/gomock"
"github.com/onsi/ginkgo"
"github.com/onsi/gomega"
appsv1 "k8s.io/api/apps/v1"
autoscalingv1 "k8s.io/api/autoscaling/v1"
corev1 "k8s.io/api/core/v1"
apiErrors "k8s.io/apimachinery/pkg/api/errors"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/kubernetes/scheme"
"k8s.io/client-go/tools/record"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake"
logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (  
epPodName = "epPod"
redirectorEpPodName = "redirectorEpPod"
defaultServiceRole = "default"
var controllerTrue = true

var _ = Describe("Pod License Controller Test", func() {

podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}
redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}
deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpDeploymentName}

var reconciler *controllers.PodLicenseReconciler
var fakeClient client.Client
var mockCtrl *gomock.Controller
var recorder *record.FakeRecorder

var licensingClient *mocks.MockLicensingClient
var allotmentService *mocks.MockAllotmentService

var pod *corev1.Pod
var deployment *appsv1.Deployment
var redirectorPod *corev1.Pod
var redirectorDeployment *appsv1.Deployment
var smartLicense *v1.SmartLicense

BeforeEach(func() {

pod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name:            epPodName,
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{ {Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue} },
    },
}

replicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "epReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{ {Kind: "Deployment", Name: epDeploymentName, Controller: &controllerTrue} },
    },
}
replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        epDeploymentName,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
       Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

secondDefaultDeployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        secondDefaultEpDeploymentName,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
       Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

redirectorPod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name:            redirectorEpPodName,
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "redirectorEpReplicaSet", Controller: &controllerTrue}},
    },
}

redirectorReplicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "redirectorEpReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName, Controller: &controllerTrue}},
    },
}

redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        redirectorEpDeploymentName,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
       Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}
smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Registered,
    },
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(
deployment, replicaSet, pod, secondDefaultDeployment,
redirectorDeployment, redirectorReplicaSet, redirectorPod,
smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
reconciler = &controllers.PodLicenseReconciler{
    Client: fakeClient,
    LicensingClient: licensingClient,
    Log: logf.NullLogger{},
    Recorder: recorder,
}

AfterEach(func() {
    mockCtrl.Finish()
})

It("should add the licensing label for licensed pod", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
    Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
    Expect(pod.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})
It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
    Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name:
        epDeploymentName}, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
})

It("should ensure one replica per service role without SmartLicense", func() {
    // initiate reconcile for the pod which is part of deployment with vpnredirector service role
    // and without smart license
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
    Expect(err).To(BeNil())

    // expect the deployment to be scaled to 1 and mark it as trial license holder
    redirDeployment := appsv1.Deployment{}
    Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
    Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))
    Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

    // create another deployment with vpnredirector role
    redirectorEpPodName2 := "redirectorEpPod2"
    redirectorEpDeploymentName2 := "redirectorEpDeployment2"
    replicaSetName2 := "redirectorEpReplicaSet2"
    redirectorPod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:            redirectorEpPodName2,
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
    redirectorReplicaSet2 := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
            Name: redirectorEpPodName2,
            Namespace: defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
})
namespace: defaultNs,
ownerReferences: [] metav1.OwnerReference{ {kind: "Deployment", name: redirectorEpDeploymentName2, controller: &controllerTrue} },

expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
initialRedirector2Replicas := int32(3)
redirectorDeployment2 := &appsv1.Deployment{
    objectMeta: metav1.ObjectMeta{
        name: redirectorEpDeploymentName2,
        namespace: defaultNs,
        labels: map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
        annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
    },
    spec: appsv1.DeploymentSpec{replicas: &initialRedirector2Replicas},
}

expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

// initiate reconcile for the pod which is part of another deployment with vpnredirector service role and without smart license
redirector2PodNsName := types.NamespacedName{Name: redirectorEpPodName2, namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirector2PodNsName.String()}).Return(nil, nil)
_, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
expect(err).To(BeNil())

// expect the second vpnredirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1.Deployment{}
expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2, namespace: defaultNs}, &redirDeployment2)).To(Succeed())
expect(*redirDeployment2.spec.replicas).Should(Equal(int32(0)))
expect(redirDeployment2.labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
expect(redirDeployment2.annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
expect(redirDeployment2.annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(initialRedirector2Replicas)))
}

context("on pod removal", func() {

    it("should release licensing allotments", func() {
        expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    })
})
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
}

It("should requeue request if failed to release licensing allotments", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
    ContextId: "fooBar",
    Tenant:   &licensing.Tenant{Name: podNsName.String()},
  }).Return(errors.New("failed to release allotments"))

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(HaveOccurred())
})

It("should not release licensing allotments if tenant is not registered", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when NumCores is 0", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

Context("for pod without corresponding SmartLicense", func() {
  It("should remove pod if not belong to any deployment", func() {

  })
})
pod.OwnerReferences = nil
Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

err = fakeClient.Get(context.TODO(), podNsName, pod)
Expect(err).NotTo(BeNil())
Expect(apiErrors.IsNotFound(err)).To(BeTrue())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license but does not belong to any Deployment")))
}

It("should scale down pod's deployment", func() {
  smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
  Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
  Return(nil, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name:
  epDeploymentName}, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})

Context("without SmartLicense resources", func() {
 BeforeEach(func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
  })

  var deployment epDeployment
  It("should scale down Deployment to 1 Replica and mark as trial", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
    Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
  })
})
Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
)

It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func()
{
    var replicaCount int32 = 4
    var expectedInitialReplicasNumber int32 = 4

createDeployment := func(name string, role string) *appsv1.Deployment {

    pod := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:         fmt.Sprintf("pod-%s", name),
            Namespace:    defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: fmt.Sprintf("rs-%s", name), Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

    replicaSet := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
            Name:         fmt.Sprintf("rs-%s", name),
            Namespace:    defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name), Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

    deployment := &appsv1.Deployment{
        ObjectMeta: metav1.ObjectMeta{
            Name:         fmt.Sprintf("deployment-%s", name),
            Namespace:    defaultNs,
            Labels:       map[string]string{controllers.ServiceRoleLabel: role},
            Annotations:  map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
        },
        Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
    }
    Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

    podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).Return(nil, nil)
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
Expect(err).To(BeNil())
return deployment
}
deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", "")

assertScaledDown := func(d *appsv1.Deployment) {
    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: d.Namespace, Name: d.Name}, d)).To(Succeed())
    Expect(*d.Spec.Replicas).Should(Equal(int32(0)))
    Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
    Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(expectedInitialReplicasNumber))))
}
assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
})

It("should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist", func() {
    deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    var replicaCount int32 = 1
    pod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:            "deployment-test-2",
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue}}
        },
    }
    Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())
    replicaSet2 := &appsv1.ReplicaSet{
ObjectMeta: metav1.ObjectMeta{
Name:            "epReplicaSet2",
Namespace:       defaultNs,
OwnerReferences: []metav1.OwnerReference{ {Kind: "Deployment", Name: deploymentName2, Controller: &controllerTrue} },
},
}
Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())

deployment2 := &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{
Name:        deploymentName2,
Namespace:   defaultNs,
Labels:      map[string]string{controllers.ServiceRoleLabel: "new-service-role"},
Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
},
Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}
Expect(fakeClient.Create(context.TODO(), deployment2)).To(Succeed())
pod2NsName := types.NamespacedName{Namespace: defaultNs, Name: "deployment-test-2"}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: pod2NsName.String(), Attributes: pod.Labels}).Return(nil, nil)
_ , err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: pod2NsName})
Expect(err).To(BeNil())
deployment2Ns := types.NamespacedName{Namespace: defaultNs, Name: deploymentName2}
Expect(fakeClient.Get(context.TODO(), deployment2Ns, deployment2)).To(Succeed())
Expect(*deployment2.Spec.Replicas).Should(Equal(int32(1)))
Expect(deployment2.Labels).Should(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(recorder.Events).ShouldNot(HaveLen(1))
}
})
})
FROM dockerhub.cisco.com/asac-dev-docker/css-golang:v1.16 as builder

WORKDIR /workspace
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates/"

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ../pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api/ api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
# disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13

WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot
USER nonroot
ENTRYPOINT ["manager"]
---
title: "Monitoring Status"
weight: 3
description: >
Learn how to monitor the ASA operational status and critical license events
---

### Smart License Status

When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

````yaml {linenos=table,hl_lines=["18-25"]}
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
````
namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: "" # omitted to use default value
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
status:
  accountDomain: InternalTestDemoAccount8.cisco.com
  accountName: asac-dev
  contextId: '6947693726752581822'
  coresPerLicense: 1
  estimatedMaxReplicas: 2
  exportControlled: true
  licenseState: IN_COMPLIANCE
  registrationState: REGISTERED

### ASA Licensing State

The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are

* AwaitingLicense (Warning)
* LicenseCommunicationFailed (Warning)
* LicenseGranted (Normal)
* LicenseVerified (Normal)
* LicenseRevoked (Warning)

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.

When the ASA comes up successfully, the Manager tries to obtain a license for the [number of cores](#core-calculation) the Pod uses. During this period, the Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For instance, when the ASA came up for the first time and operating at reduced throughput, this event would read something like ""
And, if the ASA came up and operating at full potential, then
```markdown
Warning AwaitingLicense ASA operating at full potential but not licensed, requesting for a new license
```

The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could not communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a LicenseCommunicationFailed warning event with the reasoning behind the failure.

```markdown
Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure
```

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the license granted to it and on successful verification, emits a `LicenseVerified` event.

```markdown
Normal LicenseGranted successfully obtained a license from the server
Normal LicenseVerified ASA operating at full potential, license status verified
```

It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the licenses have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale down the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager emits a `LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be granted a license, or it will be removed by Kubernetes because the controller scaled down the cluster.

```markdown
Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license, retrying to acquire
```

### Unauthorized Requests

License requests may be granted by the License Server to any pod capable of requesting a licensing, however the
License

Controller sees a grant as authorized only if that pod belonged to a Deployment/HPA specified in one of the Smart License resources otherwise it considers that pod as unauthorized and takes action to delete that pod and set the number of replicas to 0 on its owners to prevent the Kubernetes from creating such pods. The License Controller will emit an event on the pod that was deleted specifying the reason behind it. It then releases the license back to the License Server after the pod is killed.

```markdown
Warning     PodDeleted      Deleted Pod as it requested a license but does not belong to any licensed EP deployment. Please, check SmartLicense resources to update licensing configuration.
```

This might happen when you have an Enforcer deployment but did not specify that Deployment in a Smart License resource in the same namespace. To remedy that, simply add a Smart License resource with the desired configuration and specify the Deployment of the Enforcer in it.

### Identifying Licensed Pods

All licensed Deployments specified via the Smart License resources, and their Pods that have been granted a license will include a label `sfcn.cisco.com/license-holder=true`. You should be able to use `kubectl` to list all the pods in a namespace that are having this label to identify the pods currently holding a license.

```go
package listeners
import (    "context"    v1 "css.cisco.com/kasa/license-broker/api/v1"    licensing "css.cisco.com/licensing/client-agent"    licensingProto "css.cisco.com/licensing/client-agent/proto"    "fmt"    "github.com/go-logr/logr"    "k8s.io/apimachinery/pkg/api/errors"    "k8s.io/apimachinery/pkg/types"    "sigs.k8s.io/controller-runtime/pkg/client"
)

type EntitlementListener struct {    Log    logr.Logger    Client    client.Client    LicenseNsName types.NamespacedName
}```
func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
    log := l.Log.WithValues("smartlicense", l.LicenseNsName)
    log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)

    if err := l.processEvent(event); err != nil {
        log.Error(err, "failed to process entitlement event")
        return
    }
    log.V(1).Info("successfully processed entitlement event")
}

func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()

    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense", l.LicenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }

    originalLicense := license.DeepCopy()
    switch event.Type {
    case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
        license.Status.LicenseState = v1.OutOfCompliance
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
        license.Status.LicenseState = v1.Unlicensed
        license.Status.EstimatedMaxReplicas = 0
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
        license.Status.LicenseState = v1.InCompliance
    default:
        return fmt.Errorf("unknown event type: %s", event.Type.String())
    }
    license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
    license.Status.LicenseNumber = uint32(event.EntitlementNumber)

    // using patch to avoid conflict errors caused by version mismatch and optimistic lock
    // as events from the server have the latest data, it is admissible to overwrite status without version check
    if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
        return fmt.Errorf("failed to patch SmartLicense status: %w", err)
    }
    return nil
}
# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.

global:
  platform: $platform
  imageCredentials:
    # the url to the docker registry, for example dockerhub.cisco.com
    registry: $registry
    artifactoryRepo: $artifactoryRepo
  apiGroup: sfcn.cisco.com
  fullnamePrefix: sfcn-license-

# Docker image for the controller that manages licensing CRDs and their reconciliation
controllerImage: $controllerImage

# Docker image for the server-agent license server
licenseServerImage: $licenseServerImage

# licenseServerPort is the port where the server-agent license server is listening for requests
licenseServerPort: 17051

# licenseServerTransportUrl is the http transport to make use of to connect to CSSM
licenseServerTransportUrl: $licenseServerTransportUrl

# Default image policy that is used by all pod containers unless being explicitly overwritten
defaultImagePullPolicy: $defaultImagePullPolicy

# log verbosity
logLevel: $logLevel

# zap log encoder
# options: console, json
logFormat: $logFormat

# managerMemoryRequest specifies the amount of memory to allocate per request for manager container
managerMemoryRequest: "20Mi"

# managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
managerCoreRequest: "100m"

# managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
managerMemoryLimit: "100Mi"

# managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
managerCoreLimit: "100m"

# metricsPort is the port the metric endpoint binds to
metricsPort: 17080
# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"

# licenseServerXms specifies the amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory
licenseServerXms: "128M"

# licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container
licenseServerCoreRequest: "100m"

# licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container
licenseServerMemoryLimit: "768Mi"

# licenseServerXmx specifies the maximum amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory
licenseServerXmx: "512M"

# licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container
licenseServerCoreLimit: "300m"

# licenseServerStorage specifies the persistent volume size to use for storing licensing data
licenseServerStorage: "1Gi"

# disktype for dynamic azure disk storage on azure platform
# options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
azureDiskStorageAccountType: "Standard_LRS"

package handlers_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
"css.cisco.com/kasa/license-broker/controllers/handlers"  
"css.cisco.com/kasa/license-broker/controllers/handlers/mocks"  
"github.com/golang/mock/gomock"  
. "github.com/onsi/ginkgo"  
autoscalingv1 "k8s.io/api/autoscaling/v1"  
metav1 "k8s.io/apis/meta/v1"  
"k8s.io/apimachinery/pkg/apis/meta/v1"  
"k8s.io/apimachinery/pkg/types"  
"sigs.k8s.io/controller-runtime/pkg/event"  
"sigs.k8s.io/controller-runtime/pkg/handler"  
"sigs.k8s.io/controller-runtime/pkg/reconcile" )
const (  
defaultNamespace = "default"  
smartLicenseName = "smart-license"  
deploymentName = "ep-deployment"  
deploymentName2 = "ep-deployment2"  
hpaName = "ep-hpa"  
hpaName2 = "ep-hpa2"  
)  
var _ = Describe("DeploymentHandler", func() {  
var handler EventHandler  
var mockCtrl *gomock.Controller  
var mockQueue *mocks.MockRateLimitingInterface  
  
 BeforeEach(func() {  
    mockCtrl = gomock.NewController(GinkgoT())  
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)  
    handler = handlers.DeploymentHandler()  
  })  
  
  AfterEach(func() {  
    mockCtrl.Finish()  
  })  
  
  It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {  
    mockQueue.EXPECT().Add(reconcile.Request{  
      NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},  
    })  
    handler.Create(event.CreateEvent{  
      Object: &v1.SmartLicense{  
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},  
        Spec: v1.SmartLicenseSpec{  
        },  
      },  
      mockQueue)  
  })  
  
  It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {  
    handler.Create(event.CreateEvent{  
      Object: &v1.SmartLicense{  
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},  
        Spec: v1.SmartLicenseSpec{  
        },  
      })  
  })
It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
    })

    handler.Update(event.UpdateEvent{
        ObjectOld: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
            ObjectNew: &v1.SmartLicense{
                ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
                Spec: v1.SmartLicenseSpec{
                },
            },
        },
    }, mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })

    handler.Delete(event.DeleteEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

var _ = Describe("HPAHandler", func() {
    var handler handler.EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface

    // Test cases...
})
BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
    handler = handlers.HPAHandler()
})

AfterEach(func() {
    mockCtrl.Finish()
})

It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    }, mockQueue)
})

handler.Create(event.CreateEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)

It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
    })
})

handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)
It("adds request to reconcile Deployment when SmartLicense with HPA kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })

    handler.Delete(event.DeleteEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
            mockQueue)
    })
})

package handlers

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "k8s.io/apimachinery/pkg/types"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue
RateLimitingInterface

var log = ctrl.Log.WithName("handlers").WithName("SmartLicense")

// DeploymentHandler handles SmartLicense changes and queues up events for the Deployment that the
// SmartLicense manages.
func DeploymentHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.DeploymentKind)
}
// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.HPAKind)
}

func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
    return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
        smartLicense, ok := obj.(*v1.SmartLicense)
        if !ok {
            log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
            return []ctrl.Request{}
        }
        if smartLicense.Spec.ScalingRef.Kind != scalingRefKind {
            return []ctrl.Request{}
        }
        return []ctrl.Request{{NamespacedName: types.NamespacedName{
            Namespace: smartLicense.Namespace,
            Name: smartLicense.Spec.ScalingRef.Name,
        }}}
    })
}

package v1

import (
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/reconcile"
    "sigs.k8s.io/controller-runtime/pkg/source"
"strings"
"time"

const (
    RetryDuration = 15 * time.Second
    MaxWaitingDuration = 5 * time.Minute
    MaxRetryAttempts = int(MaxWaitingDuration / RetryDuration)
    LicenseCmd = "show license feature"
    UnlicensedResponse = "Licensing Status: Unlicensed"
    LicensedResponse = "Licensing Status: Licensed"
)

type licenseEvent int

const (        
    Revoked licenseEvent = iota + 1
    Awaiting
    Granted
    Verified
    CommunicationFailed
)

func (l licenseEvent) reasonCode() string {    switch l {    case Revoked:        return "LicenseRevoked"
    case Awaiting:        return "AwaitingLicense"
    case Granted:        return "LicenseGranted"
    case Verified:        return "LicenseVerified"
    case CommunicationFailed:        return "LicenseCommunicationFailed"
    }
    return "LicenseActivity"

    }

func (l licenseEvent) eventType() string {    switch l {    case Awaiting, Revoked, CommunicationFailed:        return coreV1.EventTypeWarning
    default:        return coreV1.EventTypeNormal
    }
    }
type SmartLicenseReconciler struct {
    Log                  logr.Logger
    CoreClient           *coreV1Client.CoreV1Client
    Licenser             lca.LicensingClient
    Dispatcher           dispatcher.GatewayClient
    Recorder             record.EventRecorder
    tenant               *lca.Tenant
    numRetriedAttempts   int
    allotment            *lca.AllotmentRequestStatus // needed to report the allotment held to server on request
    requiredNumCores      uint32
    isRegistered          bool
    lastRecordedEvent     licenseEvent // needed to avoid reporting the same event repeatedly
    notificationChan      chan event.GenericEvent
}

func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher)
    *SmartLicenseReconciler {
    s.notificationChan = make(chan event.GenericEvent)
    lsp.AddListener(s)
    return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
    pod := &coreV1.Pod{
    }
    s.Log.Info("lina (re)started, initiating license reconciliation")
    s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    podName := os.Getenv("POD_NAME")
    podNamespace := os.Getenv("POD_NAMESPACE")
    return ctrl.NewControllerManagedBy(mgr).
        Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{ }).
        For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{ Name: podName,
            Namespace: podNamespace, })).Complete(s)
}

// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list

func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result, error) {
    s.Log.Info("reconciling license status", "pod", request)
    errResult := reconcile.Result{RequeueAfter: RetryDuration}
    return errResult
}
pod, err := s.CoreClient.Pods().Get(request.NaededName)
if err != nil {
    s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NaededName)
    return errResult, err
}
if s.lastRecordedEvent == 0 {
    licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
    if err != nil {
        s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
        return errResult, nil
    }
    if strings.Contains(licenseResponse, LicensedResponse) {
        s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
        s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
    } else if strings.Contains(licenseResponse, UnlicensedResponse) {
        s.recordEvent(pod, Awaiting, "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
    }
}

if pod.DeletionTimestamp == nil {
    s.computeRequiredNumCores(pod)
    // (re)register with the license server
    err := s.registerTenantWithLicenseServer(pod)
    if err != nil {
        return errResult, nil
    }
    // registration successful, fetch or request allotment of this tenant
    err = s.syncAllotmentStatus(pod)
    if err != nil {
        return errResult, nil
    }
    err = s.grantASAcLicenseToOperate(pod)
    if err != nil {
        return errResult, nil
    }
} else {
    err := s.releaseAllotment()
    if err != nil {
        s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
        return errResult, nil
    }

    return reconcile.Result{ }, nil
}

func (s *SmartLicenseReconciler) recordEvent(pod *coreV1.Pod, event licenseEvent, description string) {

if s.lastRecordedEvent != event || event == Verified { // always record verified events
    s.lastRecordedEvent = event
    s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
}

func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *coreV1.Pod) {
    requiredCoresQuantity := resource.MustParse("0")
    var containerCores = make(map[string]string)
    for _, container := range pod.Spec.Containers {
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container", container.Name)
            if err != nil {
                s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
                continue
            }
            // set the required core quantities directly to the capacity of the node
            requiredCoresQuantity = *node.Status.Capacity.Cpu()
            break
        }
        requiredCoresQuantity.Add(containerLimit)
    }
    s.requiredNumCores = uint32(requiredCoresQuantity.Value())
    if len(pod.Spec.Containers) == len(containerCores) {
        s.Log.Info("computed resources usage", "cpu", containerCores)
    }
    s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
}

func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *coreV1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}.String(), Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            s.numRetriedAttempts = s.numRetriedAttempts + 1
            if s.numRetriedAttempts > MaxRetryAttempts {
                s.Log.Info("failed to communicate with licensing server with in allowed retry attempts", "+" "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
                s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license communication failure (%s), "+ "retrying communication", err.Error())))
                _ = s.revokeASAcLicenseAndRetry()
            }
        }
    }
}
return err
}
s.Log.Info(fmt.Sprintf("failed to register with licensing server, will retry (reason: %s)\", err.Error()),
"retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
return err
}
s.recordEvent(pod, Awaiting, "successfully registered the ASA with license server, awaiting a license")
s.isRegistered = true
}
return nil
}

func (s *SmartLicenseReconciler) revokeASAcLicenseAndRetry() error {
 reason, err := s.Dispatcher.RevokeLicense()
if err != nil {
 s.Log.Error(err, "failed to revoke license")
 return err
}
if reason != "" {
 err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
 return err
}
 s.Log.Info("successfully revoked ASAc license")
 s.numRetriedAttempts = 0
 return nil
}

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *coreV1.Pod) error {
 allotmentStatus, err := s.Licenser.Allotment().Status(s.tenant)
 if err != nil {
 if errors.Is(err, lca.ErrLicenseServerUnavailable) {
 s.Log.Info("licensing server is unavailable, unregistering the tenant")
 s.isRegistered = false
 }
 s.numRetriedAttempts = s.numRetriedAttempts + 1
 if s.numRetriedAttempts > MaxRetryAttempts {
 s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
 "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
 s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license
 communication failure (%s), "+
 "retrying communication", err.Error()))
 _ = s.revokeASAcLicenseAndRetry()
 return err
 }
 s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)\", err.Error()),
 "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
 return err
}
if allotmentStatus == nil {
    s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
    // no allotment was made to this tenant, requesting one
    allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
        PoolName: pod.Namespace,
        Tenant:   s.tenant,
        NumCores: s.requiredNumCores,
    })
    if err != nil {
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
                "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to
                obtain a license (%s), "+
                "retrying the operation", err.Error()))
            _ = s.revokeASAcLicenseAndRetry()
            return err
        }
        s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
            "numAttempt", s.numRetriedAttempts)
        return err
    }
    s.Log.Info("successfully leased an allotment from the licensing server")
    s.allotment = allotment
} else {
    s.allotment = allotmentStatus
}

\n\nfunc (s *SmartLicenseReconciler) grantASAcLicenseToOperate(pod *coreV1.Pod) error {
    if s.allotment != nil {
        s.Log.Info("license status verified, communicating the status to ASA")
        s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
        reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
        if err != nil {
            s.Log.Error(err, "failed to grant license")
            return err
        }
        if reason != ""
            err = fmt.Errorf("ASAc failed to set license : %v", reason)
        return err
    }
    return nil
}
s.numRetriedAttempts = 0
s.Log.Info("successfully granted license to ASA")
} else {
  s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")
}
return nil

func (s *SmartLicenseReconciler) releaseAllotment() error {
  _ = s.revokeASAcLicenseAndRetry()
  if s.allotment != nil {
    err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
      ContextId: s.allotment.ContextId,
      Tenant:    s.tenant,
    })
    if err != nil {
      s.Log.Error(err, "failed to release the allotment to server")
      return err
    }
    s.allotment = nil
  }
  return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
  podName := types.NamespacedName{
    Namespace: os.Getenv("POD_NAMESPACE"),
    Name:      os.Getenv("POD_NAME"),
  }
  pod, err := s.CoreClient.Pods().Get(podName)
  if err != nil {
    s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
  }
  switch event.Type {
  case proto.AllotmentEvent_RELEASE_ALLOTMENT:
    s.Log.Info("license requested to be released by the server, un-licensing ASA")
    if err == nil {
      s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying to acquire")
    }
    _ = s.releaseAllotment()
  case proto.AllotmentEvent_REPORT_ALLOTMENT:
    s.Log.Info("license requested to be reported to the server")
    _ = s.reportAllotment()
  }
}
func (s *SmartLicenseReconciler) reportAllotment() error {
    allotment := &lca.AllotmentReport{ContextId: "", Tenant: s.tenant, NumCores: 0}
    if s.allotment != nil {
    }
    err := s.Licenser.Allotment().ReportAllotment(allotment)
    if err != nil {
        s.Log.Error(err, "failed to report the allotment to server")
    }
    return err
}

apiVersion: v1
kind: Secret
metadata:
    name: cssm-token
    namespace: sfcn-system
stringData:
    # this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
    token:
    "NGVmN2EwNjctMzRhZS00M2ZkLTkyODktYjlmMjBmNThiNjJkLTE2NDYyMTIx%0AOTU2NjJf8UnBHL3Nz
    TUU5IldaeDJiSmNyBTVyK05qQlBzTHJJs0%0ARUg4WT0%3D%0A"
---

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
    name: sfcn-enforcer
    namespace: sfcn-system
spec:
    action: "REGISTER"
    tokenSecret:
        name: cssm-token
        namespace: sfcn-system
    minLicenseCount: 1
    maxLicenseCount: 12
    scalingFactor: 4
    scalingRef:
        kind: Deployment
        name: sfcn-enforcer

// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import (
gomock "github.com/golang/mock/gomock"
reflect "reflect"
)
// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl     *gomock.Controller
    recorder *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
}

// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}

// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
}

// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add", reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}

// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddRateLimited", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
func (m *MockRateLimitingInterface) Done(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
func (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Done", reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}

// Forget mocks base method
func (m *MockRateLimitingInterface) Forget(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
func (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Forget", reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
func (m *MockRateLimitingInterface) Get() (interface{}, bool) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Get")
    ret0, _ := ret[0].(interface{})
    return ret0, _
}
ret1, _ := ret[1].(bool)
return ret0, ret1

// Get indicates an expected call of Get
func (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Get",
    reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Len")
  ret0, _ := ret[0].(int)
  return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len",
    reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}

// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "NumRequeues", arg0)
  ret0, _ := ret[0].(int)
  return ret0
}

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues",
    reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
}

// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
  m.ctrl.T.Helper()
  m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}

// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShuttingDown))
}

package listeners_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
"k8s.io/client-go/kubernetes/scheme"  
"testing"
    
    . "github.com/onsi/ginkgo"  
    . "github.com/onsi/gomega"
)

const (  
    smartLicenseName = "license-sample"  
    defaultNs = "default"  
    licenseType = "L-ASAV10S-STD"
)

func TestListeners(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Listeners Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})
COPY license-broker/bin/sa-server-*-all.jar sa-server-all.jar

ENTRYPOINT ["java", "-jar", "sa-server-all.jar"]

/***************************************************************
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***************************************************************

package v1

import (
    "context"
    "fmt"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    "k8s.io/api/machinery/pkg/api/errors"
    "k8s.io/api/machinery/pkg/runtime"
    "k8s.io/api/machinery/pkg/types"
    "k8s.io/api/machinery/pkg/util/validation/field"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
    "sigs.k8s.io/controller-runtime/pkg/webhook"
)

// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac89-96bb5a8def84"

var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1

// log is for logging in this package.
var smartlicenseolog = logf.Log.WithName("smartlicense-resource")
var webhookClient client.Client

func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {
    webhookClient = mgr.GetClient()
    return ctrl.NewWebhookManagedBy(mgr).
        For(r).
        Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-
// smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io
var _ webhook.Defaulter = &SmartLicense{

// Default implements webhook.Defaulter so a webhook will be registered for the type
func (r *SmartLicense) Default() {
    log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)

    if r.Spec.Action == "" {
        r.Spec.Action = Register
    }
    if r.Spec.LicenseType == "" {
        r.Spec.LicenseType = SFWLicenceTag
    }
    if r.Spec.MinLicenseCount == nil {
        r.Spec.MinLicenseCount = &defaultMinLicenseCount
    }
    if r.Spec.MaxLicenseCount == nil {
        r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
    }
    if r.Spec.ScalingFactor == nil {
        r.Spec.ScalingFactor = &defaultScalingFactor
    }

    log.V(1).Info("updated SmartLicense default values")
}

// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io

var _ webhook.Validator = &SmartLicense{

// ValidateCreate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateCreate() error {
    smartlicenselog.V(1).Info("validate create", "name", r.Name)

    var allErrs field.ErrorList
    r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.ScalingFactor, "scalingFactor", &allErrs)
    r.requireRegisterAction(&allErrs)
    r.validateLicenseCount(&allErrs)
    r.validateToken(&allErrs)
    r.validateScalingRef(&allErrs)

    if len(allErrs) == 0 {
        return nil
    }
}
// ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
    smartlicenselog.V(1).Info("validate update", "name", r.Name)

    var allErrs field.ErrorList
    r.validateLicenseCount(&allErrs)

    // avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
    if r.GetDeletionTimestamp() == nil {
        r.validateToken(&allErrs)
        r.validateScalingRef(&allErrs)
        oldObj := old.(*SmartLicense)
        r.requireNoLicenseTypeChange(&allErrs, oldObj)

        if len(allErrs) == 0 {
            return nil
        }
    }

    return allErrs.ToAggregate()
}

// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}

func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
    if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
        *errs = append(*errs,
            field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
    }
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")

if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount <
*r.Spec.MinLicenseCount {
*errs = append(*errs,
field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum
license count"))
}
}

func (r *SmartLicense) validateToken(errs *field.ErrorList) {
path := field.NewPath("spec").Child("tokenSecret")
secret := &v1.Secret{
if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
if errors.IsNotFound(err) {
*errs = append(*errs, field.Required(path, "token secret is not found"))
return
} else {
*errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
return
}

if len(secret.Data[TokenKeyName]) == 0 {
*errs = append(*errs, field.Required(path.Child("data").Child(TokenKeyName), "cannot be empty"))
}
}

func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
path := field.NewPath("spec").Child("scalingRef")

if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == "" {
*errs = append(*errs, field.Required(path.Child("kind").Child(TokenKeyName), "cannot be empty"))
return
}

key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
var obj client.Object
switch r.Spec.ScalingRef.Kind {

case DeploymentKind:
obj = &appsv1.Deployment{

case HPAKind:
obj = &autoscalingv1.HorizontalPodAutoscaler{

default:
*errs = append(*errs, field.NotSupported(path.Child("kind").Child(TokenKeyName), []string{DeploymentKind, HPAKind}))
return
}

if err := webhookClient.Get(context.TODO(), key, obj); err != nil {


if errors.IsNotFound(err) {
    *errs = append(*errs, field.Required(path, "referenced object is not found"))
    return
} else {
    *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: %w", err)))
    return
}
}

func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
    if val == nil || *val < min {
        path := field.NewPath("spec").Child(path)
        *errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to %d", min)))
    }
}

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
    name: smartlicense-redirector
    namespace: sfcn-system
spec:
    action: "REGISTER"
    tokenSecret:
        name: cssm-token
        namespace: sfcn-system
    minLicenseCount: 1
    maxLicenseCount: 4
    scalingRef:
        kind: Deployment
        name: sfcn-vpnredirector-enforcer
package listeners_test

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensingProto "css.cisco.com/licensing/client-agent/proto"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
const (  
epDeploymentName    = "epDeployment"
entitlementNumber   = 4
coresPerLicenseType = 2
)

var _ = Describe("Entitlement Listener Test", func() {  
  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}
  var listener *listeners.EntitlementListener
  var fakeClient client.Client
  var smartLicense *v1.SmartLicense

 BeforeEach(func() {  
    var defaultLicenseCount uint32 = 1
    var maxLicenseCount uint32 = 3
    smartLicense = &v1.SmartLicense{  
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
      Spec: v1.SmartLicenseSpec{  
        Action:          v1.Register,
        LicenseType:     licenseType,
        MinLicenseCount: &defaultLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor:   &defaultLicenseCount,
      },
    }
  
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()

    listener = &listeners.EntitlementListener{  
      Log:           logf.NullLogger{},  
      Client:        fakeClient,
      LicenseNsName: licenseNsName,
    }
  })

  It("should update license status on OUT_OF_COMPLIANCE event", func() {  
    event := licensingProto.EntitlementEvent{  
      Type:               licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
      Message:            "entitlement is out of compliance",
      EntitlementSku:     licenseType,
      EntitlementNumber:  entitlementNumber,
    }
  })

})
CoresPerLicenseType: coresPerLicenseType,
}
listener.OnEntitlementEvent(&event)

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status-licenseState).Should(Equal(v1.OutOfCompliance))
Expect(smartLicense.Status-LicenseNumber).Should(Equal(uint32(entitlementNumber)))
Expect(smartLicense.Status-CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
   event := licensingProto.EntitlementEvent{
   Type: licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
   Message: "granted new entitlement",
   EntitlementSku: licenseType,
   EntitlementNumber: entitlementNumber,
   CoresPerLicenseType: coresPerLicenseType,
}
listener.OnEntitlementEvent(&event)

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status-licenseState).Should(Equal(v1.InCompliance))
Expect(smartLicense.Status-LicenseNumber).Should(Equal(uint32(entitlementNumber)))
Expect(smartLicense.Status-CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
   event := licensingProto.EntitlementEvent{
   Type: licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
   Message: "failed to reserve a new entitlement",
   EntitlementSku: licenseType,
   EntitlementNumber: entitlementNumber,
   CoresPerLicenseType: coresPerLicenseType,
}
listener.OnEntitlementEvent(&event)

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status-licenseState).Should(Equal(v1.Unlicensed))
Expect(smartLicense.Status-LicenseNumber).Should(Equal(uint32(entitlementNumber)))
Expect(smartLicense.Status-CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})
}
// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/kasa/license-broker/controllers (interfaces: ReplicasCalculator)

// Package mocks is a generated GoMock package.
package mocks
import {
    v1 "css.cisco.com/kasa/license-broker/api/v1"
gomock "github.com/golang/mock/gomock"
v10 "k8s.io/api/apps/v1"
    reflect "reflect"
}

// MockReplicasCalculator is a mock of ReplicasCalculator interface
type MockReplicasCalculator struct {
    ctrl  *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}

// MockReplicasCalculatorMockRecorder is the mock recorder for MockReplicasCalculator
type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

// NewMockReplicasCalculator creates a new mock instance
func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

// CalculateMaxLicensedReplicas mocks base method
func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1
*v10.Deployment) (int32, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
    ret0, _ := ret[0].(int32)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{}) *
    gomock.Call {
        mr.mock.ctrl.T.Helper()
        return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "CalculateMaxLicensedReplicas",
            reflect.TypeOf((*MockReplicasCalculator)(nil).CalculateMaxLicensedReplicas), arg0, arg1)
    }
// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import (
    clientagent "css.cisco.com/licensing/client-agent"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
    ctrl     *gomock.Controller
    recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
    mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
    mock := &MockLicensingClient{ctrl: ctrl}
    mock.recorder = &MockLicensingClientMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
    return m.recorder
}

// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Allotment")
    ret0, _ := ret[0].(clientagent.AllotmentService)
    return ret0
}

// Allotment indicates an expected call of Allotment
func (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Allotment", reflect.TypeOf((*gomock.Call)(nil)).Elem())
}


// Entitlement mocks base method
func (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Entitlement")
    ret0, _ := ret[0].(clientagent.EntitlementService)
    return ret0
}

// Entitlement indicates an expected call of Entitlement
func (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Entitlement",
        reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
func (m *MockLicensingClient) Registration() clientagent.RegistrationService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Registration")
    ret0, _ := ret[0].(clientagent.RegistrationService)
    return ret0
}

// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
        reflect.TypeOf((*MockLicensingClient)(nil).Subscription))
}
import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "css.cisco.com/kasa/license-broker/services"  "github.com/onsi/ginkgo"  "github.com/onsi/gomega" appsv1 "k8s.io/api/apps/v1" autoscalingv1 "k8s.io/api/autoscaling/v1" corev1 "k8s.io/api/core/v1"  "k8s.io/apimachinery/pkg/api/resource"  "k8s.io/apimachinery/pkg/apis/meta/v1"  "k8s.io/apimachinery/pkg/types"  "k8s.io/client-go/kubernetes/scheme"  "sigs.k8s.io/controller-runtime/pkg/client"  "sigs.k8s.io/controller-runtime/pkg/client/fake"  logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (  smartLicenseName = "license-sample"  defaultNs = "default"  licenseType = "L-ASAV10S-STD"
)

var (  minLicenseCount uint32 = 1  maxLicenseCount uint32 = 5  scalingFactor uint32 = 2
)

var _ = Describe("ReplicasCalculator Service Test", func() {
  
  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName} BeforeEach(func() {
    licenses = []v1.SmartLicense{  fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    replicasCalculator = services.NewReplicasCalculator(fakeClient, logf.NullLogger{})

    var replicaCount int32 = 1
    deployment = &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},
Spec: appsv1.DeploymentSpec{
Replicas: &replicaCount,
Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},
Template: corev1.PodTemplateSpec{
{Name: "ep-container",
Resources: corev1.ResourceRequirements{
Limits: map[corev1.ResourceName]resource.Quantity{
"cpu": resource.MustParse("2000m")},
},
},
},
}
Status: appsv1.DeploymentStatus{ReadyReplicas: replicaCount},
}

pod := &corev1.Pod{
ObjectMeta: metav1.ObjectMeta{
Name: "ep-pod",
Namespace: defaultNs,
Labels: map[string]string{"role": "enforcer"},
},
Spec: corev1.PodSpec{NodeName: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

node = &corev1.Node{
ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), node)).To(Succeed())

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

smartLicense = v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
Action: v1.Register,
LicenseType: licenseType,
MinLicenseCount: &minLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,
}
It("should return default value because license state is not in compliance", func() {
    smartLicense.Status.LicenseState = v1.OutOfCompliance
    Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(2)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should calculate max limits based on 2 smart licenses", func() {
    smartLicense2 := v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action:          v1.Register,
            LicenseType:     licenseType,
            MinLicenseCount: &minLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor:   &scalingFactor,
        },
        Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance, CoresPerLicense: 1},
    }
    Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
    licenses = append(licenses, smartLicense2)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(2)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense2)).ShouldNot(HaveOccurred())
    Expect(smartLicense2.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})
licenses = append(licenses, smartLicense2, smartLicense)

maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(4)))

licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(1)))

licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(0)))

It("should return default value if there is no node defined in pod spec", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    deployment.Status.ReadyReplicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(*deployment.Spec.Replicas))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

It("should return default value if there is no node defined in pod spec", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(0))

    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})
licenses = append(licenses, smartLicense)
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).Should(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
Expect(maxReplicas).Should(Equal(int32(0)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))

---
{{- define "kasa.licensebroker.config" -}}
{{- $ := first . -}}
{{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") }}
{{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName }}
apiVersion: v1
data:
server-id.json: |
{
  "name": "{{ $licenseServerName }}",
  "hostname": "{{ $hostname }}",
  {{/* Empty string hides an IP address from being visible on CSSM */}}
  "ipAddress": "",
  "productId": "SFW",
  "softwareTag": "regid.2021-01.com.cisco.SFW,1.0_6f4891e2-97a4-443b-ad9a-9675b85b504f",
  {{/* Serial number must consist of 11 upper-case letters according to CSSM */}}
  "serialNumber": "{{ $hostname | sha256sum | trunc 11 | upper }}",
  "storagePath": "/home/nonroot/licensing/{{ $.Release.Namespace }}",
  "transportHttpUrl": "{{ $.Values.licenseServerTransportUrl }}"
}
{{- end -}}

package controllers
import (  
  "context"  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
  "css.cisco.com/kasa/license-broker/controllers/handlers"  
  "css.cisco.com/kasa/pkg/predicates"  
  "fmt"  
  "github.com/go-logr/logr"
appsv1 "k8s.io/api/apps/v1"  
avtoscalingv1 "k8s.io/api/autoscaling/v1"  
"k8s.io/api/autoscaling/v2beta1"  
corev1 "k8s.io/api/core/v1"
type HPALicenseReconciler struct {
    client.Client
    Log            logr.Logger
    Recorder       record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(&predicates.LabelExistsPredicate{Key: LicenseHolderLabel}).
            Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).
            Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    hpa := &autoscalingv1.HorizontalPodAutoscaler{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("HPA does not exist, nothing to reconcile")
        }
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }

    licenseList := v1.SmartLicenseList{}
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
    }
registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
hpaLicenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpaLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)
    }
    log.Info("updated HPA labels")
}

if len(hpaLicenses) == 0 {
    log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(hpaLicenses) {
    log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")
    return ctrl.Result{}, nil
}

    log.Info("scaled resource is not deployment")
    return ctrl.Result{}, nil
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)
if err != nil {
    return ctrl.Result{}, err
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpaLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

if hpa.Spec.MaxReplicas > maxLicensedReplicas {
    hpa.Spec.MaxReplicas = maxLicensedReplicas
}

changedFields := []string{"MaxReplicas"}
    changedFields = append(changedFields, "MinReplicas")
}

if err = c.Client.Update(context.Background(), hpa); err != nil {

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func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa *autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
    deploymentName := hpa.Spec.ScaleTargetRef.Name
    deployment := &appsv1.Deployment{
        metadata: &metav1.ObjectMeta{
            Name: deploymentName,
        },
    }
    if err != nil {
        return nil, err
    }
    return deployment, err
}

---

apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
  creationTimestamp: null
name: mutating-webhook-configuration
webhooks:
- admissionReviewVersions:
  - v1
clientConfig:
  service:
    name: webhook-service
    namespace: system
    path: /mutate-sfcn-cisco-com-v1-smartlicense
failurePolicy: Fail
name: msmartlicense.kb.io
rules:
- apiGroups:
  - sfcn.cisco.com
  apiVersions:
  - v1
  operations:
- CREATE
- UPDATE
resources:
- smartlicenses
sideEffects: None

---
apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
  creationTimestamp: null
  name: validating-webhook-configuration
webhooks:
- admissionReviewVersions:
  - v1
clientConfig:
  service:
    name: webhook-service
    namespace: system
    path: /validate-sfcn-cisco-com-v1-smartlicense
  failurePolicy: Fail
name: vsmartlicense.kb.io
rules:
- apiGroups:
  - sfcn.cisco.com
    apiVersions:
    - v1
    operations:
    - CREATE
    - UPDATE
    resources:
    - smartlicenses
    sideEffects: None
// +build !ignore_autogenerated

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********************/

// Code generated by controller-gen. DO NOT EDIT.

package v1

import (  
k8s.io/apimachinery/pkg/runtime" )
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {
*out = *in
out.TypeMeta = in.TypeMeta
in.Spec.DeepCopyInto(&out.Spec)
out.Status = in.Status
}

func (in *SmartLicense) DeepCopy() *SmartLicense {
if in == nil {
return nil
}
out := new(SmartLicense)
in.DeepCopyInto(out)
return out
}

func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
*out = *in
out.TypeMeta = in.TypeMeta
in.ListMeta.DeepCopyInto(&out.ListMeta)
if in.Items != nil {
in, out := &in.Items, &out.Items
*out = make([]SmartLicense, len(*in))
for i := range *in {
(*in)[i].DeepCopyInto(&(*out)[i])
}
}
}

func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
if in == nil {
return nil
}
out := new(SmartLicenseList)
// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseSpec.
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseSpec)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {
    *out = *in
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new kASA.4579

func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
    in.DeepCopyInto(out)
    return out
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: EntitlementService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockEntitlementService is a mock of EntitlementService interface
type MockEntitlementService struct {
    ctrl     *gomock.Controller
    recorder *MockEntitlementServiceMockRecorder
}

// MockEntitlementServiceMockRecorder is the mock recorder for MockEntitlementService
type MockEntitlementServiceMockRecorder struct {
    mock *MockEntitlementService
}

// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
    mock.recorder = &MockEntitlementServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}

// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {

m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Notify", arg0, arg1)
ret0, _ := ret[0].(error)
return ret0
}

// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify",
    reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}

// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement",
    reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test

import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "css.cisco.com/kasa/license-broker/controllers/handlers"  "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"  "github.com/golang/mock/gomock"  . "github.com/onsi/ginkgo"  . "github.com/onsi/gomega"  corev1 "k8s.io/api/core/v1"  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  "k8s.io/apimachinery/pkg/types"  "k8s.io/client-go/kubernetes/scheme"  "sigs.k8s.io/controller-runtime/pkg/client"  "sigs.k8s.io/controller-runtime/pkg/client/fake"  "sigs.k8s.io/controller-runtime/pkg/event"  "sigs.k8s.io/controller-runtime/pkg/reconcile" )
const (  
secretName = "secretTest"
)

var _ = Describe("SecretHandler", func() {
var handler handler.EventHandler
var mockCtrl *gomock.Controller
var mockQueue *mocks.MockRateLimitingInterface
var coreClient client.Client

BeforeEach(func() {
  mockCtrl = gomock.NewController(GinkgoT())
  mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
  coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
  handler = handlers.SecretHandler(coreClient)
})

AfterEach(func() {
  mockCtrl.Finish()
})

It("should do nothing where there are no smart license objects", func() {
  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
      ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
    }, mockQueue)
})

It("should not add request because secret is not used in SmartLicense object", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name: "some_secret",
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.RegistrationFailed,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))
  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
      ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
  })
})
It("should not add request because SmartLicense is registered", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name: smartLicenseName,
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.Registered,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))
}

handler.Update(event.UpdateEvent{
  ObjectNew: &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
  },
}, mockQueue)

It("should not add request because SmartLicense is deregistered", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name: smartLicenseName,
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.Deregistered,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))
}

handler.Update(event.UpdateEvent{
  ObjectNew: &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
  },
}, mockQueue)

It("should add request because SmartLicense status is registration failed", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name: smartLicenseName,
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.Deregistered,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))
}

handler.Update(event.UpdateEvent{
  ObjectNew: &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
  },
}, mockQueue)

It("should add request because SmartLicense status is registration failed", func() {
smartLicenseObject := &v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
  Spec: v1.SmartLicenseSpec{
    TokenSecret: corev1.SecretReference{
      Name:      secretName,
      Namespace: defaultNamespace,
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.RegistrationFailed,
    },
  }
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

mockQueue.EXPECT().Add(reconcile.Request{
  NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

handler.Update(event.UpdateEvent{
  ObjectNew: &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
  },
}, mockQueue)
}

It("should add request for SmartLicense even if secret is in different namespace", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name:      secretName,
        Namespace: "test-namespace",
      },
      Status: v1.SmartLicenseStatus{
        RegistrationState: v1.RegistrationFailed,
      },
    }
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))

  mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
  })

  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
      ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: "test-namespace"},
    },
  })
})
License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).

## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:
```
```
```shell
go env -w GOPRIVATE="css.cisco.com/*"
```
```
github.com/beorn7/perks v1.0.0/go.mod h1:KWe93zE9D1o94FZ5RNWvGv6aqvK1V0QIVxmquh+CedLV8=
github.com/beorn7/perks v1.0.1 h1:VibKKn5VFv8hJeozq4acOKq6bYr3WgKZ0x8Z16+hsOM=
github.com/beorn7/perks v1.0.1/go.mod h1:G2zrVWU2WBWT9wwq4furbKhnv/1ERSJ0i0hjlfkpw=
github.com/bgentry/speakeasy v0.1.0/go.mod h1:+zsyZBPWli77F6j65etCGs5N5b74876a4V0kBD4zpoCCIs=
github.com/chzyer/logex v1.1.0+incompatible/go.mod h1:kRBjLi5Jt+iDT4Cc0OxOxy/0fnweNt5EW1YSAyrTnjjyy=
github.com/census-instrumentation/opencensus-proto v0.2.1/go.mod h1:f6KpmiuozKAb12myQoA5BBB14O9830f6eGPqihWSTHnte=
github.com/cpuguy83/go-md2man/v2 v2.0.0/go.mod h1:ma6rYwJm6d/aRx2unWj9M37+yxO70vIyTwk4yDk/F0dJdzKc6+n=
github.com/davecgh/go-spew v1.1.0 h1:vj9j/u1bqnvCEfJOwUhtlOArR+3rkHY131YWTU97c=
github.com/davecgh/go-spew v1.1.1/go.mod h1:J7Y8Yt7+CskP6OvL7SfSx+r3c5H38=
github.com/dgryski/go-sip13 v0.0.0-20181026042036-10d5f6ee7954/go.mod h1:AVd38F8PWV+bWj6yNMig1y/TA+kYO4g3RSRF0IAv0no=
github.com/dgryski/go-sip13 v0.0.0-20181026042036-10d5f6ee7954/go.mod h1:AVd38F8PWV+bWj6yNMig1y/TA+kYO4g3RSRF0IAv0no=
github.com/go-logr/zapr v0.2.0/go.mod h1:qhKdvif7YF5GI9NWEpyxTSSBdGmzkNgubrdCNVPunU=
github.com/go-openapi/analysis v0.0.0-20180825180245-b006789cd277/go.mod
h1:k70tL6pCuVxPJOHXQ+wIac1FUrvNkHolPie+cLEU6hI=
github.com/go-openapi/analysis v0.17.0/go.mod h1:1owGgpVeD0vNm45So8nrl+1cQ3pxVtpR0BWb8PVZO0ik=
github.com/go-openapi/analysis v0.18.0/go.mod h1:1owGgpVeD0vNm45So8nrl+1cQ3pxVtpR0BWb8PVZO0ik=
github.com/go-openapi/analysis v0.19.2/go.mod h1:1CPIosvZa9jKjb8ed2TPng3f0ii/UY9snX6gxii4ddjMjk=
github.com/go-openapi/analysis v0.19.5/go.mod h1:课本AxxagafIP7VTn8ygNknk4AYON2Cuu00b8L0A0U=
github.com/go-openapi/analysis v0.19.7/go.mod h1:1cZQQpmvG4wyf5j4lhA73wlFLFQg+QXOQHfjmccXzshka0=
github.com/go-openapi/analysis v0.18.0/go.mod h1:1cZQQpmvG4wyf5j4lhA73wlFLFQg+QXOQHfjmccXzshka0=
github.com/go-openapi/analysis v0.19.2/go.mod h1:JqX0BLWesyafvhluLejvPNwNRdXzhEbTA4kxpxKBC94=
github.com/go-openapi/jsonpointer v0.0.0-20160704185906-46af16f9f7b1/go.mod
h1:+35s3my2LFYsnkMFxxSJBAMHj/Dqo9BknlWoyVGY/Vk0=
github.com/go-openapi/jsonpointer v0.17.0/go.mod
h1:1c0n0m1v+CVVwFLk0A/MEexoF MJwdsUdVpsRhURCKh++3M=
github.com/go-openapi/jsonpointer v0.18.0/go.mod
h1:1c0n0m1v+CVVwFLk0A/MEexoF MJwdsUdVpsRhURCKh++3M=
github.com/go-openapi/jsonpointer v0.19.2/go.mod
h1:3akKJEda7DF1sgOqZlDvQHBCuoDBPKZgEOhC/NkijQRg=
github.com/go-openapi/jsonpointer v0.19.3/go.mod h1:Pl9vOtqEWRermShwVjC8pYs9cog34VG7RT37dQOvboagt=
github.com/go-openapi/loads v0.17.0/go.mod h1:72tmFy5wsWx89uaEVddd0RjRWpZm92WRl7fAc+4+OOU=
github.com/go-openapi/loads v0.18.0/go.mod h1:72tmFy5wsWx89uaEVddd0RjRWpZm92WRl7fAc+4+OOU=
github.com/go-openapi/loads v0.19.0/go.mod h1:72tmFy5wsWx89uaEVddd0RjRWpZm92WRl7fAc+4+OOU=
github.com/go-openapi/loads v0.19.2/go.mod h1:QAskZPMX5VC02qvKgZzJilNuuP7Hsx/4+i5jWFxsNPs=
github.com/go-openapi/strfmt v0.17.0/go.mod h1:X277bwSUBvxVICYR37xgZGGKvVbd/29gLDFGtJ8NL4=
github.com/go-openapi/strfmt v0.18.0/go.mod h1:X277bwSUBvxVICYR37xgZGGKvVbd/29gLDFGtJ8NL4=
github.com/go-openapi/strfmt v0.19.4/go.mod h1:OwNfsksmnmaZs4e+wpV3neA9yMOIPl1t4sKFxt0064=
github.com/go-openapi/strfmt v0.19.4/go.mod h1:X277bwSUBvxVICYR37xgZGGKvVbd/29gLDFGtJ8NL4=
github.com/go-openapi/swag v0.0.0-20160808142527-6aced6f5801/go.mod
h1:1h8+8jY1nAicCj+friVP/POoEl/3ecccG9LY Bs0tYLVLOWC=
github.com/go-openapi/swag v0.17.0/go.mod h1:rkf/MI0i14NmjsdZ8VtAKf8plbZzyTvZsdffsdxcBI=
github.com/go-openapi/swag v0.18.0/go.mod h1:rkf/MI0i14NmjsdZ8VtAKf8plbZzyTvZsdffsdxcBI=
github.com/go-openapi/spec v0.19.2/go.mod h1:1C3xnjykjEj4i7c4zZGzdS5zxMY=
github.com/go-openapi/spec v0.19.3/go.mod h1:FwpgSN1ksyUytemiUY7X0N/B7ja4wVFBA8Lj9mGjbo=
github.com/go-openapi/spec v0.19.4/go.mod h1:1P82hnJoCkXErkX01KjPbNBMeV6v+5pLP5i494TCuy=
github.com/go-openapi/spec v0.19.4/go.mod h1:1P82hnJoCkXErkX01KjPbNBMeV6v+5pLP5i494TCuy=
github.com/go-openapi/swagger v0.0.0-20160704191624-1d0bd113de87/go.mod
h1:DXUVe3Dpr1UpTXFw+FEluQ4HbCW2z+5fjSVR7G7C7l=
github.com/go-openapi/swagger v0.17.0/go.mod h1:AbYQ+nYG6qqQ71GIrnuMDXCPwld640yX49/fkLo40Tg=
github.com/go-openapi/swagger v0.18.0/go.mod h1:AbYQ+nYG6qqQ71GIrnuMDXCPwld640yX49/fkLo40Tg=
Open Source Used in kASA v1.5 4589
github.com/go-openapi/swag v0.19.2/go.mod: h1:POnQmlKehdgb5mhVOSnJFsiwZCEZ/vjK9gh66Z9tfKk

github.com/go-openapi/swag v0.19.5/go.mod: h1:POnQmlKehdgb5mhVOSnJFsiwZCEZ/vjK9gh66Z9tfKk

github.com/go-openapi/validate v0.18.0/go.mod: h1:4590

github.com/go-openapi/validate v0.19.2/go.mod: h1:4590

github.com/go-openapi/validate v0.19.5/go.mod: h1:4590

github.com/go-stack/stack v1.8.0/go.mod: h1:4590

github.com/gogo/protobuf v1.1.1/go.mod: h1:4590

github.com/gogo/protobuf v1.2.0/go.mod: h1:4590

github.com/gogo/protobuf v1.3.1/go.mod: h1:4590

github.com/golang/glog v0.0.0-20160126235308-3def4e6c14b/go.mod: h1:4590

github.com/golang/groupcache v0.0.0-20160516000752-2826c3e7903/go.mod: h1:4590

github.com/golang/groupcache v0.0.0-20190129154638-5b532d6fd5ef/go.mod: h1:4590

github.com/golang/groupcache v0.0.0-20190702054246-869f871628b6/go.mod: h1:4590

github.com/golang/groupcache v0.0.0-20191227052852-215e87163ea7/go.mod: h1:4590

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github.com/golang/groupcache v0.0.0-20191227052852-215e87163ea7/go.mod: h1:4590

github.com/golang/groupcache v0.0.0-20191227052852-215e87163ea7/go.mod: h1:4590

github.com/golang/groupcache v0.0.0-20191227052852-215e87163ea7/go.mod: h1:4590

github.com/google/btree v0.0.0-20180813153112-4030bb1f1f0c/go.mod: h1:4590

github.com/google/go-cmp v0.2.0/go.mod: h1:4590

github.com/google/go-cmp v0.3.0/go.mod: h1:4590

github.com/google/go-cmp v0.3.1/go.mod: h1:4590

github.com/google/go-cmp v0.4.0/go.mod: h1:4590

github.com/kASA/go-openapi/v1.5 4590
github.com/imdario/mergo v0.3.10
h1:6d5q5mVkd/vYmqngx7kZQTj5HRsx+1morDIEQ+beJgc=
github.com/imdario/mergo v0.3.10/go.mod h1:jnmQim1M+e3UYxmgPu/WyfjB3N3VIUyUjwH0dnCYA=
github.com/inconshreveable/mousetrap v1.0.0/go.mod h1:PxqplevigE2G7u3NXJIT2AAnytPF0Ar04DAkM37n8=
github.com/jbouloue/clockwork v0.1.0/go.mod h1:i8DK3G1RaLaWxj9tnq07+26W017bo22gdxWY5EU2bo=
github.com/json-iterator/go v1.1.6/go.mod h1:+6SeFBvtEyKxs/7REEP0seULQwIzhpAwLCvDaaEHeMУ=
github.com/kdouche/pretty v1.0.0/go.mod h1:KdQUc79m/52Kv8AW2vK1V8akMuk1QjKuOdHXbAo4=
github.com/json-iterator/go v1.1.10/go.mod h1:Kz6Cvnv29WGaG8Y8V8MFknMNiXq9Ya2KUV4r0juJ6h=
github.com/json-iterator/go v1.1.10/go.mod h1:KdQUc79m/52Kv8AW2vK1V8akMuk1QjKuOdHXbAo4=
github.com/jstemmer/go-junit-report v0.0.0-20190106144839-af01ea7f8024/go.mod h1:6v2b51h1f/hJhM22ozAgKL4VKEDeJCHJHtBdhtBdmNjmU=
github.com/jstemmer/go-junit-report v0.9.1/go.mod h1:Brl9GWCQeLvo8nXzPNNblvFj/XSxHf0NWXEnDohsбk=
github.com/julienschmidt/httprouter v1.2.0/go.mod h1:SYymIcj16QtmaHHD7aYjjjG7VTcXuUlmPqKk8s4w=
github.com/kisielk/errcheck v1.2.0/go.mod h1:B/MBX+zMLi60iA8v6Ksxxu/1UDYCx4uQLJ+j2L0о=
github.com/kisielk/gotool v1.0.0/go.mod h1:XKhAo+0+MFFWcvk15t/qCQrk01m1FS1RFswwLeQ+nоQHNCк=
github.com/konsorten/windows-terminal-sequences v1.0.1/go.mod h1:T0+1ngSBFLxvqU3PZ+m/2ktqBSzLMUkC4ZK/EgS/cQ=
github.com/konsorten/windows-terminal-sequences v1.0.3/go.mod h1:T0+1ngSBFLxvqU3PZ+m/2ktqBSzLMUkC4ZK/EgS/cQ=
github.com/kr/logfmt v0.0.0-20140226030751-b843e00ac5d5/go.mod h1:+0OpPa2QZZIGBFoFIjii/RkCcl2GknAs/DXo4w4kdLNec=
github.com/kr/pretty v0.1.0/go.mod h1:daY3id7l9f0nbDNQ0QOHMMYfIlhbfHSM3C4ZsorJRNо=
github.com/kr/pretty v0.2.0/go.mod h1:5hA0bm+yFO5uHy15d/Yjxi2rXrsnmRpxJxOYyIWUaQs=
github.com/kr/pretty v0.2.0/go.mod h1:ipqa2n7PKx3OHsz4KJII5eveXtPO4qwEGDfVfWznI=
github.com/kr/pretty v1.1.1/go.mod h1:pFQYN66WhOpPYNljwOMq010TkYh1fyc3Yio213bsQs=
github.com/kr/pretty v1.1.5/go.mod h1:9r2w37qlBe7rQ6e1g15/9xpxWSHaqNhdw3cMBdpDA=
github.com/kr/text v0.1.0 h1:45sCR5RtFHMHR4UwH9dsQ5TC8w0qDCCHNxt+kakKSTve=
github.com/magicair/properties v1.8.0/go.mod h1:PppFxfuXeibc/6YijjN8zlbojt8czPbwD3xdrwzmxxQ=
github.com/mailru/easyjson v0.0.0-20160728113055-d5b7844b561a/go.mod h1:C1wdFjiN94QF2bSHbYQz0LdDCWBY1qtg26g4irojpc=
github.com/mailru/easyjson v0.0.0-20180823135443-607111f88329/go.mod h1:C1wdFjiN94QF2bSHbYQz0LdDCWBY1qtg26g4irojpc=
github.com/mailru/easyjson v0.0.0-20190312143242-1de009706db/go.mod h1:C1wdFjiN94QF2bSHbYQz0LdDCWBY1qtg26g4irojpc=
github.com/mailru/easyjson v0.0.0-20190614124828-94de47d64c63/go.mod h1:C1wdFjiN94QF2bSHbYQz0LdDCWBY1qtg26g4irojpc=
github.com/mailru/easyjson v0.0.0-20190626092158-b2ccc519800e/go.mod h1:C1wdFjiN94QF2bSHbYQz0LdDCWBY1qtg26g4irojpc=
github.com/mailru/easyjson v0.0.0-20190628113105-d5b7844b561a/go.mod h1:C1wdFjiN94QF2bSHbYQz0LdDCWBY1qtg26g4irojpc=
github.com/mailru/easyjson v0.0.0-2019120728113055-d5b7844b561a/go.mod h1:C1wdFjiN94QF2bSHbYQz0LdDCWBY1qtg26g4irojpc=
github.com/sirupsen/logrus v1.6.0/go.mod h1:7uNnSe1DglxDC74fIhavMZmmYsHGZGEOFr6x/uA88=
github.com/soheilhy/cmux v0.1.4/go.mod h1:IM3lyeVI0uxMH7sFAkER9+bUd4T7Ms6E4xg4kGlYLM=
github.com/spaolacci/murmur3 v0.0.0-20180118202830-f09979ecbc72/go.mod h1:JwIasOWyU6f++ZhiEuFv7xNSzm5A2myDM2KzuzHwQUA=
github.com/splf13/afero v1.1.2/go.mod h1:j4pytiNV0e2o6bmDskpLACNPDBl0EoAkhy7loJ1B0CQ=
github.com/splf13/afero v1.2.2/go.mod h1:9ZsEEn6pIjRxe320q5DBk6AsU0r9pR7Q4oveTwdfk=
github.com/splf13/cast v1.0.3/go.mod h1:Qx5chx0v+4UWY1bimWS+eWyWzEqokL5Ec5eghLkUEJ=
github.com/splf13/cobra v0.0.3/go.mod h1:002Thzj1TupsSe7qP9H07jy7v13yXqG=
github.com/splf13/cobra v0.0.4/go.mod h1:6GTmGfVX9HjY+aRk40i05tcvkU6G6EuKReYHmNgE=
github.com/splf13/jwalterweatherman v1.0.0/go.mod h1:cB4LJTLWUgXQ7gWJv36w+1Gy4UW7BztU2xHm7H=
github.com/stoewer/go-strcase v1.2.0/go.mod h1:1BiW8Z2aKr3p3wVwVQ3Y035++gc+knqhUQag1KpM8ahLw8=
github.com/stretchr/objx v0.1.0/go.mod h1:HFkyY916IF+rwdIDfMA7V0wqBfVzrzE88Gr6GFx+wXEME=
github.com/stretchr/objx v0.1.1/go.mod h1:HFkyY916IF+rwdIDfMA7V0wqBfVzrzE88Gr6GFx+wXEME=
github.com/stretchr/objx v0.2.0/go.mod h1:qt09Ya8vwaLt6cSNmTgCsAvYiTaaZecn8ATU0HMkEqE=
github.com/stretchr/testify v1.2.2/go.mod h1:a0OnRbic4h4h0oOaRAVV+YsT7kKdqO7P7p7xL6kDkUv=
github.com/stretchr/testify v1.3.0/go.mod h1:M5W8y9Dh21EIenGcXcG5bZfKJfHn1U0VUgZm+9E=
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github.com/stretchr/testify v1.5.1/go.mod h1:h0NQdMD7FJwJNehxXigkFvNos3rEtvKbTjRv0wZb6H4=
github.com/tidwall/pretty v1.0.0/go.mod h1:XXnk88010ChpSDQMqQesy+sBenx6DDtFZXhVys0yjk=
github.com/tmc/grpc-websocket-proxy v0.0.0-20170815181823-89b8d40f7ca8/go.mod h1:ncp95uamwpCO7NiCPTXjqaC+bbZgeRs0MS7m6MHP7U=
github.com/tmc/grpc-websocket-proxy v0.0.0-201901091427-13ad06e2c5e5/go.mod h1:ncp95uamwpCO7NiCPTXjqaC+bbZgeRs0MS7m6MHP7U=
github.com/ugorjil/go/v1.1.4/go.mod h1:uQGML0O92m5W77hN/PUCp3bHzQX3Cre5K0kk+RGrE=
github.com/urfave/cli v1.20.0/go.mod h1:70W9m3FudpCu0ngEzBv17Jypv497g85qL5kWijbERA=
github.com/vektah/gqlparser v1.1.2/go.mod h1:1ycwN7j5jnmmkPpAOaRFY4ET2Exn7LkVv3vaXspKw=
github.com/xiang90/probing v0.0.0-2019011601207-43a291ad63a2/go.mod h1:UEti67q53MR2AWcXFqAaRdRn7DLGqCTpCHuHxUt=
github.com/xordataexchange/crypt v0.0.3-0.20170626215501-b2862e3d0a77/go.mod h1:aYKd+L2LvnjZKWhF0000e4fj4CCREcLnmhLdhmlA27Q=
github.com/youin/goldmark v1.1.27/go.mod h1:3hX8g2YyuyVAXszz0MRG6GTjEmBQRcFncT8zhY9decYsB7=
github.com/etcd.io/bbolt v1.3.2/go.mod h1:1bVyrI15SCnLcuVn2u8vW0eU0CEYM7e686BmAb1I0Kk+uU=
github.com/etcd.io/bbolt v1.3.3/go.mod h1:1bVyrI15SCnLcuVn2u8vW0eU0CEYM7e686BmAb1I0Kk+uU=
github.com/etcd.io/bbolt v1.3.5/go.mod h1:G5EMThwa9y8QZGBclRx5Eye+Yw9kAhnjy3hBjnVLnVIQ=
github.com/etcd.io/etcd v0.5.0-alpha.5.0.20200819165624-17ce6f6e39d5/go.mod h1:skWid08r9wCLW个性70D5XY1KMuq4Ful+4VsqlQyj8=
go.mongodb.org/mongo-driver v1.0.3/go.mod h1:u7ryQJ+D0ZQMeO7zB6MHyEr8jkEQQC8vH7qLU04qlsU=
go.mongodb.org/mongo-driver v1.1.1/go.mod h1:u7ryQJ+D0ZQMeO7zB6MHyEr8jkEQQC8vH7qLU04qlsU=
go.mongodb.org/mongo-driver v1.1.2/go.mod h1:u7ryQJ+D0ZQMeO7zB6MHyEr8jkEQQC8vH7qLU04qlsU=
Open Source Used in kASA v1.5

- golang.org/x/exp v0.0.0-20190829153037-c13cbed26979/go.mod
- golang.org/x/exp v0.0.0-20191227195350-da58074b4299/go.mod
- golang.org/x/image v0.0.0-20190227174305-5b36e655c961/go.mod
- golang.org/x/image v0.0.0-20190802002840-cff245a6509b/go.mod
- golang.org/x/lint v0.0.0-20181026193035-657002cb31b3/go.mod
- golang.org/x/lint v0.0.0-20190301231843-5614edba6e6f/go.mod
- golang.org/x/lint v0.0.0-20190313153728-414d861bb4ac/go.mod
- golang.org/x/lint v0.0.0-20190409202823-959b441ac422/go.mod
- golang.org/x/lint v0.0.0-20190909230951-414d861bb4ac/go.mod
- golang.org/x/lint v0.0.0-20190930215403-16217165b5de/go.mod
- golang.org/x/lint v0.0.0-20191125180803-fdd1cda4f05f/go.mod
- golang.org/x/mobile v0.0.0-20190312151609-d3739f865fa6/go.mod
- golang.org/x/mod v0.0.0-20190719004257-d2bd2a29d028/go.mod
- golang.org/x/mod v0.1.0-20191112051837-3d739f865fa6/go.mod
- golang.org/x/net v0.0.0-20180724234803-3673e40ba225/go.mod
- golang.org/x/net v0.0.0-20180826012351-8a410e7b638d/go.mod
- golang.org/x/net v0.0.0-20180906233101-161cd47e91fd/go.mod
- golang.org/x/net v0.0.0-20181005035420-146acd28ed58/go.mod
- golang.org/x/net v0.0.0-20181114220230-1ada6a3d119a/go.mod
gopkg.in/tomb.v1 v1.0.0-20140214235613-dd632973f1e7/go.mod
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gopkg.in/yaml.v2 v2.0.0-20170812160011-eb3733160e7/go.mod
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honnef.co/go/tools v0.0.0-20190102054323-c2f93a96b099/go.mod
h1:rf3IG4BRbNafJWhAfAdh/ePZxsR/4RTnHOCxkwk94=
honnef.co/go/tools/v0.0.0-20190106161140-3Flc8253044a/go.mod
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k8s.io/api v0.19.2 h1:+knHWKsL7OZBg/rnxycd9569Pud76U77MVXkXms=
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k8s.io/component-base v0.19.2 h1:jW5Y9RcZb79iEhW3XDVTW7MuvEgP0QZnFzSX6/+eqs=
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k8s.io/klog/v2 v2.0.0 h1:XRycwJoZgZ1UQimfGMPvRthQOvihEhYDfAaxMz/A=
k8s.io/klog/v2 v2.0.0/go.mod h1:Oo+F08eIP+W3HuB4prSrPPpp9DGU4GzlpG/TmItYTuYH/Y=
k8s.io/kube-openapi v0.0.0-20200805222855-6aeccdc4b50ec
h1:+WnxoVtG8TMiuDHSbETVL1eg36TtKkJm+bA8AxicmQ=
```yaml
k8s.io/kube-openapi v0.0.0-20200805222855-6aeccd4b50c6/go.mod
h1:UuqjUnNfuyPE5H64/qeyjQoUZhGpeFDVdxjTeEVN2o=
k8s.io/utils v0.0.0-20200729134348-d5654de09c73/go.mod
h1:0xJW26vDy+W3gG25H+r3cVFA+/

h1:UuqjUnNfuyPE5H64/qeyjQoUZhGpeFDVdxjTeEVN2o=
k8s.io/utils v0.0.0-20200912215256-4140de9c8800/h1:9ZNvtPvVIEsp/T1ezGQuzCCETEQWhovSofhR73AG6=
k8s.io/utils v0.0.0-20200912215256-4140de9c8800/go.mod
h1:0xJW26vDy+W3gG25H+r3cVFA+/

h1:0xJW26vDy+W3gG25H+r3cVFA+/
k8s.io/robogo/v0.2.0/go.mod h1:qT7v7OCock+e2FymRvadv62gMdZztPaShugOCi3I+8D8=
sigs.k8s.io/apiserver-network-proxy/connnectivity-client v0.0.9/go.mod

h1:dzAXnQbTRyDiZPJX2SUPEqvnB+j7Ajllo77PfWdug0=
sigs.k8s.io/apiserver-network-proxy/connnectivity-client v0.0.9/go.mod

{{- include "aegis.deployments.configuration" (list . "license-api" (fromYaml
    deployment: kasa.licensebroker.deployment
    rbac: config/rbac/**.yaml
    crds: config/crd/**.yaml
    webhooks: config/webhook/manifests.yaml
}}) -}}}

{{- define "kasa.licensebroker.deployment" -}}
  {{- $ := first . -}}
  {{- $global := default (dict ) $.Values.global -}}
apiVersion: apps/v1
kind: Deployment
spec:
  {{- if eq $global.platform "eks" }}
    strategy:
      type: Recreate
  {{- end }}
template:
    metadata:
      annotations:
        {{/* checksum annotation forces Deployment's RollingUpdate when ConfigMap's values are updated *!/}}
        checksum/license-config: {{ include "aegis.configmap.standard" (list S "config" "kasa.licensebroker.config") | sha256sum }}

  spec:
    {{- if eq $global.platform "eks" }}
      securityContext:
      # 65532 is ID of nonroot user group
      fsGroup: 65532
    {{- end }}
```
azure disk seems to ignore fsgroup setting right now for v1.2.0 release,
need an init container to fix permissions */}}

initContainers:
  - name: change-ownership
    image: [{{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}]
    command: ['sh', '-c', 'chown -R 65532:65532 /home/nonroot']
    volumeMounts:
      - mountPath: /home/nonroot
        name: disk
    securityContext:
      # Files or directories created with HostPath on the host are only writable by root. Which means, you either
      # need to run your container process as root or modify the file permissions on the host to be writable by
      # non-root user.
      runAsUser: 0
      capabilities:
        add:
          - DAC_OVERRIDE
          - FOWNER
    {{- end }}

containers:
  - name: manager
    image: [{{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}]
    imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
    env:
      {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
    args:
      - --zap-log-level={{ $.Values.logLevel }}
      - --zap-encoder={{ $.Values.logFormat }}
      - --webhook-port={{ $.Values.webhookPort }}
      - --metrics-port={{ $.Values.metricsPort }}
      - --license-server-port={{ $.Values.licenseServerPort }}
    ports:
      - containerPort: {{ $.Values.webhookPort }}
        name: webhook-server
        protocol: TCP
    resources:
      requests:
        cpu: {{ $.Values.managerCoreRequest }}
        memory: {{ $.Values.managerMemoryRequest }}
      limits:
        cpu: {{ $.Values.managerCoreLimit }}
        memory: {{ $.Values.managerMemoryLimit }}
    securityContext:
      allowPrivilegeEscalation: false
  - name: license-server
    image: [{{ include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) }}]
    imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
command:
- "java"
- "-Xms{{ $.Values.licenseServerXms }}"
- "-Xmx{{ $.Values.licenseServerXmx }}"
- "-jar"
- "sa-server-all.jar"
- "--configFile"
- "/etc/licensing/server-id.json"
- "--port"
- 
- containerPort: 
- 
- protocol: TCP
ports:
securityContext:
  # 65532 is ID of nonroot user
  runAsUser: 65532
  allowPrivilegeEscalation: false
env:
  
- include "aegis.containers.standardEnv" (list $) nindent 12
resources:
requests:
  cpu: 
  memory: 
limits:
  cpu: 
  memory: 
volumeMounts:
  - mountPath: /home/nonroot
    name: disk
  - mountPath: /etc/licensing/server-id.json
    name: license-config
    subPath: server-id.json
volumes:
  - name: disk
    persistentVolumeClaim:
      claimName: 
    name: license-config
    configMap:
      name: 
  {{- if ne $global.platform "kind" }}
imagePullSecrets:
  - name: regsfcn
{{- end }}
terminationGracePeriodSeconds: 10
}}
apiVersion: v1
kind: Service
metadata:
  name: aegis.metadata.fullname
spec:
  ports:
    - protocol: TCP
      port: 80
      targetPort: $Values.licenseServerPort
  type: ClusterIP

package controllers
import (v1 "css.cisco.com/kasa/license-broker/api/v1"
  "github.com/onsi/ginkgo"
  "github.com/onsi/gomega"
autoscalingv1 "k8s.io/api/autoscaling/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/types"
"strings"
)

var _ = Describe("Common Test", func () {
  It("serialNumber", func () {
    serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())
    Expect(len(serialNum)).Should(Equal(11))
    Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))
    Expect(serialNum).Should(Equal("F0529A6CDD9"))
  })

  It("containsString", func () {
    list := []string{"one", "two", "three"}
    Expect(containsString(list, "three")).Should(BeTrue())
    Expect(containsString(list, "four"), ShouldBeFalse())
  })

  It("removeString", func () {
    list := []string{"one", "two", "three"}
    Expect(removeString(list, "two"), ShouldEqual([]string{"one", "three"}))
    Expect(removeString(list, "four"), ShouldEqual([]string{"one", "two", "three"}))
  })

  It("filterLicensesByState", func () {

Open Source Used In kASA v1.5  4608
licenses := []v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{
        Name: "license1",
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Deregistered,
    },
    ObjectMeta: metav1.ObjectMeta{
        Name: "license2",
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Registered,
    },
}

filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{
        Name: "license1",
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Deregistered,
    },
}))

filteredLicenses := filterLicensesByState(licenses, v1.DeregistrationFailed)
Expect(filteredLicenses).Should(BeEmpty())

It("filterLicensesByKind", func() {
    var licenses v1.SmartLicenseList
    licenses.Items = []v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
        },
    },
    Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
    },
    Spec: v1.SmartLicenseSpec{

ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName1"},
},
},

filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{[Spec: v1.SmartLicenseSpec{
ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
]},
}]})
filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
Expect(filteredLicenses).Should(BeNil())

filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{[Spec: v1.SmartLicenseSpec{
ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
]},
]})

It("pendingLicenseExists", func() {
licenses := []v1.SmartLicense{[{
Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance},
},
{
}
}

Expect(pendingLicenseExists(licenses)).Should(BeFalse())
licenses = append(licenses, v1.SmartLicense{
Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState},
})

Expect(pendingLicenseExists(licenses)).Should(BeTrue())
})

It("setLicenseLabel", func() {
meta := metav1.ObjectMeta{}
res := setLicenseLabel(&meta, LicenseHolderLabel, true)
Expect(res).Should(BeTrue())
val, ok := meta.Labels[LicenseHolderLabel]
Expect(ok).Should(BeTrue())
Expect(val).Should(Equal("true"))
res = setLicenseLabel(&meta, LicenseHolderLabel, true)
Expect(res).Should(BeFalse())

res = setLicenseLabel(&meta, LicenseHolderLabel, false)
Expect(res).Should(BeTrue())

_, ok = meta.Labels[LicenseHolderLabel]
Expect(ok).Should(BeFalse())
}
}

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---
title: "Licensing the Cluster"
weight: 2
description: >
  Learn how to license a scalable cluster, understand the components involved, and the implications of an unlicensed cluster
---

Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing. There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.

# Smart Licensing

* Licensing a kASA cluster involves licensing every ASA instance running in the cluster. Since the ASA instances are ephemeral, a license server runs locally in your cluster to manage the license lifecycle of these ASA instances. This server is responsible for registering the set of ASA instances you license with the Cisco Smart Software Manager, obtain or release the licenses based on the number of cores those instances use, and releasing all the licenses back to your Smart account when you deregister the cluster.

* After kASA bundle is successfully installed with licensing enabled, to license the cluster, you need a token from your Smart Account that has Secure Firewall (SFW) licenses. Go to [software.cisco.com](http://software.cisco.com) and navigate to Smart Software Licensing. Find `asac-dev` virtual account that has the SFW licenses and generate a token from it.

For development purposes, we have created a token that you can use:

```
YTRkNWFlM2MiZWEzYi00MWEzLWI2MDExZTgwMzQ1MjM3MTkuMDQ1MDU4MTgwMTc3NzExODExMTQ5MzE4MjAwMTk5Njg5NTE3MjA4MTI0MzE5Ok1Hz0NzaFVzQW4v
```

---

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If this token has expired, please send an email to sfcn-controlplane@cisco.com

* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create
  a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc)
  and a service type (e.g. `Deployment` or `HorizontalPodAutoscaler`).

* Examples of the secret and the Smart License object are located [here](../../license-broker/config/samples/sfcn.cisco.com_v1_smartlicense.yaml).

Licensing setup comprises two components - the License Server, and the License Controller. References to Server and Controller in this document mean the License Server and License Controller.

1. User creates a Smart License resource and applies it to the Kubernetes API Server
2. Kubernetes API Server sends a notification to License Controller.
3. License Controller inspects the configuration in the Smart License resource
   1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server, which then talks to CSSM to reserve the licenses and responds back to the Controller
   2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server
4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.
5. The License Server checks its pool to see if it has sufficient licenses to grant the request

   1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates this status to ASAc.
   2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.
## Packaging

Licensing components are packaged in two Kubernetes Deployment resources targeting different namespaces and distributed via Helm as part of the `sfcn-bundle` Helm chart.

### License Broker

The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

License Broker is set to be deployed once per Cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode).

The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.

### License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the [Controller](#license-controller), sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is...
killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.

## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the License Server(). It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests] for more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the form of events on that resource.

### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart License resource in the same namespace.
Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
# license type can be blank or not set explicitly to let the system use the default value
# At present, there is only one license type for kASA, so this field is reserved for future use.
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by obtaining a token from the [Virtual Account]({{< relref "terminology#smart-and-virtual-accounts">}}) and doing a base64 encoding of that text. This can be done from a shell as follows

```shell
echo "your-token" | base64
```

And, use that content in the Secret as follows

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: cssm-token
  namespace: cisco-systems
data:
# this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
token:
  "TXpJMk1UVXhOV1V0Tm1Jd1ppMDBORFUzTFRnd09ETXRNamMyWm1JMVltWTBORGhtTFRFMk16YzBNamcyJTBBTVRBMrk16QjhVSFE1U25WVGNHbEpRMEZWU2paSk5FeDRZbHAxYnpkdGFHcGFZbIJVdFGWfoyMURjR3h4JTBBVFUxVk9EMCUzRCUwQQ=="
```
The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual account as you are expecting the number of vCPUs in your cluster namespace.

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`. The resource specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a minimum of 1 license and upto 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA license type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request for upto 10 vCPUs. Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing configuration thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the License Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the license configuration. In the example here, the Deployment replica count would be set to 2.

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more replicas, the license Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to the account. Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.

### Using the Scaling Factor

When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient number of licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to retry the operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the `scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or
down, it reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may ask the pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the pod is assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its pool. Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the virtual account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following configuration, the Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this number to the number of vCPUs the enforcer pods will be using.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  # scaling factor of 4 implies the license reservations change in increments/decrements of 4
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.
Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates un-registration and on successfully unregistering from the virtual account, the Controller deletes the resource.

### The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

#### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

{{% alert title="Note" color="primary" %}}
It is recommended that a CPU limit be specified on all the containers where the ASA is running. If you prefer to take advantage of burstable CPU of the Node, be advised that the licensed cores would be that of the Node rather than the Pod.
{{% /alert %}}

#### Licensing ASA

When the ASA comes up, it does not hold a license and therefore runs at a low-bandwidth mode, typically 100kbps and has very restricted capabilities and features it supports. The Manager tries to get a license from the License Server and if successful communicates the status to ASA. Once licensed, ASA runs at its full potential.

The Manager periodically verifies the status of the license it obtained, with the License Server, and if the license is not valid anymore either because the License Server has insufficient licenses, or the Manager failed to verify the validity despite several retries, it will revoke the license of ASA and keeps retrying to fetch the license.

---

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  creationTimestamp: null
name: broker-role
rules:
```
- apiGroups:
  - apps
  resources:
  - deployments
  verbs:
  - get
  - list
  - update
  - watch
- apiGroups:
  - apps
  resources:
  - replicaset
  verbs:
  - get
  - list
  - watch
- apiGroups:
  - autoscaling
  resources:
  - horizontalpodautoscalers
  verbs:
  - get
  - list
  - update
  - watch
- apiGroups:
  - ""
  resources:
  - pods
  verbs:
  - delete
  - get
  - list
  - update
  - watch
- apiGroups:
  - ""
  resources:
  - secrets
  verbs:
  - get
  - list
  - watch
- apiGroups:
  - sfcn.cisco.com
  resources:
  - smartlicenses

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verbs:
- create
- delete
- get
- list
- patch
- update
- watch
apiGroups:
- sfcn.cisco.com
resources:
- smartlicenses/status
verbs:
- get
- patch
- update
module css.cisco.com/kasa/license-broker

go 1.14

require ( css.cisco.com/kasa/pkg/predicates v0.0.0 css.cisco.com/licensing/client-agent v0.1.11 github.com/go-logr/logr v0.3.0 github.com/golang/mock v1.3.1 github.com/onsi/ginkgo v1.14.1 github.com/onsi/gomega v1.10.2 k8s.io/api v0.19.2 k8s.io/apimachinery v0.19.2 k8s.io/client-go v0.19.2 k8s.io/utils v0.0.0-20200912215256-4140de9c8800 sigs.k8s.io/controller-runtime v0.7.2 )

replace css.cisco.com/kasa/pkg/predicates v0.0.0 => ../pkg/predicates

apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into versioned archives
# to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They're included as
# a dependency of application charts to inject those utilities and functions into the rendering
# pipeline. Library charts do not define any templates and therefore cannot be deployed.
type: application
# This is the chart version. This version number should be incremented each time you make changes
# to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
version: 0.1.0

# This is the version number of the application being deployed. This version number should be
# incremented each time you make changes to the application. Versions are not expected to
# follow Semantic Versioning. They should reflect the version the application is using.
appVersion: 1.16.0

dependencies:
- name: aegis-common
  version: "0.1.0"
  repository: "file://../aegis-common"
// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: AllotmentService)

// Package mocks is a generated GoMock package.
package mocks

import (
  proto "css.cisco.com/licensing/client-agent/proto"
  service "css.cisco.com/licensing/client-agent/service"
  gomock "github.com/golang/mock/gomock"
  reflect "reflect"
)

// MockAllotmentService is a mock of AllotmentService interface
type MockAllotmentService struct {
  ctrl    *gomock.Controller
  recorder *MockAllotmentServiceMockRecorder
}

// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService
type MockAllotmentServiceMockRecorder struct {
  mock *MockAllotmentService
}

// NewMockAllotmentService creates a new mock instance
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {
  mock := &MockAllotmentService{ctrl: ctrl}
  mock.recorder = &MockAllotmentServiceMockRecorder{mock}
  return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
}

// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReleaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).ReleaseAllotment), arg0)
}
### Cisco Smart Software Manager (CSSM)

Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any licensing activity outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed.
There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html) often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.

{{% alert title="Warning" color="warning" %}}
kASA Licensing currently supports only direct access to CSSM. The system is NOT tested for accessing CSSM from behind an HTTPs proxy or via Satellite, and the behavior is unknown; though, in theory, it may work.
{{% /alert %}}

### Smart License

Smart License is the license(_noun_) that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license(_verb_) a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that license from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).

### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.
Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited to. The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account. You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased. This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation

License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product.

The reservation process requires connectivity to internet and only on successful reservation can you use the product in
Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR).

PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does not mean the product supports it. You should check the product documentation to verify the support for license reservation

```{ % alert title="Warning" color="warning" % }
kASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.
{ % /alert % }
```

### References

If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

/*
 * Copyright (c) 2020 Cisco Systems, Inc.
 * All rights reserved.
 * Unauthorized redistribution prohibited.
 */

package integ_tests

import (  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/api/machinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
)

var _ = Describe("SmartLicense Webhook Test", func() {
  const defaultNamespace = "default"
var defaultCount uint32 = 1

var secret *corev1.Secret
var hpa *autoscalingv1.HorizontalPodAutoscaler

BeforeEach(func() {
    secret = &corev1.Secret{
        Data: map[string][]byte{"token": []byte("MTIz")},
    }
    Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())
    hpa = &autoscalingv1.HorizontalPodAutoscaler{
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: 3,
        },
    }
    Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
})

AfterEach(func() {
    Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
    Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
})

Context("Mutating Webhook", func() {
    It("should fill in values on creation", func() {
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
            },
        }
        err := k8sClient.Create(testCtx, license)
        Expect(err).ShouldNot(HaveOccurred())
        err = k8sClient.Get(testCtx, types.NamespacedName{
            Namespace: defaultNamespace,
            Name: "foo",
        }, license)
        Expect(err).ShouldNot(HaveOccurred())
        Expect(license.Spec.Action).To(Equal(v1.Register))
        Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
        Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
        Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
    })
})
Expect(license.Spec.ScalingFactor).To(Equal(&defaultCount))
})
})

Context("Validating Webhook", func() {

It("should pass for valid object", func() {
license := &v1.SmartLicense{
 Spec: v1.SmartLicenseSpec{
 },
} Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
})

It("has fields validations", func() {
//given
 var zeroLicenses uint32 = 0
 license := &v1.SmartLicense{
 Spec: v1.SmartLicenseSpec{
 MinLicenseCount: &zeroLicenses,
 MaxLicenseCount: &zeroLicenses,
 ScalingFactor: &zeroLicenses,
 },
}

//when
 err := k8sClient.Create(testCtx, license)

//then
 Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: 
["spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, 
"spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, 
"spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1"]"))
})

It("should return error if max value is less then min value", func() {
 //given
 var minLicenses uint32 = 5
 var maxLicenses uint32 = 3
 license := &v1.SmartLicense{
 Spec: v1.SmartLicenseSpec{

MinLicenseCount: &minLicenses,
MaxLicenseCount: &maxLicenses,

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))
}

It("should return error when creating license with non-REGISTER action", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      Action:      v1.Deregister,
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))
})

It("should return error when secret does not exist", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))
})
It("should return error when secret does not token key", func() {
    //given
    secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
    Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))
})

It("should return error when invalid scalingRef kind is specified", func() {
    //given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.scalingRef.kind: Unsupported value: "Pod": supported values: "Deployment", "HorizontalPodAutoscaler""))
})

It("should return error when scalingRef does not exist", func() {
    //given
    license := &v1.SmartLicense{
Open Source Used In kASA v1.5

/*
 * Spec: v1.SmartLicenseSpec{
 * },
 * }
 */

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found"))
}

It("should not allow changing licenseType after registration", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }
  Expect(k8sClient.Create(context.TODO(), license)).To(Succeed())
  license.Status.RegistrationState = v1.Registered
  Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())

  //when
  license.Spec.LicenseType = "buzz"
  err := k8sClient.Update(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})
})
})

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: broker-role-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: broker-role
subjects:
- kind: ServiceAccount
  name: default
  namespace: system
package controllers_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"
"k8s.io/client-go/kubernetes/scheme"
"testing"
. "github.com/onsi/ginkgo"
. "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {  
RegisterFailHandler(Fail)
RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {  
_ = v1.AddToScheme(scheme.Scheme)
})
package handlers_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"
"k8s.io/client-go/kubernetes/scheme"
"testing"
. "github.com/onsi/ginkgo"
. "github.com/onsi/gomega"
)

func TestHandlers(t *testing.T) {  
RegisterFailHandler(Fail)
RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {  
Expect(v1.AddToScheme(scheme.Scheme)).To(Succeed())
})

/***************************************************************
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***************************************************************/
package integ_tests

import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "github.com/go-logr/logr"  . "github.com/onsi/ginkgo"  "k8s.io/apimachinery/pkg/runtime"  "k8s.io/client-go/rest"  ctrl "sigs.k8s.io/controller-runtime"  "sigs.k8s.io/controller-runtime/pkg/envtest"
)

func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))

    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }

    close(done)
    if err := mgr.Start(ctx); err != nil {
        return err
    }

    return nil
}

package controllers_test

import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "css.cisco.com/kasa/license-broker/controllers"  "css.cisco.com/kasa/license-broker/controllers/mocks"  "fmt"
)
const (  
  epDeploymentName = "epDeployment"
  initialDeploymentReplicas int32 = 3
)

var _ = Describe("Deployment License Controller Test", func() {

  deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
  var (
    reconciler     *controllers.DeploymentLicenseReconciler
    fakeClient     client.Client
    mockCtrl       *gomock.Controller
    deployment     *appsv1.Deployment
    smartLicense   *v1.SmartLicense
    recorder       *record.FakeRecorder
    replicasCalculatorMock *mocks.MockReplicasCalculator
  )

 BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    recorder = record.NewFakeRecorder(1024)
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

    reconciler = &controllers.DeploymentLicenseReconciler{
      Client: fakeClient,
      Log:    logf.NullLogger{ },
      Recorder: recorder,
      ReplicasCalculator: replicasCalculatorMock,
    }

    smartLicense = &v1.SmartLicense{
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    }

    deployment = &appsv1.Deployment{
      ObjectMeta: metav1.ObjectMeta{Name: deploymentNsName.Name, Namespace: deploymentNsName.Namespace},
      Spec: appsv1.DeploymentSpec{
        Replicas: &initialDeploymentReplicas,
      },
    }
  })
Spec: v1.SmartLicenseSpec{
    Action: v1.Register,
    LicenseType: licenseType,
    MinLicenseCount: &minLicenseCount,
    MaxLicenseCount: &maxLicenseCount,
    ScalingFactor: &scalingFactor,
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: epDeploymentName,
        Namespace: defaultNs,
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
        },
    },
    Spec: appsv1.DeploymentSpec{
        Replicas: &replicas,
    },
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())
}

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
    mockCtrl.Finish()
})

It("should skip if Deployment does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})

It("should skip if Deployment SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())
})
Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(4), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(2))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3")))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 2")))
})

It("should an event if initial replica number annotation is incorrect", func() {

replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)

deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(HaveOccurred())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial-replicas-count label is not correct. Please, update it to correct number.")))

It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
  *deployment.Spec.Replicas = 0
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(25), nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
  Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
  Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3")))
})

It("should send a warning if deployment controlled by HPA", func() {
  replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(4), nil)

  hpa := &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
      MaxReplicas: initialHPAMaxReplicas,
    },
  }
  Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())

  Expect(recorder.Events).Should(HaveLen(2))
  Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3"))))
})
"Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA",
(epDeploymentName, epHpaName, epHpaName))))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3")))
})
})
package v1_test

import (
  v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
  "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1/mocks"
  dispatcherMock "cisco.com/kasa/operator/enforcementpoint/dispatcher/mocks"
  "context"
coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
clientagent "css.cisco.com/licensing/client-agent"
lca "css.cisco.com/licensing/client-agent"
"css.cisco.com/licensing/client-agent/proto"
  "fmt"
  "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
coreV1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/resource"
metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/runtime"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/tools/record"
  "os"
crl "sigs.k8s.io/controller-runtime"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/client/fake"
logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService

var _ = Describe("SmartLicense Controller Test", func() {

  const (podName = "sfcn-enforcer"
podNamespace = "sfcn-system"
nodeName = "aws-eks-node0"
)

var tenant, podNamespacedName = &clientagent.Tenant{
  Name: podNamespace + "/" + podName,
  Attributes: map[string]string{
    "role": "license-requestor",
  },
}, types.NamespacedName{
  Namespace: podNamespace,
  Name:      podName,
}

newPod := func(name, namespace, nodeName string) *coreV1.Pod {
  return &coreV1.Pod{
    TypeMeta: metaV1.TypeMeta{
      Kind: "Pod",
      APIVersion: "v1",
    },
    ObjectMeta: metaV1.ObjectMeta{
      Name:     name,
      Namespace: namespace,
      Labels:   tenant.Attributes,
    },
    Spec: coreV1.PodSpec{NodeName: nodeName, Containers: []coreV1.Container{
     {Name: "ep-container",
       Resources: coreV1.ResourceRequirements{
         Limits: map[coreV1.ResourceName]resource.Quantity{
           "cpu": resource.MustParse("2000m"),
         },
       },
      },
    }},
  }
}

newNode := func(name string) *coreV1.Node {
  return &coreV1.Node{
    TypeMeta:   metaV1.TypeMeta{Kind: "Node", APIVersion: "v1"},
    ObjectMeta: metaV1.ObjectMeta{Name: name},
      "cpu": resource.MustParse("4"),
    }},
  }
}

var (
  pod       *coreV1.Pod
  node      *coreV1.Node
  reconciler *v1.SmartLicenseReconciler
)
fakeClient       client.Client
mockCtrl         *gomock.Controller
licensingClient  *mocks.MockLicensingClient
allotmentService *mocks.MockAllotmentService
dispatcher      *dispatcherMock.MockGatewayClient
recorder         *record.FakeRecorder

resetRecorder := func() {
    recorder = record.NewFakeRecorder(1024)
    reconciler.Recorder = recorder
}

reconcileAndExpectFail := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred()) // failure is determined by requeue after duration
    Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration})))
}

reconcileAndExpectSuccess := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred())
    Expect(result).To(Equal(ctrl.Result{}))
}

recordedEvents := func() []string {
    close(recorder.Events)
    var events []string
    for event := range recorder.Events {
        events = append(events, event)
    }
    return events
}

lastRecordedEvent := func() string {
    events := recordedEvents()
    if len(events) == 0 {
        return ""
    }
    return events[0]
}

BeforeEach(func() {
    pod = newPod(podName, podNamespace, nodeName)
    node = newNode(nodeName)
    data := []client.Object{pod, node}
mockCtrl = gomock.NewController(GinkgoT())
scheme := runtime.NewScheme()
Expect(coreV1.AddToScheme(scheme)).To(Succeed())
fakeClient = fake.NewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
allocationService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
recorder = record.NewFakeRecorder(1024)
reconciler = &v1.SmartLicenseReconciler{
    CoreClient: coreV1Client.New(fakeClient, context.Background),
    Licenser: licensingClient,
    Log:      logf.NullLogger{},
    Recorder: recorder,
    Dispatcher: dispatcher,
}
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()})
It("should revoke ASAc license after failing multiple attempts of registration", func() {
allocationService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(fmt.Errorf("test registration failure"), nil)
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().RevokeLicense().Times(1)
numAttempts := 0
for numAttempts < v1.MaxRetryAttempts {
    reconcileAndExpectFail()
    numAttempts += 1
    if numAttempts == 1 {
        // on the first attempt expect an event is recorded
        Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
    } else {
        Expect(lastRecordedEvent()).Should(BeEmpty())
    }
    reconcileAndExpectFail()
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
})
ItReconcileSuccessfullyWithExpectedNumberOfCores := func(numCores uint32) {
allocationService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
allocationService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil)
allocationService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
    PoolName: podNamespace,
    Tenant:   tenant,
    NumCores: numCores, // this is the limit specified for the container
})


It("should verify the license status and request on successful registration", func() {
    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
        Name: "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
    })
    Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
    ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})

It("should revoke ASAc license after successful registration but fails to get a lease", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().GrantLicense(true)
    reconcileAndExpectSuccess()
    Expect(recordedEvents()).Should(ConsistOf(  
        HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),     
        HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),     
        HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified")
    ))
}

numAttempts := 0
for numAttempts < v1.MaxRetryAttempts {
    reconcileAndExpectFail()
    numAttempts += 1
    if numAttempts == 1 {
        // on the first attempt expect an event is recorded
        Expect(lastRecordedEvent()).Should(HavePrefix("test insufficient cores"))
    }
    numAttempts := 0
}
"Warning AwaitingLicense ASA operating at full potential but not licensed")
    } else {
    Expect(lastRecordedEvent()).Should(BeEmpty())
    }
    }
    reconcileAndExpectFail()
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because it failed to obtain a license"))
    })

    It("should revoke ASAc license when server requests to the release the allotment", func() {
        _ = os.Setenv("POD_NAME", podName)
        _ = os.Setenv("POD_NAMESPACE", podNamespace)

        dispatcher.EXPECT().RevokeLicense().Times(1)
        allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
            ContextId: "test-context",
            Tenant:    tenant,
        })).Return(nil)

        ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
        resetRecorder()
        reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
            ContextId: "test-context",
            Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
            Message:   "testing release allotment request",
            Tenant:    tenant,
        })

        Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license"))
    })

    It("should report the allotment it holds when the server requests so", func() {
        _ = os.Setenv("POD_NAME", podName)
        _ = os.Setenv("POD_NAMESPACE", podNamespace)

        allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
            ContextId: "test-context",
            Tenant:    tenant,
            NumCores:  2,
        })).Return(nil)

        ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
        resetRecorder()
        reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
            ContextId: "test-context",
        })
    })
Type: proto.AllotmentEvent_REPORT_ALLOTMENT,
Message: "testing release allotment request",
Tenant: tenant,
})
Expect(lastRecordedEvent()).Should(BeEmpty())
})

It("should mark tenant as unregistered if license server is unavailable and retry again", func() {
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
alotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
alotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil,
fmt.Errorf("some error occurs: %w", lca.ErrLicenseServerUnavailable))
res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})

Expect(err).Should(BeNil())
Expect(res).ShouldNot(BeNil())
Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
})

AfterEach(func() {
mockCtrl.Finish()
})
})

package handlers

import (
"context"
v1 "css.cisco.com/kasa/license-broker/api/v1"
"fmt"
coreV1 "k8s.io/api/core/v1"
"k8s.io/apimachinery/pkg/types"
"k8s.io/client-go/util/workqueue"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/controller-runtime/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/event"
"sigs.k8s.io/controller-runtime/pkg/handler"
)

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
return handler.Funcs{
UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
licenseList := v1.SmartLicenseList{}
err := c.List(context.TODO(), &licenseList)
if err != nil {
    secretLog.Error(err,
        "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
    panic(err.Error())
}

for _, smartLicense := range licenseList.Items {
    if smartLicense.Spec.TokenSecret.Name == secret.Name &&
        if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
            smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
            q.Add(ctrl.Request{NamespacedName: types.NamespacedName{
                Namespace: smartLicense.Namespace,
                Name:      smartLicense.Name,
            } })
        }
    } else {
        secretLog.Error(fmt.Errorf("cannot cast %T to Secret", evt.ObjectNew), "event is ignored")
    }
}

/***************************************************************
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**************************************************************/
package controllers

import (
    "context"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/listeners"
    licensing "css.cisco.com/licensing/client-agent"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"

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const SFCNProductId = "SFW"

const (
    registrationReason = "Registration"
    deregistrationReason = "Deregistration"
    FinalizerName = "sfcn.cisco.com/license-degistration-finalizer"
)

// SmartLicenseReconciler reconciles a SmartLicense object
type SmartLicenseReconciler struct {
    Client            client.Client
    LicensingClient   licensing.LicensingClient
    Log               logr.Logger
    Recorder          record.EventRecorder
    Scheme            *runtime.Scheme
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v1.SmartLicense{}, builder.WithPredicates(&corePredicate.GenerationChangedPredicate{})).
        Watches(&source.Channel{Source: oobChangeNotifier}, &handler.EnqueueRequestForObject{}).
        Complete(r)
}

// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses,verbs=get;list;watch;create;update;patch;delete
// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses/status,verbs=get;update;patch
// +kubebuilder:rbac:groups=core,resources=secrets,verbs=get;list;watch
// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list;watch;update;delete
// +kubebuilder:rbac:groups=apps,resources=deployments,verbs=get;list;watch;update
// +kubebuilder:rbac:groups=apps,resources=replicasets,verbs=get;list;watch
// +kubebuilder:rbac:groups=autoscaling,resources=horizontalpodautoscalers,verbs=get;list;watch;update

func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := r.Log.WithValues("smartlicense", req.NamespacedName)
log.V(1).Info("reconciliation started")
start := time.Now()
def err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
if apiErrors.IsNotFound(err) {
log.Info("SmartLicense does not exist, nothing to reconcile")
return ctrl.Result{}, client.IgnoreNotFound(err)
}
var license v1.SmartLicense

if license.ObjectMeta.DeletionTimestamp.IsZero() {
if err := r.addFinalizerIfMissing(&license); err != nil {
return ctrl.Result{}, err
}
} else {
// the license is being deleted, need to deregister it first
return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
}
switch license.Spec.Action {
案 v1.Register:
err := r.registerPlatform(&license)
if err != nil {
return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
}
err = r.scaleEntitlements(&license)
if err != nil {
return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
}
if err = r.recordSuccessAndUpdateStatus(&license, registrationReason, err); err != nil {
return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
}
return ctrl.Result{}, nil

 case v1.Deregister:
err := r.deregisterPlatform(&license)
if err != nil {
return ctrl.Result{}, fmt.Errorf("failed to deregister the platform: %w", err)
}
if err = r.recordSuccessAndUpdateStatus(&license, deregistrationReason); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
}
return ctrl.Result{}, nil

default:
    // should not happen due to CRD validation, but not returning an error as subsequent reconciliations will not fix the
    // issue anyway
    // 'action' value")
    return ctrl.Result{}, nil
}

func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
    if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
        r.licenseLogger(license).Info("added finalizer")
    }
    return nil
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    if containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        if license.Status.RegistrationState == v1.Registered {
            if err := r.deregisterPlatform(license); err != nil {
                // TODO: return error and do not remove finalizer when corner cases are tested
                log.Error(err, "failed to deregister the platform in CSSM, proceed with removing finalizer")
            }
        } else {
            log.Info("removing finalizer without deregistration as platform is not registered")
        }
        license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
        log.Info("removed finalizer")
        return nil
    }

    func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {

licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
log := r.licenseLogger(license)
token, err := r.getToken(license)
if err != nil {
    return fmt.Errorf("failed to retrieve licensing token: %w", err)
}

log.Info("trying to register platform", "platformName", licenseNsName.String())

deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client, ctrl.Log.WithName("listeners").WithName("DeregistrationListener"), r.Recorder, oobChangeNotifier)
registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
    Uuid:         string(license.UID),
    Name:         licenseNsName.String(),
    SerialNumber: serialNumber(licenseNsName.String()),
    ProductId:    SFCNProductId,
    PoolName:     license.Namespace,
}, token, deregistrationListener)
if err != nil {
    license.Status.RegistrationState = v1.RegistrationFailed
    license.Status.LicenseState = v1.Unlicensed
    return fmt.Errorf("failed to complete registration call: %w", err)
}

log.Info("registered the platform in CSSM", "registrationInfo", registration)
license.Status.RegistrationState = v1.Registered
// we don't want to change license state to Pending if a platform is already registered and a user just updates some field.
if !registration.IsRegistered {
    license.Status.LicenseState = v1.PendingLicenseState
}
license.Status.AccountDomain = registration.SmartAccountName
license.Status.AccountName = registration.VirtualAccountName
license.Status.ContextId = registration.ContextId
license.Status.ExportControlled = registration.ExportControlled

entitlementListener := &listeners.EntitlementListener{
    Log:       ctrl.Log.WithName("listeners").WithName("EntitlementListener"),
    Client:    r.Client,
    LicenseNsName: licenseNsName,
}
if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
    if errors.Is(err, licensing.ErrDuplicateListener) {
        log.Info("entitlement listener is already added", "contextId", registration.ContextId)
        return nil
    }
    return fmt.Errorf("failed to subscribe to entitlement notifications: %w", err)
}
log.Info("added entitlement listener", "contextId", registration.ContextId)
return nil
func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
    if license.Status.RegistrationState != v1.Registered {
        return fmt.Errorf("platform must be registered before license reservation")
    }
    log := r/licenseLogger(license)

    log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
    err := r/LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
        ContextId:       license.Status.ContextId,
        EntitlementId:   license.Spec.LicenseType,
        MinEntitlements: *license.Spec.MinLicenseCount,
        MaxEntitlements: *license.Spec.MaxLicenseCount,
        ScalingFactor:   *license.Spec.ScalingFactor,
    })
    if err != nil {
        return fmt.Errorf("failed to enable licensing scaling: %w", err)
    }

    log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
    return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
    log := r/licenseLogger(license)

    state := license.Status.RegistrationState
    if state == v1.Deregistered {
        log.Info("platform is already deregistered, skipping deregistration")
        return nil
    }

    err := r/LicensingClient.Registration().Deregister(license.Status.ContextId)
    if err != nil {
        license.Status.RegistrationState = v1.DeregistrationFailed
        return fmt.Errorf("failed to complete deregistration call: %w", err)
    }

    log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.EstimatedMaxReplicas = 0
    license.Status.CoresPerLicense = 0
    license.Status.LicenseNumber = 0
    return nil
}

func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
secretNamespacedName := types.NamespacedName{
    Namespace: license.Spec.TokenSecret.Namespace,
    Name:      license.Spec.TokenSecret.Name,
}
var tokenSecret coreV1.Secret
if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
    return "", fmt.Errorf("failed to get token secret: %w", err)
}
return string(tokenSecret.Data[v1.TokenKeyName]), nil
}

func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error) {
    r.Recorder.Event(license, coreV1.EventTypeWarning, reason,
        fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
    license.Status.ErrorReason = err.Error()
    if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
        r.Log.Error(statusErr, "failed to update SmartLicense status")
    }
}

func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
    r.Recorder.Event(license, coreV1.EventTypeNormal, reason, "SmartLicense state updated.
    license.Status.ErrorReason = ""
    if err := r.Client.Status().Update(context.Background(), license); err != nil {
        return err
    }
    return nil
}

func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
    return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
}

package controllers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "fmt"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
)
const (  
  smartLicenseName = "license-sample"  
  secretName = "secret-sample"  
  defaultNs = "default"  
  licenseType = "L-ASAV10S-STD"  
  secretToken = "MTIz"  
)

var (  
  minLicenseCount uint32 = 1  
  maxLicenseCount uint32 = 5  
  newMaxLicenseCount uint32 = 10  
  scalingFactor uint32 = 2  
)

var _ = Describe("SmartLicense Controller Test", func() {

  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var reconciler *controllers.SmartLicenseReconciler  
  var fakeClient client.Client  
  var mockCtrl *gomock.Controller  

  var licensingClient *mocks.MockLicensingClient  
  var registrationService *mocks.MockRegistrationService  
  var entitlementService *mocks.MockEntitlementService

  var (  
    smartLicense *v1.SmartLicense  
    secret *corev1.Secret  
  )

 BeforeEach(func() {
    
  })
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()

registrationService = mocks.NewMockRegistrationService(mockCtrl)
entitlementService = mocks.NewMockEntitlementService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
reconciler = &controllers.SmartLicenseReconciler{
    Client:          fakeClient,
    LicensingClient: licensingClient,
    Log:             logf.NullLogger{},
    Recorder:        record.NewFakeRecorder(1024),
}

licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()

secret = &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},
    Data:       map[string][]byte{"token": []byte(secretToken)},
}
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:           v1.Register,
        TokenSecret:      corev1.SecretReference{
            Name:         secretName,
            Namespace:    defaultNs,
        },
        LicenseType:     licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor:   &scalingFactor,
    },
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

AfterEach(func() {
    mockCtrl.Finish()
})

Context("platform registration", func() {
    It("should register platform in licensing system", func() {
        registrationService.EXPECT().Register(&licensing.Platform{
            Uuid:     string(smartLicense.UID),
            Name:     licenseNsName.String(),
        })
    })
})
SerialNumber: "8B201B63BB8",
ProductId: controllers.SFCNProductId,
PoolName: defaultNs,
}, secretToken, gomock.Any()).Return(&licensing.Registration{
  ContextId:          "testContextId",
  SmartAccountName:   "TestAccountName",
  VirtualAccountName: "TestVirtualName",
  ExportControlled:   true,
  IsRegistered:       false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
  ContextId:       "testContextId",
  EntitlementId:   licenseType,
  MinEntitlements: minLicenseCount,
  MaxEntitlements: maxLicenseCount,
  ScalingFactor:   scalingFactor,
}).Return(nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
  Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
  Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
  Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
  Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
  Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
  Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))
})

It("should ignore ErrDuplicateListener error", func() {
  registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
gomock.Any()).Return(&licensing.Registration{
  IsRegistered: false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(
  fmt.Errorf("entitlement listener already exists: %w", licensing.ErrDuplicateListener))
entitlementService.EXPECT().ScaleEntitlement(gomock.Any()).Return(nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
  Expect(err).To(BeNil())

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
  Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Context("platform deregistration", func() {
It("should deregister platform in licensing system", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.ContextId = "testContextId"
    smartLicense.Status.RegistrationState = v1.Registered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
})

It("should skip deregistration if platform is already deregistered", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})

It("should deregister platform on resource deletion", func() {
    smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
    now := metav1.Now()
    smartLicense.DeletionTimestamp = &now
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.RegistrationState = v1.Registered
    smartLicense.Status.ContextId = "testContextId"
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
// cannot check finalizer removal due to a bug in fakeClient: https://github.com/kubernetes/client-go/issues/607
// Expect(smartLicense.Finalizers).ShouldNot(ContainElement(finalizerName))
}
}

Context("smart license updating", func() {
It("license state should not be updated", func() {
Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
licenseStateBeforeUpdate := smartLicense.Status.LicenseState
smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
gomock.Any()).Return(&licensing.Registration{
    ContextId:    "testContextId",
    IsRegistered: true,
}).=nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
    ContextId: "testContextId",
    EntitlementId: licenseType,
    MinEntitlements: minLicenseCount,
    MaxEntitlements: newMaxLicenseCount,
    ScalingFactor: scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))
})
})
})

package subscribers

import (  
    licensing "css.cisco.com/licensing/client-agent"  
    "css.cisco.com/licensing/client-agent/proto"  
    "github.com/go-logr/logr"  
    coreV1 "k8s.io/api/core/v1"  
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
    "sigs.k8s.io/controller-runtime/pkg/apis/meta/v1"  
    "strings"
)
func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
    return &subscriptionListener{
        channel: channel,
        log:     log,
    }
}

type subscriptionListener struct {
    channel chan event.GenericEvent
    log     logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)
    switch e.Type {
    case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED, proto.AllotmentEvent_ALLOTMENT_DENIED:
        l.log.V(1).Info("scheduling event for PodLicenseReconciler")
        l.sendEventToChannel(e.Tenant.Name)
    }
}

func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
        Name:      namespacedName[1],
        Namespace: namespacedName[0],
    }}
    l.channel <- event.GenericEvent{Object: pod}
}

package listeners

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
)
func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger, 
recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
  log:     log,
  client:  client,
  licenseNsName: licenseNsName,
  recorder: recorder,
  notifierChannel: notifierChannel,
}

const MaxRetries = 10

type deregistrationListener struct {
  log     logr.Logger
  client  client.Client
  licenseNsName types.NamespacedName
  recorder record.EventRecorder
  notifierChannel chan event.GenericEvent
  retries int
}

// OnAutoDeregistration updates SmartLicense status to be in deregistered state.
//
// The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
  log := d.log.WithValues("smartlicense", d.licenseNsName)
  log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)

  if err := d.warnSmartLicenseDeregistered(msg); err != nil {
    if d.retries < MaxRetries {
      log.Error(err, "failed to process auto-deregistration event. retrying...")
      d.retries++
      time.Sleep(1 * time.Second)
      d.OnAutoDeregistration(platform, msg)
      return
    }

    log.Error(err, "failed to process auto-deregistration event")
  }
}
d.retries = 0
log.V(1).Info("successfully processed auto-deregistration event")

func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
    var license v1.SmartLicense
    if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.LicenseNumber = 0
    license.Status.CoresPerLicense = 0
    license.Status.EstimatedMaxReplicas = 0
    if err := d.client.Status().Update(context.Background(), &license); err != nil {
        return fmt.Errorf("failed to update SmartLicense status: %w", err)
    }
    d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
    d.notifierChannel <- event.GenericEvent{Object: &license}
    return nil
}

package controllers

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/pkg/predicates"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
//go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator

type ReplicasCalculator interface {
    CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error)
}

type DeploymentLicenseReconciler struct {
    client.Client
    Log               logr.Logger
    Recorder          record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&appsv1.Deployment{}, builder.WithPredicates(
            &predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey: InitialReplicasNumberAnnotation}).
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.DeploymentHandler()).
        Complete(c)
}

// Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value
// when it exceeds the replicas allowed by licensing config.
func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := c.Log.WithValues("deployment", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took ", "ms", time.Since(start).Milliseconds())
    }()

    deployment := &appsv1.Deployment{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("Deployment does not exist, nothing to reconcile")
            return ctrl.Result{}, client.IgnoreNotFound(err)
        }
        log.Info("Deployment does not exist, nothing to reconcile")
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }

    licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("updated Deployment labels")
}

if len(deploymentLicenses) == 0 {
    log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentControlledByHPA", fmt.Sprintf("%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", deployment.Name, hpa.Name, hpa.Name))
}

if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
    initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
    if err != nil {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "WrongInitialReplicasNumber",...
fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
return ctrl.Result{}, err
}

log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
deletionSpec.Replicas = int32(initialReplicasCountInt)
// delete initial replicas number from Deployment annotations to don't back to initial number on each reconciliation
if err = c.Client.Update(context.Background(), deployment); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.Recorder.Event(deployment, corev1.EventTypeNormal, "ScaledDeploymentToInitialReplicasNumber",
    fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))

if *deployment.Spec.Replicas > maxLicensedReplicas {
    log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas",
        *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
    *deployment.Spec.Replicas = maxLicensedReplicas
}

if err = c.Client.Update(context.Background(), deployment); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
    fmt.Sprintf("Decreased Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", maxLicensedReplicas))
log.Info("successfully scaled down deployment to max license limit", "updatedReplicas",
    *deployment.Spec.Replicas)
return ctrl.Result{}, nil

log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas",
    *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment *appsv1.Deployment) (*autoscalingv1.HorizontalPodAutoscaler, error) {

    hpaList := &autoscalingv1.HorizontalPodAutoscalerList{}
    if err != nil {
        return nil, err
    }

    for _, hpa := range hpaList.Items {
  return &hpa, err
}
}

return nil, err
}

package controllers

import {
  "context"
  "errors"
  "fmt"
  "strconv"
  "time"

  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/pkg/predicates"
  licensing "css.cisco.com/licensing/client-agent"
  "github.com/go-logr/logr"
  appsV1 "k8s.io/api/apps/v1"
  autoscalingV1 "k8s.io/api/autoscaling/v1"
  coreV1 "k8s.io/api/core/v1"
  corev1 "k8s.io/api/core/v1"
  apiErrors "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/labels"
  "k8s.io/apimachinery/pkg/selection"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/tools/record"
  "k8s.io/utils/pointer"
  ctrl "sigs.k8s.io/controller-runtime"
  "sigs.k8s.io/controller-runtime/pkg/builder"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/event"
  "sigs.k8s.io/controller-runtime/pkg/handler"
  "sigs.k8s.io/controller-runtime/pkg/source"
}

type PodLicenseReconciler struct {
  client.Client
  LicensingClient licensing.LicensingClient
  Log      logr.Logger
  Recorder record.EventRecorder
}

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent) error {
  return ctrl.NewControllerManagedBy(mgr).
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    pod := coreV1.Pod{}
    podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
    err := c.Client.Get(ctx, podNsName, &pod)
    if err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("Pod does not exist, releasing allotments it might still hold")
            return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
        }
        return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
    }

    status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    shouldHaveLicensingLabel := status != nil && status.NumCores != 0
    changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
    if changed {
        if err = c.Client.Update(ctx, &pod); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
        }
        log.Info("updated Pod labels")
    }

    deployment, err := c.findPodDeployment(&pod)
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
    }

    if deployment == nil {
        // Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
        // a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
        // On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
        // Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
        // a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
        // On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
        // Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
        // a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
        // On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
    }
}
log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
if err := c.Client.Delete(context.Background(), &pod); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
}

c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration."))
log.Info("deleted orphan Pod")
return ctrl.Result{}, nil
}

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

serviceRole := getDeploymentServiceRole(deployment)

serviceRoleIsRegistered, err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
}

if !serviceRoleIsRegistered {
    if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
} else {
    if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
    if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
}

return ctrl.Result{}, nil
}

// releaseAllotmentsIfAny releases licensing allotments that Pod held in the licence-server
func (c *PodLicenseReconciler) releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
    log := c.Log.WithValues("pod", nsName.String())

    tenant := &licensing.Tenant{Name: nsName.String()}
    status, err := c.LicensingClient.Allotment().Status(tenant)
    if err != nil {
        if errors.Is(err, licensing.ErrNotRegistered) {
log.Info("Pod tenant is not registered in license server, nothing to release")
return nil
}
return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)

if status != nil && status.NumCores != 0 {
log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
if err := c.LicensingClient.Allotment().ReleaseAllotment(&licensing.AllotmentRelease{
  ContextId: status.ContextId,
  Tenant:    tenant,
}); err != nil {
return fmt.Errorf("failed to release Pod allotments: %w", err)
}
log.Info("successfully released Pod allotments")
return nil
}
log.Info("Pod does not hold any allotments, nothing to release")
return nil

func (c *PodLicenseReconciler) podLogger(pod *corev1.Pod) logr.Logger {
}

func toLicenseTenant(pod corev1.Pod) *licensing.Tenant {
podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each service role
// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is scaled down.
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment,
reconciledName types.NamespacedName) error {
log := c.Log.WithValues("pod", reconciledName.String())
log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the namespace")

trialDeploymentList := appsv1.DeploymentList{}
labelSelector := labels.NewSelector()
trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals,
[]string{"true"})
if err == nil {
labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
}
serviceRole := getDeploymentServiceRole(deployment)
serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals, []string{serviceRole})
if err == nil {
    labelSelector = labelSelector.Add(*serviceLabelRequirement)
}
if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
    Namespace:     deployment.Namespace,
    LabelSelector: labelSelector,
}); err != nil {
    return fmt.Errorf("failed to fetch Deployments with trial license label")
}
log.Info("Length of trial deployment list", "length", len(trialDeploymentList.Items))
var allowedReplicas int32 = 0
if trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
    isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name == deployment.Name
if trialDeploymentIsAbsent || isDeploymentInTrial {
    log.Info("Deployment has to be marked as trial license holder")
    allowedReplicas = 1
}

trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
if scaleDownRequired := *deployment.Spec.Replicas > allowedReplicas && trialLabelUpdated {
    initialReplicasNumber := strconv.Itoa(int(pointer.Int32PtrDerefOr(deployment.Spec.Replicas, 1)))
    log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
    deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
    deployment.Spec.Replicas = &allowedReplicas
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
}

// throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
// If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList []v1.SmartLicense, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    // throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
    // If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
if err != nil {
    return fmt.Errorf("failed to determine licensed deployment names: %w", err)
}

if !containsString(licensedDeploymentNames, deployment.Name) {
    log.Info("scaling down Pod's Deployment to 0 as it requested license but does not belong to any licensed EP deployment")
    *deployment.Spec.Replicas = 0
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
        "as it requested license but does not belong to any licensed EP deployment. "+
        "Please, check SmartLicense resources to update licensing configuration.")
    log.Info("scaled down Pod's Deployment to 0")
    return nil
}

log.Info("verified that Pod belongs to the licensed Deployment")
return nil

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
func (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment: %w", err)
        }
        log.Info("removed Deployment trial license label")
    }
    return nil
}

// getLicensedDeploymentNames collects names of all Deployments that have a corresponding SmartLicense resource.
f func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
    var deploymentNames []string
    for _, license := range licenseList {
        switch license.Spec.ScalingRef.Kind {
        case v1.DeploymentKind:
            deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
        case v1.HPAKind:
            hpa := &autoscalingv1.HorizontalPodAutoscaler{}
            hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
    return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
}
deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
default:
}
return deploymentNames, nil

// findPodDeployment tries to find Pod's Deployment if Pod is managed by Deployment.
// If Pod is not managed by Deployment controller, `nil` is returned.
func (c *PodLicenseReconciler) findPodDeployment(pod *corev1.Pod) (*appsv1.Deployment, error) {
    log := c.podLogger(pod)
    if len(pod.OwnerReferences) != 1 || !*pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind != "ReplicaSet" {
        log.Info("pod is not owned by ReplicaSet")
        return nil, nil
    }
    replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
    replicaSet := &appsv1.ReplicaSet{}
    if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
        return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
    }
    if len(replicaSet.OwnerReferences) != 1 || !*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
        log.Info("pod's ReplicaSet is not owned by Deployment")
        return nil, nil
    }
    deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
    deployment := &appsv1.Deployment{}
    if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
        return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
    }
    return deployment, nil
}

// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in
// registeredLicenses.
// It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified
// service role label.
func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense,
namespace string, serviceRole string) (bool, error) {
licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
if err != nil {
    return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
}
for _, deploymentName := range licensedDeploymentNames {
    deployment := &appsv1.Deployment{
        deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
        err := c.Client.Get(context.Background(), deploymentNsName, deployment)
        if err != nil {
            return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
        }
        if getDeploymentServiceRole(deployment) == serviceRole {
            return true, nil
        }
    }
return false, nil
}

func getDeploymentServiceRole(deployment *appsv1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: RegistrationService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {
    ctrl     *gomock.Controller
    recorder *MockRegistrationServiceMockRecorder
}

type MockRegistrationServiceMockRecorder struct {
mock *MockRegistrationService

// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister", reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener) (*service.Registration, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
    ret0, _ := ret[0].(*service.Registration)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}

val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistrylessTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String, String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra

val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(":")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

ext {
    set("publishImages", listOf(
        project.findProperty("imageName") as String,
        project.findProperty("licenseServerImageName") as String
    ))
}

tasks {

    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }

    named("dockerBuild") {
        doLast {
            exec {
                environment("DOCKER_BUILDKIT", 1)
                commandLine("docker build -f ./Dockerfile -t $imageNameForPush ./").split(" ")
            }
            val artifactoryUser = project.findProperty("artifactoryUser")!! as String
            val artifactoryApiKey = project.findProperty("artifactoryApiKey")!! as String
            val saArtifactoryUrl = project.findProperty("saArtifactoryUrl")!! as String
            val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
        }
    }
}
if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
    exec {
        setWorkingDir("bin")
        commandLine = listOf(
            "bash", "-c",
            "curl -f -u $artifactoryUser:$artifactoryApiKey -O $downloadUrl"
        )
    }
}
exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}
}

named("promoteImage") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        val sourceTag: String? by project
        val sourceRepo: String? by project
        val imageTag: String? by project
        if (sourceTag == null || sourceRepo == null || imageTag == null) {
            val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please, specify them with: -PsourceTag=<srcImageTag> -PsourceRepo=<sourceRepoName> -PimageTag=<targetImageTag>"
            logger.error(msg)
            throw GradleException(msg)
        }
        val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
        val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split(':')[0]
        promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
    }
}

named("check") {
    doLast {
        execCommands(listOf(
            "go fmt ./...",
            "go vet ./...")
        )
    }
}
named("test") {
    doLast {
        execCommands(listOf(
            "go test -coverpkg=./... -coverprofile cover.out ./...",
            "go tool cover -func=cover.out -o ${project.name}-cover.txt"
        ))
    }
}
	named("publish") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        println(execCommand("docker push $serverImageNameForPush"))
    }
}
	named("manifests") {
    dependsOn("controller-gen")
    description = "Generates manifests for k8s deployment using Helm"
    doLast {
        execHelmCommand("helm dependency update")
        val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")} . --namespace $systemNamespace --set nameOverride=licenseapi")
        buildDir.deleteRecursively()
        buildDir.mkdir()
        File("$buildDir/license-broker.yaml").writeText(stdOut)
    }
}

named<Copy>("generateValuesFile") {
    expand(
        "platform" to project.findProperty("platform")!!,
        "registry" to project.findProperty("dockerRegistry")!!,
        "artifactaryRepo" to project.findProperty("imageDirectory")!!,
        "controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
        "licenseServerImage" to getRegistrylessTaggedImage(project.findProperty("licenseServerImageName")!! as String),
        "defaultImagePullPolicy" to project.findProperty("imagePullPolicy")!!,
        "logLevel” to project.findProperty("logLevel")!!,
        "logFormat" to project.findProperty("logFormat")!!,
        "licenseServerTransportUrl" to project.findProperty("licenseServerTransportUrl")!!
    )
}
named("generateControllerGenFiles") {
    dependsOn("controller-gen")
    doLast {
        execCommand("controllerGen $crdOpts rbac:roleName=broker-role webhook paths=./...
          output:crd:artifacts:config=config/crd")
    }
}

register("generate") {
    dependsOn("controller-gen")
    description = "Executes code generators"
    doLast {
        execCommand("controllerGen object:headerFile=./hack/boilerplate.go.txt paths=./...")
    }
}

register("uninstall") {
    description = "Removes k8s objects from the active cluster"
    dependsOn("manifests")
    doLast {
        exec {
            isIgnoreExitValue = true
            commandLine("kubectl delete -f $buildDir".split(" "))
        }
    }
}

named("deploy") {
    dependsOn":"installCertManager"
    dependsOn("manifests")
    doLast {
        exec {
            commandLine("kubectl apply -f $buildDir".split(" "))
        }
        createRegistrySecret(systemNamespace)
    }
}

named("loadImagesToKind") {
    doLast {
        val clusterName: String by project
        execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")
        execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
        execCommand("docker tag $imageNameForPush $imageNameForPull")
    }
}
execCommand("kind load docker-image $imageNameForPull --name $clusterName")

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Cisco End User License Agreement

package integ_tests

import {
    "context"
v1 "css.cisco.com/kasa/license-broker/api/v1"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/rest"
    "path/filepath"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
    "sigs.k8s.io/controller-runtime/pkg/envtest/printer"
    "sigs.k8s.io/controller-runtime/pkg/log/zap"
    "strings"
    "testing"
    "time"

    logf "sigs.k8s.io/controller-runtime/pkg/log"
"

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {
    RegisterFailHandler(Fail)
    SetDefaultEventuallyTimeout(time.Minute)
    RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite",
        []Reporter{printer.NewlineReporter{}})
}

var _ = BeforeSuite(func(done Done) {
    logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))
    By("bootstrapping test environment")
    apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
testEnv = &envtest.Environment{
    WebhookInstallOptions: envtest.WebhookInstallOptions{
        Paths: []string{filepath.Join("..", "config", "webhook")},
        CRDDirectoryPaths: []string{filepath.Join("..", "config", "crd")},
        KubeAPIServerFlags: apiServerFlags,
        ControlPlaneStartTimeout: 100 * time.Second,
        ControlPlaneStopTimeout: 100 * time.Second,
    }
}

var err error
cfg, err = testEnv.Start()
Expect(err).ToNot(HaveOccurred())
Expect(cfg).ToNot(BeNil())

er = v1.AddToScheme(scheme.Scheme)
Expect(err).ToNot(HaveOccurred())

k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
Expect(err).ToNot(HaveOccurred())
Expect(k8sClient).ToNot(BeNil())

By("running webhook server")
go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done) }, envtest.StartTimeout)

var _ = AfterSuite(func(done Done) {
    By("tearing down the test environment")
cancelCtx()
    Expect(testEnv.Stop()).ToNot(HaveOccurred())

    close(done)
}, envtest.StopTimeout)

func errCauses(err error) []string {
    var causes []string
    if statusError, ok := err.(*errors.StatusError); ok {
        for _, cause := range statusError.Status().Details.Causes {
            causes = append(causes, strings.Split(cause.Message, ": ")[2])
        }
    }
    return causes
}

/*******************************************************************************
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*********************************************************************************/
package v1

import (
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
)

const TokenKeyName = "token"

type RegistrationAction string

const (  
    Register   RegistrationAction = "REGISTER"
    Deregister RegistrationAction = "DEREGISTER"
)

// SmartLicenseSpec defines the desired state of SmartLicense
type SmartLicenseSpec struct {
    // Action is the desired state of the Smart Agent license registration.
    // +kubebuilder:validation:Enum=REGISTER;DEREGISTER
    // +optional
    Action RegistrationAction `json:"action"

    // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
    TokenSecret v1.SecretReference `json:"tokenSecret"

    // LicenseType defines the type of license to request/release, usually the SKU of the license.
    // The default value is a SFW license tag being able to handle 1vCPU.
    // +optional
    LicenseType string `json:"licenseType"

    // MinLicenseCount is a minimum number of licenses SFCN reserves for the product.
    // The default value is 1.
    // +optional
    MinLicenseCount *uint32 `json:"minLicenseCount,omitempty"

    // MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.
    // The default value is equal to MinLicenseCount.
    // +optional
    MaxLicenseCount *uint32 `json:"maxLicenseCount,omitempty"

    // ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down.
// The default value is 1.
// +optional
ScalingFactor *uint32 `json:"scalingFactor,omitempty"

// ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
ScalingRef autoscalingv1.CrossVersionObjectReference `json:"scalingRef,omitempty"
}

type LicenseState string

const (
    PendingLicenseState LicenseState = "PENDING"
    Unlicensed LicenseState = "UNLICENSED"
    InCompliance LicenseState = "IN_COMPLIANCE"
    OutOfCompliance LicenseState = "OUT_OF_COMPLIANCE"
    Overage LicenseState = "OVERAGE"
)

const (    DeploymentKind = "Deployment"
    HPAKind = "HorizontalPodAutoscaler"
)

type RegistrationState string

const (    PendingRegistrationState RegistrationState = "PENDING"
    Registered RegistrationState = "REGISTERED"
    RegistrationFailed RegistrationState = "REGISTRATION_FAILED"
    Deregistered RegistrationState = "DEREGISTERED"
    DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
)

// SmartLicenseStatus defines the observed state of SmartLicense
type SmartLicenseStatus struct {

    // AccountDomain is the account domain in Cisco Software Central.
    AccountDomain string `json:"accountDomain,omitempty"

    // AccountName is the name of the virtual account in Cisco Software Central.
    AccountName string `json:"accountName,omitempty"

    // RegistrationState is the registration status of the SFCN product in Cisco Software Central.
    // +kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DEREGISTRATION_FAILED
    RegistrationState RegistrationState `json:"registrationState,omitempty"
// LicenseState is the state of the reserved licenses.
// +kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVER
// AGE
LicenseState LicenseState `json:"licenseState,omitempty"

// ErrorReason specifies the error due to which the the SFCN product was not registered in Cisco Software Central.
ErrorReason string `json:"errorReason,omitempty"

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
LicenseNumber uint32 `json:"licenseNumber,omitempty"

// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicense,omitempty"

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and
// CoresPerLicense,
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicas,omitempty"

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while
// generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlled,omitempty"

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextId,omitempty"`

// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
    metav1.TypeMeta `json:"",inline"
    metav1.ObjectMeta `json:"metadata,omitempty"

    Spec SmartLicenseSpec `json:"spec,omitempty"
    Status SmartLicenseStatus `json:"status,omitempty"
}

// SmartLicenseList contains a list of SmartLicense
type SmartLicenseList struct {

```go
func init() {
    SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}

// Package v1 contains API Schema definitions for the sfcn.cisco.com v1 API group
// +kubebuilder:object:generate=true
// +groupName=sfcn.cisco.com
package v1

import (
    "k8s.io/apimachinery/pkg/runtime/schema"
    "sigs.k8s.io/controller-runtime/pkg/scheme"
)

var (
    // GroupVersion is group version used to register these objects

    // SchemeBuilder is used to add go types to the GroupVersionKind scheme
    SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}

    // AddToScheme adds the types in this group-version to the given scheme.
    AddToScheme = SchemeBuilder.AddToScheme
)

domain: sfcn.cisco.com
repo: css.cisco.com/kasa/license-broker

resources:
- group: sfcn.cisco.com
  kind: SmartLicense
  version: v1
  version: "2"

package controllers

import (  
    "crypto/md5"
    "fmt"
)

v1 "css.cisco.com/kasa/license-broker/api/v1"
```
const (
    LicenseHolderLabel = "sfcn.cisco.com/license-holder"
    TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder"
    ServiceRoleLabel = "sfcn.cisco.com/service-role"
    // DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set
    DefaultServiceRole = "default"
    InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"
)

// serialNumber generates platform's Serial Number for SmartLicense resource.
// According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {
    return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName))[0:11])
}

func containsString(slice []string, s string) bool {
    for _, item := range slice {
        if item == s {
            return true
        }
    }
    return false
}

func removeString(slice []string, s string) (result []string) {
    for _, item := range slice {
        if item == s {
            continue
        }
        result = append(result, item)
    }
    return
}

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Status.RegistrationState == state {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}
// filterLicensesByKind filters SmartLicenses by given kind and name properties of ScalingRef field and returns the result.
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// pendingLicenseExists returns true if any license in the list is in Pending state.
func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status.LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

// setLicenseLabel makes sure that the licensing label is present when `shouldBePresent` is `true`
// and that the label is absent when `shouldBePresent` is `false`.
func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
        return true
    }
    if _, ok := meta.Labels[label]; ok && !shouldBePresent {
        delete(meta.Labels, label)
        return true
    }

    return false
}

package services

import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "fmt"  "github.com/go-logr/logr"  appsV1 "k8s.io/api/apps/v1"
    return &ReplicasCalculator{client, logger}
}

type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and calculates maximum amount of replicas based on licensing. 
// If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 && deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods", "deployment", deployment.Name)
        // it can be a scenario when we have spec.Replicas = 5, but Status.ReadyReplicas = 0. So, we just return desired replicas by a user.
        return *deployment.Spec.Replicas, nil
    }
    var err error
    if coresQuantity == 0 && deployment.Status.ReadyReplicas != 0 {
        coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
        if err != nil {
            return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
        }
    }
    r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores", coresQuantity)
    for _, license := range licenses {
        if license.Status.LicenseState == v1.InCompliance {
            maxLicensedCores := int(*license.Spec.MaxLicenseCount) * int(license.Status.CoresPerLicense)
            maxLicensedReplicas := int32(maxLicensedCores / int(coresQuantity))
            maxLimit = int32(maxLimit + maxLicensedReplicas)
        }
    }
    return maxLimit, nil
}
r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)

maxLimit += maxLicensedReplicas
license.Status.EstimatedMaxReplicas = maxLicensedReplicas

if err := r.Client.Status().Update(ctx, &license); err != nil {
    return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
}

// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil
}

func (r *ReplicasCalculator) getCoresQuantity(deployment *appsv1.Deployment) uint32 {
    coresQuantity := resource.MustParse("0")
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
            return 0
        }
        coresQuantity.Add(containerLimit)
    }
    return uint32(coresQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
    podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    if err != nil {
        return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
    }
    pods := corev1.PodList{ }
    if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
        return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
    }

    // TODO: do not rely on the fact that all nodes have the same CPU limit
    node := corev1.Node{ }
    nodeNsName := types.NamespacedName{Name: pod.Spec.NodeName}
    if err := r.Client.Get(ctx, nodeNsName, &node); err != nil {
        return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
    }
r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPULimit, nil

1.330 netty-handler-proxy 4.1.63.Final
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Found in path(s):
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/META-INF/maven/io.netty/netty-handler-proxy/pom.xml
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Found in path(s):
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/io/netty/handler/proxy/ProxyHandler.java
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/io/netty/handler/proxy/HttpProxyHandler.java
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/io/netty/handler/proxy/package-info.java
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/io/netty/handler/proxy/ProxyConnectionEvent.java
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/io/netty/handler/proxy/Socks5ProxyHandler.java
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/io/netty/handler/proxy/Socks4ProxyHandler.java
* /opt/cola/permits/1151803558_1617990451.82/0/netty-handler-proxy-4-1-63-final-sources-jar/io/netty/handler/proxy/ProxyConnectException.java

1.331 itext-pdf 2.1.5

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In a mail sent to Bruno Lowagie on January 23, 2008, Brian Burkhalter (@sun.com) writes: "This code is under a BSD license and supersedes the older codec packages on which your code is based. It also includes numerous fixes among them being the ability to handle a lot of 'broken' TIFFs."

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FYI: Brian also added: "A bit of history might be in order. The codec classes that you used originally were based on some classes included with JAI but not strictly part of JAI. As of Java SE 1.4 an official Image I/O framework was added in javax.imageio.... This framework supports these formats:

Java 1.4: GIF (read only), JPEG, PNG
Java 1.5: Added support for BMP and WBMP
Java 1.6: Added support for writing GIF

The JAI Image I/O Tools packages (jai-imageio-core) were created to support formats handled by JAI but not included in Java SE as well as some new things like JPEG2000."

(4) the file com/lowagie/text/pdf/codec/TIFFConstants
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procs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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include/GL/glxext.h
include/GL/wglxext.h :

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c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.
e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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uses the Library", as object code and/or source code, so that the
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b) Use a suitable shared library mechanism for linking with the
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rather than copying library functions into the executable, and (2)
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interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at
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d) If distribution of the work is made by offering access to copy
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e) Verify that the user has already received a copy of these
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package spec

// License information for the exposed API.
//
// For more information: http://goo.gl/8us55a#licenseObject
type License struct {
  Name string `json:"name,omitempty"
  URL  string `json:"url,omitempty"
}

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package migration

import "fmt"

// Notice is a migration warning
type Notice struct {
    Plugin     string
    Option     string
    Severity   string // 'deprecated', 'removed', or 'unsupported'
    ReplacedBy string
    Additional string
    Version    string
}

func (n *Notice) ToString() string {
    s := ""
    if n.Option == "" {
        s += fmt.Sprintf(`Plugin "%v" `, n.Plugin)
    } else {
        s += fmt.Sprintf(`Option "%v" in plugin "%v" `, n.Option, n.Plugin)
    }
    if n.Severity == unsupported {
        s += "is unsupported by this migration tool in " + n.Version + "." 
    } else if n.Severity == newdefault {
        s += "is added as a default in " + n.Version + "." 
    } else {
        s += "is " + n.Severity + " in " + n.Version + "." 
    }
    if n.ReplacedBy != "" {
        s += fmt.Sprintf(` It is replaced by "%v" `, n.ReplacedBy)
    }
    if n.Additional != "" {
        s += " " + n.Additional
    }
    return s
}

const (
The following statuses are used to indicate the state of support/deprecation in a given release.

deprecated = "deprecated"  // deprecated, but still completely functional
ignored = "ignored"  // if included in the corefile, it will be ignored by CoreDNS
removed = "removed"  // completely removed from CoreDNS, and would cause CoreDNS to exit if present in the corefile
newdefault = "newdefault"  // added to the default corefile. CoreDNS may not function properly if it is not present in the corefile.
unsupported = "unsupported" // the plugin/option is not supported by the migration tool

The following statuses are used for selecting/filtering notifications
all = "all" // show all statuses

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- Copy files to and from Containers in a cluster

# Copying Container Files
## Motivation

- Copying files from Containers in a cluster to a local filesystem
- Copying files from a local filesystem to Containers in a cluster

{% panel style="warning", title="Install Tar" %}
Copy requires that *tar* be installed in the container image.
{% endpanel %}

{% method %}

## Local to Remote

Copy a local file to a remote Pod in a cluster.

- Local file format is `</path>`
- Remote file format is `</pod-name>:<path>`

{% sample lang="yaml" %}

```bash
kubectl cp /tmp/foo_dir <some-pod>:/tmp/bar_dir
```%endmethod%

{% method %}

## Remote to Local

Copy a remote file from a Pod to a local file.

- Local file format is `</path>`
- Remote file format is `</pod-name>:<path>`

{% sample lang="yaml" %}

```bash
kubectl cp <some-pod>:/tmp/foo /tmp/bar
```%endmethod%

{% method %}

## Specify the Container

Specify the Container within a Pod running multiple containers.

- `-c <container-name>`
```
bash
kubectl cp /tmp/foo <some-pod>:/tmp/bar -c <specific-container>
```

```
bash
kubectl cp /tmp/foo <some-namespace>/<some-pod>:/tmp/bar
```

---

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# first address should be used in the submit logs and
# that the second address should be recognized as the
# same person when interacting with Rietveld.

# Please keep the list sorted.

Alain Vongsouvanhalainv <alainv@google.com>
Andrew Gerrand <adg@golang.org>
Brad Fitzpatrick <bradfitz@golang.org>
Eric Koleda <ekoleda+devrel@googlers.com>
Francesc Campoy <campoy@golang.org>
Garrick Evans <garrick@google.com>
Glenn Lewis <gmlewis@google.com>
Ivan Krasin <krasin@golang.org>
Jason Hall <jasonhall@google.com>
Johan Euphrosine <proppy@google.com>
Kostik Shtoyk <kostik@google.com>
Kunpei Sakai <namusyaka@gmail.com>
Matthew Dolan <dolan@lightstep.com>
Matthew Whisenhunt <matt.whisenhunt@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Nick Craig-Wood <nickcw@gmail.com>
Robbie Trencheny <me@robbiet.us>
Ross Light <light@google.com>
Sarah Adams <shadams@google.com>
Scott Van Woudenberg <scottvw@google.com>
Takashi Matsuo <tmatsuo@google.com>

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Abhijeet Kasurde <akasurde@redhat.com>
abrarshivani <abrarshivani@users.noreply.github.com>
Adam Shannon <adamkshannon@gmail.com>
Alessandro Cortiana <alessandro.cortiana@gmail.com>
Alex Bozhenko <alexbozhenko@fb.com>
Alex Ellis (VMware) <alexellis2@gmail.com>
Alvaro Miranda <kikitux@gmail.com>
Amanda H. L. de Andrade <amanda.andrade@serpro.gov.br>
Amit Bathla <abathla@vmware.com>
amit bezalel <amit.bezalel@hpe.com>
Andrew <AndrewDi@users.noreply.github.com>
Andrew Chin <andrew@andrewtchin.com>
Andrew Kutz <akutz@vmware.com>
Anfernee Yongkun Gui <agui@vmware.com>
angystardust <angystardust@users.noreply.github.com>
aniketGslab <aniket.shinde@gslab.com>
Arran Walker <arran.walker@zopa.com>
Aryeh Weinreb <aryehweinreb@gmail.com>
Austin Parker <aparker@apprenda.com>
Balu Dontu <bdontu@vmware.com>
bastienbc <bastien.barbe.creuly@gmail.com>
Bob Killen <killen.bob@gmail.com>
Brad Fitzpatrick <bradfitz@golang.org>
Bruce Downs <bruceadowns@gmail.com>
Cdrich Blomart <cblomart@gmail.com>
Chris Marchesi <chrism@vanclueverttech.com>
Christian Hltje <docwhat@gerf.org>
Clint Greenwood <cgreenwood@vmware.com>
CuiHaozhi <cuihaozhi@chinacloud.com.cn>
Danny Lockard <danny.lockard@banno.com>
Dave Tucker <dave@dtucker.co.uk>
Davide Agnello <dagnello@hp.com>
David Stark <dave@daviddark.name>
Davinder Kumar <davinderk@vmware.com>
Deric Crago <deric.crago@gmail.com>
Doug MacEachern <dougm@vmware.com>
Eloy Coto <eloy.coto@gmail.com>
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freebsdly <qinhuajun@outlook.com>
Gavin Gray <gavin@infinio.com>
Gavrie Philipson <gavrie.philipson@elastifile.com>
George Hicken <ghicken@vmware.com>
Gerrit Renker <Gerrit.Renker@ctl.io>
gthombare <gthombare@vmware.com>
Hasan Mahmood <mahmoodh@vmware.com>
Henrik Hodne <henrik@travis-ci.com>
Isaac Rodman <isaac@eyz.us>
Ivan Porto Carrero <icarrero@vmware.com>
James King <james.king@emc.com>
Jason Kincl <jkincl@gmail.com>
Jeremy Canady <jcanady@jackhenry.com>
jeremy-clerc <jeremy@clerc.io>
Jiatong Wang <wjiatong@vmware.com>
Joo Pereira <jooadrp@gmail.com>
Jonas Ausevicius <jonas.ausevicius@virtustream.com>
Jorge Sevilla <jorge.sevilla@rstor.io>
kayrus <kay.diam@gmail.com>
Kevin George <georgek@vmware.com>
leslie-qiw <leslie.qiwa@gmail.com>
Louie Jiang <jiangl@vmware.com>
maplain <fangyuanl@vmware.com>
Marc Carmier <mcarmier@gmail.com>
Maria Ntalla <maria.ntalla@gmail.com>
Marin Atanasov Nikolov <mnnikolov@vmware.com>
Matt Clay <matt@mystile.com>
Matthew Cosgrove <matthew.cosgrove@dell.com>
Matt Moriarity <matt@mattmoriarity.com>
Mevan Samaratunga <mevansam@gmail.com>
Michal Jankowski <mjankowski@vmware.com>
mengwei <mingwei@smartx.com>
Nicolas Lamirault <nicolas.lamirault@gmail.com>
Omar Kohl <omarkohl@gmail.com>
Parham Alvani <parham.alvani@gmail.com>
Pierre Gronlier <pierre.gronlier@corp.ovh.com>
Pieter Noordhuis <pnoordhuis@vmware.com>
prydin <prydin@vmware.com>
Rowan Jacobs <rojacobs@pivotal.io>
runner.mei <runner.mei@gmail.com>
S.alar Onur <conur@vmware.com>
Sergey Ignatov <sergey.ignatov@jetbrains.com>
Steve Purcell <steve@sanityinc.com>
Takaaki Furukawa <takaaki.frkw@gmail.com>
Tamas Eger <tamas.eger@bitrise.io>
tanishi <tanishi503@gmail.com>
Ted Zlatanov <tzz@lifelegs.com>
Thibaut Ackermann <thibaut.ackermann@alcatel-lucent.com>
Trevor Dawe <trevor.dawe@gmail.com>
Uwe Bessle <Uwe.Bessle@iteratec.de>
Vadim Egorov <vegorov@vmware.com>
Vikram Krishnamurthy <vikramkrishnamu@vmware.com>
Volodymyr Bobyr <pupsua@gmail.com>
Witold Krecicki <wpk@culm.net>
Yang Yang <yangy@vmware.com>
Yuya Kusakabe <yuya.kusakabe@gmail.com>
Zacharias Taubert <zacharias.taubert@gmail.com>
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package simulator

import (  
  "github.com/vmware/govmomi/object"  
  "github.com/vmware/govmomi/vim25/methods"  
  "github.com/vmware/govmomi/vim25/mo"  
  "github.com/vmware/govmomi/vim25/soap"  
  "github.com/vmware/govmomi/vim25/types"  
)

// EvalLicense is the default license
var EvalLicense = types.LicenseManagerLicenseInfo{  
  LicenseKey: "00000-00000-00000-00000-00000",  
  EditionKey: "eval",  
  Name: "Evaluation Mode",  
  Properties: []types.KeyAnyValue{  

Key: "feature",
Value: types.KeyValue{
Key: "serialuri:2",
Value: "Remote virtual Serial Port Concentrator",
},
},
{
Key: "feature",
Value: types.KeyValue{
Key: "dvs",
Value: "vSphere Distributed Switch",
},
},
},
}

```
type LicenseManager struct {
    mo.LicenseManager
}

func NewLicenseManager(ref types.ManagedObjectReference) object.Reference {
m := &LicenseManager{}
m.Self = ref
m.Licenses = []types.LicenseManagerLicenseInfo{EvalLicense}

    if Map.IsVPX() {
        am := Map.Put(&LicenseAssignmentManager{}).Reference()
m.LicenseAssignmentManager = &am
    }

    return m
}

func (m *LicenseManager) AddLicense(req *types.AddLicense) soap.HasFault {
    body := &methods.AddLicenseBody{
        Res: &types.AddLicenseResponse{},
    }

    for _, license := range m.Licenses {
        if license.LicenseKey == req.LicenseKey {
            body.Res.Returnval = licenseInfo(license.LicenseKey, license.Labels)
            return body
        }
    }

    m.Licenses = append(m.Licenses, types.LicenseManagerLicenseInfo{
        LicenseKey: req.LicenseKey,
        Labels: req.Labels,
    })
```
body.Res.Returnval = licenseInfo(req.LicenseKey, req.Labels)

return body
}

func (m *LicenseManager) RemoveLicense(req *types.RemoveLicense) soap.HasFault {
body := &methods.RemoveLicenseBody{
Res: &types.RemoveLicenseResponse{},
}

for i, license := range m.Licenses {
if req.LicenseKey == license.LicenseKey {
    m.Licenses = append(m.Licenses[:i], m.Licenses[i+1:]...)
    return body
}
}
return body
}

func (m *LicenseManager) UpdateLicenseLabel(req *types.UpdateLicenseLabel) soap.HasFault {
body := &methods.UpdateLicenseLabelBody{}

for i := range m.Licenses {
    license := &m.Licenses[i]

    if req.LicenseKey != license.LicenseKey {
        continue
    }

    body.Res = new(types.UpdateLicenseLabelResponse)

    for j := range license.Labels {
        label := &license.Labels[j]

        if label.Key == req.LabelKey {
            if req.LabelValue == ""
                license.Labels = append(license.Labels[:i], license.Labels[i+1:]...)
            } else {
                label.Value = req.LabelValue
            }
            return body
        }
    }

    license.Labels = append(license.Labels, types.KeyValue{
        Key:   req.LabelKey,
        Value: req.LabelValue,
    })

    return body
}

license.Labels = append(license.Labels, types.KeyValue{
    Key:   req.LabelKey,
    Value: req.LabelValue,
})
Value: req.LabelValue,
})

return body
}

body.Fault_ = Fault("", &types.InvalidArgument{InvalidProperty: "licenseKey"})
return body
}

type LicenseAssignmentManager struct {
mo.LicenseAssignmentManager
}

func (m *LicenseAssignmentManager) QueryAssignedLicenses(req *types.QueryAssignedLicenses) soap.HasFault {

body := &methods.QueryAssignedLicensesBody{
Res: &types.QueryAssignedLicensesResponse{},
}

// EntityId can be a HostSystem or the vCenter InstanceUuid
if req.EntityId != "" {
if req.EntityId != Map.content().About.InstanceUuid {
id := types.ManagedObjectReference{
Type: "HostSystem",
Value: req.EntityId,
}

if Map.Get(id) == nil {
return body
}
}
}


body.Res.Returnval = []types.LicenseAssignmentManagerLicenseAssignment{
{
EntityId: req.EntityId,
AssignedLicense: EvalLicense,
},
}

return body
}

func licenseInfo(key string, labels []types.KeyValue) types.LicenseManagerLicenseInfo {
info := EvalLicense

info.LicenseKey = key
info.Labels = labels

return info
}
= vendor/github.com/client9/misspell licensed under: =

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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/$Gson$Types.java
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  jar/com/google/gson/stream/JsonToken.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/stream/JsonWriter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/stream/JsonScope.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/stream/MalformedJsonException.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/stream/JsonReader.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/LazilyParsedNumber.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/bind/SqlDateTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/ConstructorConstructor.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/bind/TimeTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/bind/DateTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/UnsafeAllocator.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/JsonSyntaxException.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
  jar/com/google/gson/internal/Streams.java
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/*
Found in path(s):
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/LongSerializationPolicy.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonStreamParser.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldAttributes.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonParser.java

1.347 selinux 2.8-1+b1

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1.351 go-autorest-validation v0.3.1
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1.352 kasa-pkg-cliutils v0.0.0
1.352.1 Available under license :
- ReadWriteOnce
volumeMode: Filesystem

{{- if ($global.platform | eq "aws") | or ($global.platform | eq "eks" ) }}
storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */}}
{{- else if ($global.platform | eq "azure") }}
storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc" ) }} {{/* example yaml has 'managed-csi' as the name which is vague af */}}
{{- else if ($global.platform | eq "kind") }}
storageClassName: "standard" {{/* Kind has a default 'standard' StorageClass so reusing it here */}}
{{- else }}
storageClassName: {{ include "aegis.metadata.fullname" (list $ "broker") }}
{{- end }}
resources:
  requests:
    storage: {{ $.Values.licenseServerStorage }}

---

{{- define "kasa.licensebroker.storageLocal" }}
{{- $ := first . }}
{{- $storageName := last . }}
apiversion: storage.k8s.io/v1
kind: StorageClass

{{ template "aegis.metadata.standard" (list $ $storageName) }}
provisioner: kubernetes.io/no-provisioner
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer

{{- end }}

---

{{- define "kasa.licensebroker.storageAzureDisk" }}
{{- $ := first . }}
{{- $storageName := last . }}
apiversion: storage.k8s.io/v1
kind: StorageClass

{{ template "aegis.metadata.standard" (list $ $storageName) }}
provisioner: disk.csi.azure.com
parameters:
reclaimPolicy: Delete
volumeBindingMode: WaitForFirstConsumer
allowVolumeExpansion: true

{{- define "kasa.validate.eula" }}
{{- $ := first . }}
{{- $acceptValues := list "yes" "agree" }}

{{ if $.Release.IsInstall | and (not ($acceptValues | has $.Values.global.acceptEULA)) }}

---

{{- define "kasa.validate.eula" -}}
package services_test

import {
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
}

func TestControllers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

package listeners_test

import {
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensing "css.cisco.com/licensing/client-agent"
  "github.com/golang/mock/gomock"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
  "k8s.io/client-go/tools/record"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/client/fake"
  "sigs.k8s.io/controller-runtime/pkg/event"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
}

var _ = Describe("Deregistration Listener Test", func() {

  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var listener licensing.DeregistrationListener
var fakeClient client.Client
var mockCtrl *gomock.Controller
var recorder *record.FakeRecorder

var smartLicense *v1.SmartLicense
var notifier chan event.GenericEvent

BeforeEach(func() {
    smartLicense = &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1.SmartLicenseSpec{
            Action:      v1.Register,
            LicenseType: licenseType,
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Registered,
            LicenseState:      v1.InCompliance,
            ErrorReason:       "",
        },
    }
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
    recorder = record.NewFakeRecorder(1024)
    notifier = make(chan event.GenericEvent, 10)
    listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger{}, recorder, notifier)
})

AfterEach(func() {
    mockCtrl.Finish()
})

It("should update SmartLicense status on deregistration event", func() {
    listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
Reason: something happened"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response to out-of-band event from License Server")))
})
Expect(notifier).Should(Receive(&event.GenericEvent{
    Object: smartLicense,
}))
})
})
}

package controllers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    "k8s.io/utils/pointer"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (epHpaName                   = "epHPA"
    initialHPAMaxReplicas int32 = 3
)

var _ = Describe("HPA License Controller Test", func() {

    hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}
    var (reconciler       *controllers.HPALicenseReconciler
        fakeClient      client.Client
        mockCtrl        *gomock.Controller
        hpa             *autoscalingv1.HorizontalPodAutoscaler
        smartLicense    *v1.SmartLicense
        recorder        *record.FakeRecorder
        replicasCalculatorMock *mocks.MockReplicasCalculator)

    BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
    })

    func TestHpaLicenseReconciler() {
        // Test cases...
    }

})
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
recorder = record.NewFakeRecorder(1024)
replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

reconciler = &controllers.HPALicenseReconciler{
    Client: fakeClient,
    Log:    logf.NullLogger{},
    Recorder: recorder,
    ReplicasCalculator: replicasCalculatorMock,
}

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor: &scalingFactor,
    },
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

deployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: "ep",
        Namespace: defaultNs,
    },
    Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

hpa = &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{
        Name: epHpaName,
        Namespace: defaultNs,
    },
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: initialHPAMaxReplicas,
    },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())
}
AfterEach(func()
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())

})

It("should skip if HPA does not exist", func()
    Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

})

It("should skip if HPA SmartLicense does not exist", func()
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))

})

It("should skip if SmartLicense is in deregistered state", func()
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))

})

It("should skip if registered SmartLicense has enough licenses", func()
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(initialHPAMaxReplicas, nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))

})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func()


replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Spec.MinReplicas).Should(BeNil())
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))
})

It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

hpa.Spec.MaxReplicas = 10
hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(*hpa.Spec.MinReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas MinReplicas] to 2 ")))
})

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())
smartLicense3 := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
    Spec:   smartLicense.Spec,
    Status: v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
}
Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas]
to 2 "))))
}

---

apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  annotations:
    controller-gen.kubebuilder.io/version: v0.4.1
  creationTimestamp: null
  name: smartlicenses.sfcn.cisco.com
spec:
  group: sfcn.cisco.com
  names:
    kind: SmartLicense
    listKind: SmartLicenseList
    plural: smartlicenses
    singular: smartlicense
  scope: Namespaced
  versions:
    - additionalPrinterColumns:
        - jsonPath: .metadata.creationTimestamp
          name: Age
type: date
        - jsonPath: .status.registrationState
          name: Registration State
type: string
        - jsonPath: .status.licenseState
          name: License State
type: string
        - jsonPath: .status.licenseNumber
          name: License Number
type: integer
- jsonPath: .status.accountDomain
  name: Domain
  priority: 1
  type: string
- jsonPath: .status.accountName
  name: Account
  priority: 1
  type: string
name: v1
schema:
  openAPIV3Schema:
    description: SmartLicense is the Schema for the smartlicenses API
    properties:
      apiVersion:
        description: 'APIVersion defines the versioned schema of this representation of an object. Servers should convert recognized schemas to the latest internal value, and may reject unrecognized values. More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#resources'
        type: string
      kind:
        description: 'Kind is a string value representing the REST resource this object represents. Servers may infer this from the endpoint the client submits requests to. Cannot be updated. In CamelCase. More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'
        type: string
    metadata:
      type: object
    spec:
      description: SmartLicenseSpec defines the desired state of SmartLicense
      properties:
        action:
          description: Action is the desired state of the Smart Agent license registration.
          enum:
            - REGISTER
            - Deregister
          type: string
        licenseType:
          description: LicenseType defines the type of license to request/release, usually the SKU of the license. The default value is a SFW license tag being able to handle 1vCPU.
          type: string
        maxLicenseCount:
          description: MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product. The default value is equal to MinLicenseCount.
          format: int32
type: integer
minLicenseCount:
  description: MinLicenseCount is a minimum number of licenses SFCN reserves for the product. The default value is 1.
  format: int32
type: integer
scalingFactor:
  description: ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down. The default value is 1.
  format: int32
type: integer
scalingRef:
  description: ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
  properties:
    apiVersion:
      description: API version of the referent
type: string
    kind:
      description: Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds”
type: string
    name:
      description: Name is unique within a namespace to reference a secret resource.
type: string
required:
  - kind
  - name
  type: object
tokenSecret:
  description: TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
  properties:
    name:
      description: Name is unique within a namespace to reference a secret resource.
type: string
    namespace:
      description: Namespace defines the space within which the secret name must be unique.
type: string
  required:
    - tokenSecret
type: object
status:
  description: SmartLicenseStatus defines the observed state of SmartLicense
properties:
  accountDomain:
    description: AccountDomain is the account domain in Cisco Software Central.
    type: string
  accountName:
    description: AccountName is the name of the virtual account in Cisco Software Central.
    type: string
  contextId:
    description: ContextId is an internal identifier uniquely defining platform registration.
    type: string
  coresPerLicense:
    description: CoresPerLicense is number of cores per one requested LicenseType.
    format: int32
    type: integer
  errorReason:
    description: ErrorReason specifies the error due to which the the SFCN product was not registered in Cisco Software Central.
    type: string
  estimatedMaxReplicas:
    description: EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
    format: int32
    type: integer
  exportControlled:
    description: ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
    type: boolean
  licenseNumber:
    description: LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
    format: int32
    type: integer
  licenseState:
    description: LicenseState is the state of the reserved licenses.
    enum:
      - PENDING
      - UNLICENSED
      - IN_COMPLIANCE
      - OUT_OF_COMPLIANCE
      - OVERAGE
    type: string
  registrationState:
description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.

description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.

description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.

description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.

description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.

enum:
- PENDING
- REGISTERED
- REGISTRATION_FAILED
- Deregistered
- Deregistration_FAILED

type: string

type: object

type: object

served: true

storage: true

subresources:

status: {}

status:

acceptedNames:

kind: ""

plural: ""

conditions: []

storedVersions: []

FROM dockerhub.cisco.com/asac-dev-docker/css-golang:v1.16 as builder

WORKDIR /workspace
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"]
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates/"]

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ../pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api/ api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
# disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13

WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot

USER nonroot

ENTRYPOINT ["manager"]

package controllers_test

import (  
  "context"  
  "errors"  
  "fmt"  
  "strconv"

v1 "css.cisco.com/kasa/license-broker/api/v1"  
"css.cisco.com/kasa/license-broker/controllers"  
"css.cisco.com/kasa/license-broker/controllers/mocks"  
licensing "css.cisco.com/kasa/license-broker/licensing/client-agent"  
"github.com/golang/mock/gomock"  
  
  . "github.com/onsi/ginkgo"  
  . "github.com/onsi/gomega"
appsv1 "k8s.io/api/apps/v1"  
autoscalingv1 "k8s.io/api/autoscaling/v1"  
corev1 "k8s.io/api/core/v1"  
apiErrors "k8s.io/apimachinery/pkg/api/errors"  
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
"k8s.io/apimachinery/pkg/types"  
"k8s.io/client-go/kubernetes/scheme"  
"k8s.io/client-go/tools/record"  
ctrl "sigs.k8s.io/controller-runtime"  
"sigs.k8s.io/controller-runtime/pkg/client"  
"sigs.k8s.io/controller-runtime/pkg/client/fake"  
logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent

AllotmentService

const (  
epPodName = "epPod"  
redirectorEpPodName = "redirectorEpPod"  
defaultServiceRole = "default"  
vpnRedirectorServiceRole = "vpnredirector"  
deploymentName2 = "test-deployment-2"  
secondDefaultEpDeploymentName = "secondDefaultEpDeployment"  
redirectorEpDeploymentName = "vpnRedirectorEpDeployment"  
)
initialRedirectorDeploymentReplicas int32 = 2
)

var controllerTrue = true

var _ = Describe("Pod License Controller Test", func() {

  podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}
  redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}
  deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
  redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpDeploymentName}

  var reconciler *controllers.PodLicenseReconciler
  var fakeClient client.Client
  var mockCtrl *gomock.Controller
  var recorder *record.FakeRecorder

  var licensingClient *mocks.MockLicensingClient
  var allotmentService *mocks.MockAllotmentService

  var pod *corev1.Pod
  var deployment *appsv1.Deployment
  var redirectorPod *corev1.Pod
  var redirectorDeployment *appsv1.Deployment
  var smartLicense *v1.SmartLicense

 BeforeEach(func() {

    pod = &corev1.Pod{
      ObjectMeta: metav1.ObjectMeta{
        Name:            epPodName,
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue}},
      },
    }

    replicaSet := &appsv1.ReplicaSet{
      ObjectMeta: metav1.ObjectMeta{
        Name:            "epReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: epDeploymentName, Controller: &controllerTrue}},
      },
    }

    replicas := initialDeploymentReplicas

  })
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: epDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{
            controllers.ServiceRoleLabel: defaultServiceRole,
        },
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

secondDefaultDeployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: secondDefaultEpDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{
            controllers.ServiceRoleLabel: defaultServiceRole,
        },
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

redirectorPod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name: redirectorEpPodName,
        Namespace: defaultNs,
        OwnerReferences: []metav1.OwnerReference{
            metav1.OwnerReference{
                Kind: "ReplicaSet",
                Name: "redirectorEpReplicaSet",
                Controller: &controllerTrue,
            },
        },
    },
}

redirectorReplicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name: "redirectorEpReplicaSet",
        Namespace: defaultNs,
        OwnerReferences: []metav1.OwnerReference{
            metav1.OwnerReference{
                Kind: "Deployment",
                Name: redirectorEpDeploymentName,
                Controller: &controllerTrue,
            },
        },
    },
}

redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: redirectorEpDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{
            controllers.ServiceRoleLabel: vpnRedirectorServiceRole,
        },
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}

redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: redirectorEpDeploymentName,
        Namespace: defaultNs,
        Labels: map[string]string{
            controllers.ServiceRoleLabel: vpnRedirectorServiceRole,
        },
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}
smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:   v1.Register,
        LicenseType: licenseType,
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Registered,
    },
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(deployment, replicaSet, pod, secondDefaultDeployment, redirectorDeployment, redirectorReplicaSet, redirectorPod, smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()

reconciler = &controllers.PodLicenseReconciler{
    Client:          fakeClient,
    LicensingClient: licensingClient,
    Log:             logf.NullLogger{},
    Recorder:        recorder,
}

AfterEach(func() {
    mockCtrl.Finish()
})

It("should add the licensing label for licensed pod", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
    Expect(pod.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(HaveOccurred())
    expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
    expect(pod.Labels).Should(Not(HaveKey(controllers.LicenseHolderLabel)))
})
Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

smartLicense.Status.RegistrationState = v1.Deregistered
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
}

It("should ensure one replica per service role without SmartLicense", func() {
  // initiate reconcile for the pod which is part of deployment with vpnredirector service role and without smart license
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
  Expect(err).To(BeNil())

  // expect the deployment to be scaled to 1 and mark it as trial license holder
  redirDeployment := appsv1.Deployment{}
  Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
  Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))
  Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
  Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
  Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

  // create another deployment with vpnredirector role
  redirectorEpPodName2 := "redirectorEpPod2"
  redirectorEpDeploymentName2 := "redirectorEpDeployment2"
  replicaSetName2 := "redirectorEpReplicaSet2"
  redirectorPod2 := &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
      Name:            redirectorEpPodName2,
      Namespace:       defaultNs,
      OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}},
    },
  }
  Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
  redirectorReplicaSet2 := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
      Name:            replicaSetName2,
      Namespace:       defaultNs,
      OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName2, Controller: &controllerTrue}},
    },
  }
*}

// expect the deployment to be scaled to 1 and mark it as trial license holder
redirDeployment := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))
Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

// create another deployment with vpnredirector role
redirectorEpPodName2 := "redirectorEpPod2"
redirectorEpDeploymentName2 := "redirectorEpDeployment2"
replicaSetName2 := "redirectorEpReplicaSet2"
redirectorPod2 := &corev1.Pod{
  ObjectMeta: metav1.ObjectMeta{
    Name:            redirectorEpPodName2,
    Namespace:       defaultNs,
    OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}},
  },
}

Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
redirectorReplicaSet2 := &appsv1.ReplicaSet{
  ObjectMeta: metav1.ObjectMeta{
    Name:            replicaSetName2,
    Namespace:       defaultNs,
    OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName2, Controller: &controllerTrue}},
  },
}
Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

initialRedirector2Replicas := int32(3)
redirectorDeployment2 := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        redirectorEpDeploymentName2,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &initialRedirector2Replicas},
}
Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

// initiate reconcile for the pod which is part of another deployment with vpnredirector service role and without
smart license
redirector2PodNsName := types.NamespacedName{Name: redirectorEpPodName2, Namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirector2PodNsName.String()}).Return(nil, nil)
_, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
Expect(err).To(BeNil())

// expect the second vpnredirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1_Deployment{}
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2, Namespace: defaultNs}, &redirDeployment2)).To(Succeed())
Expect(*redirDeployment2.Spec.Replicas).Should(Equal(int32(0)))
Expect(redirDeployment2.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(redirDeployment2.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment2.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirector2Replicas))))
}

Context("on pod removal", func() {

It("should release licensing allotments", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
    ContextId: "fooBar",
    Tenant:    &licensing.Tenant{Name: podNsName.String()},
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())
})
It("should requeue request if failed to release licensing allotments", func() {
    Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
    allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
        ContextId: "fooBar",
        Tenant:    &licensing.Tenant{Name: podNsName.String()},
    }).Return(errors.New("failed to release allotments"))

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(HaveOccurred())
})

It("should not release licensing allotments if tenant is not registered", func() {
    Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
    Return(nil, fmt.Errorf("unknown tenant: %w", licensing.ErrNotRegistered))

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
})

It("should not release licensing allotments when NumCores is 0", func() {
    Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
    Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
    Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
    Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
})

Context("for pod without corresponding SmartLicense", func() {

    It("should remove pod if not belong to any deployment", func() {
        pod.OwnerReferences = nil
        Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
        Return(nil, nil)

        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())
    })
})
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

er = fakeClient.Get(context.TODO(), podNsName, pod)
Expect(err).NotTo(BeNil())
Expect(apiErrors.IsNotFound(err)).To(BeTrue())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license but does not belong to any Deployment")))
}

It("should scale down pod's deployment", func() {
    smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    allocationService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})

Context("without SmartLicense resources", func() {
   BeforeEach(func() {
        Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    })

    It("should scale down Deployment to 1 Replica and mark as trial", func() {
        allocationService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).Return(nil, nil)

        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())

        Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
        Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
        Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
        Expect(recorder.Events).Should(HaveLen(1))
        Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
    })
})
It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func()
{
    var replicaCount int32 = 4
    var expectedInitialReplicasNumber int32 = 4

    createDeployment := func(name string, role string) *appsv1.Deployment {

        pod := &corev1.Pod{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("pod-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: fmt.Sprintf("rs-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

        replicaSet := &appsv1.ReplicaSet{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("rs-%s", name),
                Namespace: defaultNs,
                OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name), Controller: &controllerTrue}},
            },
        }
        Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

        deployment := &appsv1.Deployment{
            ObjectMeta: metav1.ObjectMeta{
                Name: fmt.Sprintf("deployment-%s", name),
                Namespace: defaultNs,
                Labels: map[string]string{controllers.ServiceRoleLabel: role},
                Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
            },
            Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
        }
        Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

        podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).
            Return(nil, nil)
        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
        Expect(err).To(BeNil())
    }
})
// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", "")

assertScaledDown := func(d *appsv1.Deployment) {
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    Expect(d.Spec.Replicas).Should(Equal(int32(0)))
    Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
    Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(expectedInitialReplicasNumber))))
}
assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))

It("should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist", func() {
    deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    var replicaCount int32 = 1
        Name: "deployment-test-2",
        OwnerReferences: []*metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue}}},
    }
    Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())

        Namespace: defaultNs,
        OwnerReferences: []*metav1.OwnerReference{{Kind: "Deployment", Name: deploymentName2, Controller:}}}
    Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())

    })
&controllerTrue},
],
}

Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

deployment2 := &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{
    Name:        deploymentName2,
    Namespace:   defaultNs,
    Labels:      map[string]string{controllers.ServiceRoleLabel: "new-service-role"},
    Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
},
    Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}

Expect(fakeClient.Create(context.TODO(), deployment2)).To(Succeed())

pod2NsName := types.NamespacedName{Namespace: defaultNs, Name: "deployment-test-2"}
alottmentService.EXPECT().Status(&licensing.Tenant{Name: pod2NsName.String(), Attributes: pod.Labels}).Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: pod2NsName})

Expect(err).To(BeNil())

deployment2Ns := types.NamespacedName{Namespace: defaultNs, Name: deploymentName2}

Expect(fakeClient.Get(context.TODO(), deployment2Ns, deployment2)).To(Succeed())

Expect(*deployment2.Spec.Replicas).Should(Equal(int32(1)))

Expect(deployment2.Labels).Should(HaveKey(controllers.TrialLicenseHolderLabel))

Expect(recorder.Events).ShouldNot(HaveLen(1))

---

title: "Monitoring Status"
weight: 3
description: >
  Learn how to monitor the ASA operational status and critical license events
---

### Smart License Status

When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license.
type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: "" # omitted to use default value
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
status:
  accountDomain: InternalTestDemoAccount8.cisco.com
  accountName: asac-dev
  contextId: '6947693726752581822'
  coresPerLicense: 1
  estimatedMaxReplicas: 2
  exportControlled: true
  licenseState: IN_COMPLIANCE
  registrationState: REGISTERED
```

### ASA Licensing State

The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are

* AwaitingLicense (Warning)
* LicenseCommunicationFailed (Warning)
* LicenseGranted (Normal)
* LicenseVerified (Normal)
* LicenseRevoked (Warning)

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.
When the ASA comes up successfully, the Manager tries to obtain a license for the
[number of cores](https://kasa.readthedocs.io/en/latest/deployment/#core-calculation) the Pod uses. During this period, the
Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For
instance, when
the ASA came up for the first time and operating at reduced throughput, this event would read something like
```markdown
Warning AwaitingLicense ASA operating at reduced throughput because it was not licensed, requesting for a new license
```

And, if the ASA came up and operating at full potential, then
```markdown
Warning AwaitingLicense ASA operating at full potential but not licensed, requesting for a new license
```

The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could
not
communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a
LicenseCommunicationFailed warning event with the reasoning behind the failure.
```markdown
Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure
```

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies
the license
to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the
license
granted to it and on successful verification, emits a `LicenseVerified` event.
```markdown
Normal LicenseGranted successfully obtained a license from the server
Normal LicenseVerified ASA operating at full potential, license status verified
```

It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the
licenses
have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale
down
the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager
emits a
`LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be
granted a
license, or it will be removed by Kubernetes because the controller scaled down the cluster.
Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license, retrying to acquire

### Unauthorized Requests

License requests may be granted by the License Server to any pod capable of requesting a licensing, however the License Controller sees a grant as authorized only if that pod belonged to a Deployment/HPA specified in one of the Smart License resources otherwise it considers that pod as unauthorized and takes action to delete that pod and set the number of replicas to 0 on its owners to prevent the Kubernetes from creating such pods. The License Controller will emit an event on the pod that was deleted specifying the reason behind it. It then releases the license back to the License Server after the pod is killed.

Warning PodDeleted Deleted Pod as it requested a license but does not belong to any licensed EP deployment. Please, check SmartLicense resources to update licensing configuration.

This might happen when you have an Enforcer deployment but did not specify that Deployment in a Smart License resource in the same namespace. To remedy that, simply add a Smart License resource with the desired configuration and specify the Deployment of the Enforcer in it.

### Identifying Licensed Pods

All licensed Deployments specified via the Smart License resources, and their Pods that have been granted a license will include a label `sfcn.cisco.com/license-holder=true`. You should be able to use `kubectl` to list all the pods in a namespace that are having this label to identify the pods currently holding a license.

```go
package handlers_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/api/machinery/pkg/apis/meta/v1"
    "k8s.io/api/machinery/pkg/types"
```
const (  
defaultNamespace = "default"  
smartLicenseName = "smart-license"  
deploymentName = "ep-deployment"  
deploymentName2 = "ep-deployment2"  
hpaName = "ep-hpa"  
hpaName2 = "ep-hpa2"  
)  

var _ = Describe("DeploymentHandler", func() {  
var handler handler.EventHandler  
var mockCtrl *gomock.Controller  
var mockQueue *mocks.MockRateLimitingInterface  

BeforeEach(func() {  
mockCtrl = gomock.NewController(GinkgoT())  
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)  
handler = handlers.DeploymentHandler()  
})  

AfterEach(func() {  
mockCtrl.Finish()  
})  

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {  
mockQueue.EXPECT().Add(reconcile.Request{  
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},  
})  

handler.Create(event.CreateEvent{  
Object: &v1.SmartLicense{  
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},  
Spec: v1.SmartLicenseSpec{  
},  
}),  
mockQueue)  
})  

It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {  
handler.Create(event.CreateEvent{  
Object: &v1.SmartLicense{  
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},  
})  
})
Spec: v1.SmartLicenseSpec{
},
},
}, mockQueue)
})

It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
  mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
  })
  mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
  })

  handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
      Spec: v1.SmartLicenseSpec{
      },
      ObjectNew: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
      },
      mockQueue}
  })
})

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is deleted", func() {
  mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
  })

  handler.Delete(event.DeleteEvent{
    Object: &v1.SmartLicense{
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
      Spec: v1.SmartLicenseSpec{
      },
      mockQueue}
  })
})

var _ = Describe("HPAHandler", func() {

})
var handler handler.EventHandler
var mockCtrl *gomock.Controller
var mockQueue *mocks.MockRateLimitingInterface

BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
    handler = handlers.HPAHandler()
})

AfterEach(func() {
    mockCtrl.Finish()
})

It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            }
        },
        mockQueue
    })
})

It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            }
        },
        mockQueue
    })
})

It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
    })
})
handler.Update(event.UpdateEvent{
ObjectOld: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
ObjectNew: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
}, mockQueue)
})

It("adds request to reconcile Deployment when SmartLicense with HPA kind is deleted", func() {
mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
})
})

handler.Delete(event.DeleteEvent{
Object: &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
},
},
}, mockQueue)
})
})

package listeners

import (  
"context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  licensing "css.cisco.com/licensing/client-agent"
  licensingProto "css.cisco.com/licensing/client-agent/proto"
  "fmt"
  "github.com/go-logr/logr"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/types"
  "sigs.k8s.io/controller-runtime/pkg/client"

  type EntitlementListener struct {
    Log           logr.Logger
    Client        client.Client
  }

  func (l *EntitlementListener) Update(updateRequest reconcile.Request) error {
    return l.Client.Update(updateRequest)
  }

  func (l *EntitlementListener) Delete(deleteRequest reconcile.Request) error {
    return l.Client.Delete(deleteRequest)
  }

  func (l *EntitlementListener) HandleEvent(event metav1.EventType, object metav1.Object) {
    switch event {
    case metav1.EventLifecycle:
      if object, ok := object.(interface{Kind string, CreateTime metav1.Time}); ok {
        l.Log.Info("Event created")
      }
    case metav1.EventAdd:
      if object, ok := object.(interface{Kind string, CreateTime metav1.Time}); ok {
        l.Log.Info("Event added")
      }
    case metav1.EventUpdate:
      if object, ok := object.(interface{Kind string, CreateTime metav1.Time}); ok {
        l.Log.Info("Event updated")
      }
    case metav1.EventDelete:
      if object, ok := object.(interface{Kind string, CreateTime metav1.Time}); ok {
        l.Log.Info("Event deleted")
      }
    }
  }

  func (l *EntitlementListener) Serve() {
    for ; ; {
      event, err := l.Client.GetEvent(l.Namespace)
      if err != nil {
        l.Log.Error(err, "Error getting event")
        time.Sleep(1 * time.Second)
        continue
      }
      l.HandleEvent(event.Type, event.Object)
    }
  }

  func (l *EntitlementListener) Close() {
    _ = l.Client.Close()
  }

  func (l *EntitlementListener) Start() {
    go l.Serve()
  }

  func main() {
    listener := &EntitlementListener{
      Log: logr.New(logr.Logger{}),
      Client: &client.Client{
    }
    listener.Start()
  }
func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
    log := l.Log.WithValues("smartlicense", l.LicenseNsName)
    log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)

    if err := l.processEvent(event); err != nil {
        log.Error(err, "failed to process entitlement event")
        return
    }
    log.V(1).Info("successfully processed entitlement event")
}

func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()

    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense", l.LicenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }

    originalLicense := license.DeepCopy()

    switch event.Type {
    case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
        license.Status.LicenseState = v1.OutOfCompliance
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
        license.Status.LicenseState = v1.Unlicensed
        license.Status.EstimatedMaxReplicas = 0
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
        license.Status.LicenseState = v1.InCompliance
    default:
        return fmt.Errorf("unknown event type: %s", event.Type.String())
    }

    license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
    license.Status.LicenseNumber = uint32(event.EntitlementNumber)

    // using patch to avoid conflict errors caused by version mismatch and optimistic lock
    // as events from the server have the latest data, it is admissible to overwrite status without version check
    if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
        return fmt.Errorf("failed to patch SmartLicense status: %w", err)
    }
}
return nil
}
# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.

global:
  platform: $platform
imageCredentials:
    # the url to the docker registry, for example dockerhub.cisco.com
    registry: $registry
    artifactoryRepo: $artifactoryRepo
  apiGroup: sfcn.cisco.com
  fullnamePrefix: sfcn-license-

  # Docker image for the controller that manages licensing CRDs and their reconciliation
  controllerImage: $controllerImage

  # Docker image for the server-agent license server
  licenseServerImage: $licenseServerImage

  # licenseServerPort is the port where the server-agent license server is listening for requests
  licenseServerPort: 17051

  # licenseServerTransportUrl is the http transport to make use of to connect to CSSM
  licenseServerTransportUrl: $licenseServerTransportUrl

  # Default image policy that is used by all pod containers unless being explicitly overwritten
  defaultImagePullPolicy: $defaultImagePullPolicy

  # log verbosity
  logLevel: $logLevel

  # zap log encoder
  # options: console, json
  logFormat: $logFormat

  # managerMemoryRequest specifies the amount of memory to allocate per request for manager container
  managerMemoryRequest: "20Mi"

  # managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
  managerCoreRequest: "100m"

  # managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
  managerMemoryLimit: "100Mi"

  # managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
  managerCoreLimit: "100m"
# metricsPort is the port the metric endpoint binds to
metricsPort: 17080

# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"

# licenseServerXms specifies the amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory
licenseServerXms: "128M"

# licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container
licenseServerCoreRequest: "100m"

# licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container
licenseServerMemoryLimit: "768Mi"

# licenseServerXmx specifies the maximum amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory
licenseServerXmx: "512M"

# licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container
licenseServerCoreLimit: "300m"

# licenseServerStorage specifies the persistent volume size to use for storing licensing data
licenseServerStorage: "1Gi"

# disktype for dynamic azure disk storage on azure platform
# options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
azureDiskStorageAccountType: "Standard_LRS"

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "k8s.io/apimachinery/pkg/types"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface
var log = ctrl.Log.WithName("handlers").WithName("SmartLicense")

// DeploymentHandler handles SmartLicense changes and queues up events for the Deployment that the
// SmartLicense manages.
func DeploymentHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.DeploymentKind)
}

// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.HPAKind)
}

func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
    return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
        smartLicense, ok := obj.(*v1.SmartLicense)
        if !ok {
            log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
            return []ctrl.Request{}
        }
        if smartLicense.Spec.ScalingRef.Kind != scalingRefKind {
            return []ctrl.Request{}
        }
        return []ctrl.Request{{NamespacedName: types.NamespacedName{
            Namespace: smartLicense.Namespace,
            Name:      smartLicense.Spec.ScalingRef.Name,
        }}}
    })
}

package v1

import (
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
const (  
    RetryDuration = 15 * time.Second  
    MaxWaitingDuration = 5 * time.Minute  
    MaxRetryAttempts = int(MaxWaitingDuration / RetryDuration)  
    LicenseCmd = "show license feature"  
    UnlicensedResponse = "Licensing Status : Unlicensed"  
    LicensedResponse = "Licensing Status : Licensed"
)

type licenseEvent int

cost (  
    Revoked licenseEvent = iota + 1  
    Awaiting  
    Granted  
    Verified  
    CommunicationFailed
)

func (l licenseEvent) reasonCode() string {  
    switch l {  
    case Revoked:  
        return "LicenseRevoked"  
    case Awaiting:  
        return "AwaitingLicense"  
    case Granted:  
        return "LicenseGranted"  
    case Verified:  
        return "LicenseVerified"  
    case CommunicationFailed:  
        return "LicenseCommunicationFailed"  
    }  
    return "LicenseActivity"
}

func (l licenseEvent) eventType() string {  

switch l {
    case Awaiting, Revoked, CommunicationFailed:
        return coreV1.EventTypeWarning
    default:
        return coreV1.EventTypeNormal
} }

type SmartLicenseReconciler struct {
    Log                logr.Logger
    CoreClient         *coreV1Client.CoreV1Client
    Licenser           lca.LicensingClient
    Dispatcher         dispatcher.GatewayClient
    Recorder           record.EventRecorder
    tenant             *lca.Tenant
    numRetriedAttempts int
    allotment          *lca.AllotmentRequestStatus // needed to report the allotment held to server on request
    requiredNumCores   uint32
    isRegistered       bool
    lastRecordedEvent  licenseEvent // needed to avoid reporting the same event repeatedly
    notificationChan   chan event.GenericEvent
}

func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher) *SmartLicenseReconciler {
    s.notificationChan = make(chan event.GenericEvent)
    lsp.AddListener(s)
    return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
    pod := &coreV1.Pod{
    }
    s.Log.Info("lina (re)started, initiating license reconciliation")
    s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    podName := os.Getenv("POD_NAME")
    podNamespace := os.Getenv("POD_NAMESPACE")
    return ctrl.NewControllerManagedBy(mgr).
        Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{}).
        For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{
            Name: podName,
            Namespace: podNamespace,
        })).Complete(s)

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func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result, error) {
    s.Log.Info("reconciling license status", "pod", request)
    errResult := reconcile.Result{RequeueAfter: RetryDuration}
    pod, err := s.CoreClient.Pods().Get(request.NamespacedName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NamespacedName)
        return errResult, err
    }
    if s.lastRecordedEvent == 0 {
        licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
        if err != nil {
            s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
            return errResult, nil
        }
        if strings.Contains(licenseResponse, LicensedResponse) {
            s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
            s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
        } else if strings.Contains(licenseResponse, UnlicensedResponse) {
            s.recordEvent(pod, Awaiting, "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
        }
    }
    if pod.DeletionTimestamp == nil {
        s.computeRequiredNumCores(pod)
        // (re)register with the license server
        err := s.registerTenantWithLicenseServer(pod)
        if err != nil {
            return errResult, nil
        }
        // registration successful, fetch or request allotment of this tenant
        err = s.syncAllotmentStatus(pod)
        if err != nil {
            return errResult, nil
        }
        err = s.grantASAcLicenseToOperate(pod)
        if err != nil {
            return errResult, nil
        }
    } else {
        err := s.releaseAllotment()
        if err != nil {
            s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
        }
    }
}

// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list
func (s *SmartLicenseReconciler) recordEvent(pod *coreV1.Pod, event licenseEvent, description string) {
    if s.lastRecordedEvent != event || event == Verified { // always record verified events
        s.lastRecordedEvent = event
        s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
    }
}

func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *coreV1.Pod) {
    requiredCoresQuantity := resource.MustParse("0")
    var containerCores = make(map[string]string)
    for _, container := range pod.Spec.Containers {
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container", container.Name)
            if err != nil {
                s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
                continue
            }
            // set the required core quantities directly to the capacity of the node
            requiredCoresQuantity = *node.Status.Capacity.Cpu()
            break
        }
        requiredCoresQuantity.Add(containerLimit)
    }
    s.requiredNumCores = uint32(requiredCoresQuantity.Value())
    if len(pod.Spec.Containers) == len(containerCores) {
        s.Log.Info("computed resources usage", "cpu", containerCores)
    }
    s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
}

func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *coreV1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamedName{Name: pod.Name, Namespace: pod.Namespace}.String(), Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            return err
        }
    }
    return reconcile.Result{}, nil
}

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s.numRetriedAttempts = s.numRetriedAttempts + 1
if s.numRetriedAttempts > MaxRetryAttempts {
    s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
    "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
    s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license 
    communication failure (%s), "+
    "retrying communication", err.Error()))
    _ = s.revokeASAcLicenseAndRetry()
    return err
}
    s.Log.Info(fmt.Sprintf("failed to register with licensing server, will retry (reason: %s)", err.Error()),
    "retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
    return err
}
    s.recordEvent(pod, Awaiting, "successfully registered the ASA with license server, awaiting a license")
    s.isRegistered = true
}
    return nil
}

func (s *SmartLicenseReconciler) revokeASAcLicenseAndRetry() error {
    reason, err := s.Dispatcher.RevokeLicense()
    if err != nil {
        s.Log.Error(err, "failed to revoke license")
        return err
    }
    if reason != "" {
        err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
        return err
    }
    s.Log.Info("successfully revoked ASAc license")
    s.numRetriedAttempts = 0
    return nil
}

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *coreV1.Pod) error {
    allotmentStatus, err := s.Licenser.Allotment().Status(s.tenant)
    if err != nil {
        if errors.Is(err, lca.ErrLicenseServerUnavailable) {
            s.Log.Info("licensing server is unavailable, unregistering the tenant")
            s.isRegistered = false
        }
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
            "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license 
            communication failure (%s), "+
            "retrying communication", err.Error()))
            return err
        }
    }
    return nil
}
"retrying communication", err.Error())
_ = s.revokeASAcLicenseAndRetry()
return err
}
s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)", err.Error()),
"retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
return err
}

if allotmentStatus == nil {
    s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
    // no allotment was made to this tenant, requesting one
    allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
        PoolName: pod.Namespace,
        Tenant:   s.tenant,
        NumCores: s.requiredNumCores,
    })
    if err != nil {
        s.numRetriedAttempts = s.numRetriedAttempts + 1
        if s.numRetriedAttempts > MaxRetryAttempts {
            s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
            "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
            s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to
            obtain a license (%s), "+
            "retrying the operation", err.Error()))
            _ = s.revokeASAcLicenseAndRetry()
            return err
        }
        s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
            "numAttempt", s.numRetriedAttempts)
        return err
    }
    s.Log.Info("successfully leased an allotment from the licensing server")
    s.recordEvent(pod, Granted, "successfully obtained a license from the server")
    s.allotment = allotment
} else {
    s.allotment = allotmentStatus
}
s.Log.Info("allotment status verified", "cores", s.allotment.NumCores, "context", s.allotment.ContextId,
    "domain", s.allotment.SmartAccountName, "account", s.allotment.VirtualAccountName, "exportControlled",
    s.allotment.ExportControlled, "tenant", s.allotment.Tenant.Name)
return nil
}

func (s *SmartLicenseReconciler) grantASAcLicenseToOperate(pod *coreV1.Pod) error {
    if s.allotment != nil {
        s.Log.Info("license status verified, communicating the status to ASA")
        s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
        return nil
    }

    //
reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
if err != nil {
    s.Log.Error(err, "failed to grant license")
    return err
}
if reason != "" {
    err = fmt.Errorf("ASAc failed to set license : %v", reason)
    return err
}
s.numRetriedAttempts = 0
s.Log.Info("successfully granted license to ASA")
} else {
    s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")
}
return nil

func (s *SmartLicenseReconciler) releaseAllotment() error {
    _ = s.revokeASAcLicenseAndRetry()
    if s.allotment != nil {
        err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
            ContextId: s.allotment.ContextId,
            Tenant:    s.tenant,
        })
        if err != nil {
            s.Log.Error(err, "failed to release the allotment to server")
            return err
        }
        s.allotment = nil
    }
    return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
podName := types.NamespacedName{
    Namespace: os.Getenv("POD_NAMESPACE"),
    Name:      os.Getenv("POD_NAME"),
}
pod, err := s.CoreClient.Pods().Get(podName)
if err != nil {
    s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
}
switch event.Type {
case proto.AllotmentEvent_RELEASE_ALLOTMENT:
    s.Log.Info("license requested to be released by the server, un-licensing ASA")
    if err == nil {
        s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying to acquire")
    }}
case proto.AllotmentEvent_REPORT_ALLOTMENT:
    s.Log.Info("license requested to be reported to the server")
    _ = s.reportAllotment()
}

func (s *SmartLicenseReconciler) reportAllotment() error {
    allotment := &lca.AllotmentReport{ContextId: ",", Tenant: s.tenant, NumCores: 0}
    if s.allotment != nil {
    } err := s.Licenser.Allotment().ReportAllotment(allotment)
    if err != nil {
        s.Log.Error(err, "failed to report the allotment to server")
    } return err
}

---

apiVersion: v1
kind: Secret
metadata:
    name: cssm-token
    namespace: sfcn-system
stringData:
    # this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
    token:
        "NGVmN2EwNjctMzRhZS00M2ZkLTkyODktYjlmMjBmNTNjNjjkLTE2NDYyMTIx%0AOTU2NjF8UnBHL3NzTUU5S1daeDjiSmNBYStBMTVyK05qQlBzTHJJSkk0TE9r%0ARUg4WT0%3D%0A"

---

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
    name: sfcn-enforcer
    namespace: sfcn-system
spec:
    action: "REGISTER"
    tokenSecret:
        name: cssm-token
        namespace: sfcn-system
    minLicenseCount: 1
    maxLicenseCount: 12
    scalingFactor: 4
    scalingRef:
        kind: Deployment
        name: sfcn-enforcer
// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import {
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
    time "time"
}

// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl *gomock.Controller
    recorder *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
}

// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}

// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
}

// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add", reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}
// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddRateLimited", reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
func (m *MockRateLimitingInterface) Done(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
func (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Done", reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}

// Forget mocks base method
func (m *MockRateLimitingInterface) Forget(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
func (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Forget",
reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
func (m *MockRateLimitingInterface) Get() (interface{}, bool) {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Get")
ret0, _ := ret[0].(interface{})
ret1, _ := ret[1].(bool)
return ret0, ret1
}

// Get indicates an expected call of Get
func (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Get",
reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "Len")
ret0, _ := ret[0].(int)
return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len",
reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}

// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "NumRequeues", arg0)
ret0, _ := ret[0].(int)
return ret0
}

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
mr.mock.ctrl.T.Helper()
return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues",
reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}

// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShuttingDown))
}

package listeners_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
)

const (
    smartLicenseName = "license-sample"
    defaultNs       = "default"
    licenseType     = "L-ASAV10S-STD"
)

func TestListeners(t *testing.T) {
    RegisterFailHandler(Fail)
RunSpecs(t, "Listeners Suite")
}
var _ = BeforeSuite(func() {
_ = v1.AddToScheme(scheme.Scheme)
})
FROM gcr.io/distroless/java-debian10:nonroot
WORKDIR /
COPY license-broker/bin/sa-server-*-all.jar sa-server-all.jar
ENTRYPOINT ["java", "-jar", "sa-server-all.jar"]
/***************************************************************
* Copyright (c) 2021 Cisco Systems, Inc.
* All rights reserved.
* Unauthorized redistribution prohibited.
**************************************************************/
package v1
import (
"context"
"fmt"
appsv1 "k8s.io/api/apps/v1"
autoscalingv1 "k8s.io/api/autoscaling/v1"
v1 "k8s.io/api/core/v1"
"k8s.io/apimachinery/pkg/api/errors"
"k8s.io/apimachinery/pkg/runtime"
"k8s.io/apimachinery/pkg/types"
"k8s.io/apimachinery/pkg/util/validation/field"
ctrl "sigs.k8s.io/controller-runtime"
"sigs.k8s.io/controller-runtime/pkg/client"
logf "sigs.k8s.io/controller-runtime/pkg/log"
"sigs.k8s.io/controller-runtime/pkg/webhook"
)
// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac8996bb5a8def84"
var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1
// log is for logging in this package.
var smartlicenselog = logf.Log.WithName("smartlicense-resource")
var webhookClient client.Client
func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {

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webhookClient = mgr.GetClient()
return ctrl.NewWebhookManagedBy(mgr).
For(r).
Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io

var _ webhook.Defaulter = &SmartLicense{}

// Default implements webhook.Defaulter so a webhook will be registered for the type
func (r *SmartLicense) Default() {
    log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)

    if r.Spec.Action == "" {
        r.Spec.Action = Register
    }
    if r.Spec.LicenseType == "" {
        r.Spec.LicenseType = SFWLicenceTag
    }
    if r.Spec.MinLicenseCount == nil {
        r.Spec.MinLicenseCount = &defaultMinLicenseCount
    }
    if r.Spec.MaxLicenseCount == nil {
        r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
    }
    if r.Spec.ScalingFactor == nil {
        r.Spec.ScalingFactor = &defaultScalingFactor
    }

    log.V(1).Info("updated SmartLicense default values")
}

// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io

var _ webhook.Validator = &SmartLicense{}

// ValidateCreate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateCreate() error {
    smartlicenselog.V(1).Info("validate create", "name", r.Name)

    var allErrs field.ErrorList
    r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
    r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)

    return &allErrs
}
r.validateMinimum(1, r.Spec.ScalingFactor, "scalingFactor", &allErrs)
r.requireRegisterAction(&allErrs)
r.validateLicenseCount(&allErrs)
r.validateToken(&allErrs)
r.validateScalingRef(&allErrs)

if len(allErrs) == 0 {
    return nil
}
return allErrs.ToAggregate()

// ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
    smartlicenselog.V(1).Info("validate update", "name", r.Name)

    var allErrs field.ErrorList
    r.validateLicenseCount(&allErrs)

    // avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
    if r.GetDeletionTimestamp() == nil {
        r.validateToken(&allErrs)
r.validateScalingRef(&allErrs)
    }
    oldObj := old.(*SmartLicense)
r.requireNoLicenseTypeChange(&allErrs, oldObj)

    if len(allErrs) == 0 {
        return nil
    }
    return allErrs.ToAggregate()
}

// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
        field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}

func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
    *errs = append(*errs,
        field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")

    if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount <
        *r.Spec.MinLicenseCount {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum
                license count"))
    }
}

func (r *SmartLicense) validateToken(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("tokenSecret")
    secret := &v1.Secret{}
    if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "token secret is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
            return
        }
    }

    if len(secret.Data[TokenKeyName]) == 0 {
        *errs = append(*errs, field.Required(path.Child("data").Child(TokenKeyName), "cannot be empty"))
    }
}

func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("scalingRef")

    if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == "" {
        *errs = append(*errs, field.Required(path, "kind or name of referenced object cannot be empty"))
        return
    }

    key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
    var obj client.Object
    switch r.Spec.ScalingRef.Kind {
    case DeploymentKind:
        obj = &appsv1.Deployment{}
case HPAKind:
obj = &autoscalingv1.HorizontalPodAutoscaler{}
default:
return
}

if err := webhookClient.Get(context.TODO(), key, obj); err != nil {
if errors.IsNotFound(err) {
*errs = append(*errs, field.Required(path, "referenced object is not found"))
return
} else {
*errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: %w", err)))
return
}
}

func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
if val == nil || *val < min {
path := field.NewPath("spec").Child(path)
*errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to %d", min)))
}
}

package listeners_test

import {
"context"
v1 "css.cisco.com/kasa/license-broker/api/v1"
"css.cisco.com/kasa/license-broker/controllers/listeners"
licensingProto "css.cisco.com/licensing/client-agent/proto"
. "github.com/onsi/ginkgo"
. "github.com/onsi/gomega"
autoscalingv1 "k8s.io/api/autoscaling/v1"
corev1 "k8s.io/api/core/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"k8s.io/apimachinery/pkg/apis/meta" "k8s.io/apimachinery/pkg/types" "k8s.io/client-go/kubernetes/scheme" "sigs.k8s.io/controller-runtime/pkg/client"
"sigs.k8s.io/controller-runtime/pkg/client/fake" logf "sigs.k8s.io/controller-runtime/pkg/log"
}

const (epDeploymentName = "epDeployment"
entitlementNumber = 4
coresPerLicenseType = 2

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var _ = Describe("Entitlement Listener Test", func() {

licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

var listener *listeners.EntitlementListener
var fakeClient client.Client
var smartLicense *v1.SmartLicense

BeforeEach(func() {
  var defaultLicenseCount uint32 = 1
  var maxLicenseCount uint32 = 3
  smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
      Action: v1.Register,
      LicenseType: licenseType,
      MinLicenseCount: &defaultLicenseCount,
      MaxLicenseCount: &maxLicenseCount,
      ScalingFactor: &defaultLicenseCount,
    },
  }
  fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()

  listener = &listeners.EntitlementListener{
    Log: logf.NullLogger{},
    Client: fakeClient,
    LicenseNsName: licenseNsName,
  }
})

It("should update license status on OUT_OF_COMPLIANCE event", func() {
  event := licensingProto.EntitlementEvent{
    Type: licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
    Message: "entitlement is out of compliance",
    EntitlementSku: licenseType,
    EntitlementNumber: entitlementNumber,
    CoresPerLicenseType: coresPerLicenseType,
  }
  listener.OnEntitlementEvent(&event)

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})
It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
    event := licensingProto.EntitlementEvent{
        Type:    licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
        Message: "granted new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:    licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
        Message: "failed to reserve a new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
    name: smartlicense-redirector
    namespace: sfcn-system
spec:
    action: "REGISTER"
    tokenSecret:
        name: cssm-token
        namespace: sfcn-system
    minLicenseCount: 1
    maxLicenseCount: 4
kind: Deployment
name: sfcn-vpnredirector-enforcer

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/kasa/license-broker/controllers (interfaces: ReplicasCalculator)

// Package mocks is a generated GoMock package.
package mocks

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    gomock "github.com/golang/mock/gomock"
    v10 "k8s.io/api/apps/v1"
    reflect "reflect"
)

// MockReplicasCalculator is a mock of ReplicasCalculator interface
type MockReplicasCalculator struct {
    ctrl    *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}

// MockReplicasCalculatorMockRecorder is the mock recorder for MockReplicasCalculator
type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

// NewMockReplicasCalculator creates a new mock instance
func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

// CalculateMaxLicensedReplicas mocks base method
func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1 *v10.Deployment) (int32, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
    ret0, _ := ret[0].(int32)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}
// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{})
*gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "CalculateMaxLicensedReplicas",
        reflect.TypeOf((*MockReplicasCalculator)(nil).CalculateMaxLicensedReplicas), arg0, arg1)
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import {
    clientagent "css.cisco.com/licensing/client-agent"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
}

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
    ctrl     *gomock.Controller
    recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
    mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
    mock := &MockLicensingClient{ctrl: ctrl}
    mock.recorder = &MockLicensingClientMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
    return m.recorder
}

// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Allotment")
    ret0, _ := ret[0].(clientagent.AllotmentService)
    return ret0
}
return ret0
}

// Allotment indicates an expected call of Allotment
func (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Allotment",
        reflect.TypeOf((*MockLicensingClient)(nil).Allotment))
}

// Entitlement mocks base method
func (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Entitlement")
    ret0, _ := ret[0].(clientagent.EntitlementService)
    return ret0
}

// Entitlement indicates an expected call of Entitlement
func (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Entitlement",
        reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
func (m *MockLicensingClient) Registration() clientagent.RegistrationService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Registration")
    ret0, _ := ret[0].(clientagent.RegistrationService)
    return ret0
}

// Registration indicates an expected call of Registration
func (mr *MockLicensingClientMockRecorder) Registration() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Registration",
        reflect.TypeOf((*MockLicensingClient)(nil).Registration))
}

// Subscription mocks base method
func (m *MockLicensingClient) Subscription() clientagent.SubscriptionService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Subscription")
    ret0, _ := ret[0].(clientagent.SubscriptionService)
    return ret0
}

// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
        reflect.TypeOf((*MockLicensingClient)(nil).Subscription))
}
// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call { 
    mr.mock.ctrl.T.Helper() 
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription", 
        reflect.TypeOf((*MockLicensingClient)(nil).Subscription)) 
}
}

package services_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/services"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (
    smartLicenseName = "license-sample"
    defaultNs = "default"
    licenseType = "L-ASAV10S-STD"
)

var ( 
    minLicenseCount uint32 = 1
    maxLicenseCount uint32 = 5
    scalingFactor uint32 = 2
)

var _ = Describe("ReplicasCalculator Service Test", func() { 
    var ( 
        deployment *appsv1.Deployment 
        licenses []v1.SmartLicense 
        fakeClient client.Client 
        replicasCalculator *services.ReplicasCalculator 
        smartLicense v1.SmartLicense 
        node *corev1.Node 
    )
})
licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}
BeforeEach(func() {
  licenses = []v1.SmartLicense{
  fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
  replicasCalculator = services.NewReplicasCalculator(fakeClient, logf.NullLogger{})

  var replicaCount int32 = 1
deployment = &appsv1.Deployment{
  ObjectMeta: metav1.ObjectMeta{Name: "ep", Namespace: "default"},
  Spec: appsv1.DeploymentSpec{
    Replicas: &replicaCount,
    Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},
    Template: corev1.PodTemplateSpec{
          Name: "ep-container",
          Resources: corev1.ResourceRequirements{
            Limits: map[corev1.ResourceName]resource.Quantity{
              "cpu": resource.MustParse("2000m"),
            },
          },
        },
      },
      Status: appsv1.DeploymentStatus{ReadyReplicas: replicaCount},
    }
  }
}
pod := &corev1.Pod{
  ObjectMeta: metav1.ObjectMeta{
    Name: "ep-pod",
    Namespace: defaultNs,
    Labels: map[string]string{"role": "enforcer"},
  },
  Spec: corev1.PodSpec{NodeName: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

node = &corev1.Node{
  ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
}
Expect(fakeClient.Create(context.TODO(), node)).To(Succeed())

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

smartLicense = v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
  Action:          v1.Register,
  LicenseType:     licenseType,
  MinLicenseCount: &minLicenseCount,
  MaxLicenseCount: &maxLicenseCount,
  ScalingFactor:   &scalingFactor,
},

}

Expect(fakeClient.Create(context.TODO(), &smartLicense)).To(Succeed())

})

AfterEach(func() {
  Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Pod{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &corev1.Node{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
})

It("should return default value because license state is not in compliance", func() {
  smartLicense.Status.LicenseState = v1.OutOfCompliance
  Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())
  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(int32(2)))
  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should calculate max limits based on 2 smart licenses", func() {
  smartLicense2 := v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      Action:          v1.Register,
      LicenseType:     licenseType,
      MinLicenseCount: &minLicenseCount,
      MaxLicenseCount: &maxLicenseCount,
      ScalingFactor:   &scalingFactor,
    },
  },
  smartLicense.Status.LicenseState = v1.OutOfCompliance
  Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())
  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(int32(1)))
  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
}).

It("should calculate max limits based on 2 smart licenses", func() {
  smartLicense2 := v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      Action:          v1.Register,
LicenseType:     licenseType,
MinLicenseCount: &minLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor:   &scalingFactor,
},
Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance, CoresPerLicense: 1},
}

Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
licenses = append(licenses, smartLicense2, smartLicense)

maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(4)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense2)).ShouldNot(HaveOccurred())
Expect(smartLicense2.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
}

It("should look at node limits if pod containers do not have limits defined", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{}
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(int32(1)))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
}

It("should return default value if pod containers do not have limits defined and deployment ready replicas is 0", func() {
  deployment.Spec.Template = corev1.PodTemplateSpec{}
  deployment.Status.ReadyReplicas = 0
  Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

  licenses = append(licenses, smartLicense)
  maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
  Expect(err).ShouldNot(HaveOccurred())
  Expect(maxReplicas).Should(Equal(*deployment.Spec.Replicas))

  Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
})
It("should return default value if there is no node defined in pod spec", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    Expect(fakeClient.Delete(context.TODO(), node)).To(Succeed())

    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).Should(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
    Expect(maxReplicas).Should(Equal(int32(0)))
})

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

{{ include "aegis.configmap.standard" (list . "config" "kasa.licensebroker.config") }}

---

{{- define "kasa.licensebroker.config" -}}
{{- $ := first . -}}
{{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") }}
{{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName }}

apiVersion: v1
kind: ConfigMap
data:
  server-id.json:
  {
    "name": "{{ $licenseServerName }}",
    "hostname": "{{ $hostname }}",
    "ipAddress": "",
    "productld": "SFW",
    "softwareTag": "regid.2021-01.com.cisco.SFW,1.0_6f4891e2-97a4-443b-ad9a-9675b85b504f",
    "serialNumber": "{{ $hostname | sha256sum | trunc 11 | upper }}",
    "storagePath": "/home/nonroot/licensing/{{ $.Release.Namespace }}",
    "transportHttpUrl": "{{ $.Values.licenseServerTransportUrl }}"
  }
{{- end -}}

package controllers

import (
    "context"
v1 "css.cisco.com/kasa/license-broker/api/v1"
type HPALicenseReconciler struct {
    client.Client
    Log                logr.Logger
    Recorder           record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
    For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(
        &predicates.LabelExistsPredicate{Key: LicenseHolderLabel}).
    Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).
    Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    hpa := &autoscalingv1.HorizontalPodAutoscaler{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("HPA does not exist, nothing to reconcile")
        } else {
            return ctrl.Result{}, errors.Wrap(err, "failed to get HPA")
        }
    } else {
            log.V(1).Info("HPA needs to scale")
            return ctrl.Result{Requeue: true, RequeueAfter: 10 * time.Second}, nil
        }
    }

    return ctrl.Result{}, nil
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
hpaLicenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpaLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)
    }
    log.Info("updated HPA labels")
}

if len(hpaLicenses) == 0 {
    log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(hpaLicenses) {
    log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")
    return ctrl.Result{}, nil
}

    log.Info("scaled resource is not deployment")
    return ctrl.Result{}, nil
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)
if err != nil {
    return ctrl.Result{}, err
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpaLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

if hpa.Spec.MaxReplicas > maxLicensedReplicas {
    hpa.Spec.MaxReplicas = maxLicensedReplicas
}
changedFields := []string{"MaxReplicas"}
    changedFields = append(changedFields, "MinReplicas")
}

if err = c.Client.Update(context.Background(), hpa); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update HPA resource: %w", err)
}
c.Recorder.Event(hpa, corev1.EventTypeWarning, "HPAScaledDown", fmt.Sprintf("Decreased HPA's %s to %d as it is the maximum EP replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", changedFields, maxLicensedReplicas))
return ctrl.Result{}, nil

log.Info("skipping HPA update, system has enough licenses to have all HPA's MaxReplicas running", "hpaMaxReplicas", hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil

func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa *autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
    deploymentName := hpa.Spec.ScaleTargetRef.Name
    deployment := &appsv1.Deployment{
        metadata: &metav1.ObjectMeta{
            name: deploymentName,
            namespace: hpa.Namespace,
        },
    }
    if err != nil {
        return nil, err
    }
    return deployment, err
}

---

apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
  creationTimestamp: null
  name: mutating-webhook-configuration
webhooks:
- admissionReviewVersions:
  - v1
  clientConfig:
    service:
      name: webhook-service
      namespace: system
    path: /mutate-sfcn-cisco-com-v1-smartlicense
failurePolicy: Fail
name: msmartlicense.kb.io
rules:
  - apiGroups:
    - sfcn.cisco.com
  apiVersions:
    - v1
  operations:
    - CREATE
    - UPDATE
  resources:
    - smartlicenses
  sideEffects: None

---

apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
  creationTimestamp: null
name: validating-webhook-configuration
webhooks:
  - admissionReviewVersions:
    - v1
  clientConfig:
    service:
      name: webhook-service
      namespace: system
      path: /validate-sfcn-cisco-com-v1-smartlicense
  failurePolicy: Fail
name: vsmartlicense.kb.io
rules:
  - apiGroups:
    - sfcn.cisco.com
  apiVersions:
    - v1
  operations:
    - CREATE
    - UPDATE
  resources:
    - smartlicenses
  sideEffects: None

// +build !ignore_autogenerated

/***************************************************************
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**************************************************************/
// Code generated by controller-gen. DO NOT EDIT.

package v1

import (
    "k8s.io/apimachinery/pkg/runtime"
)

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.Spec.DeepCopyInto(&out.Spec)
    out.Status = in.Status
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicense.
func (in *SmartLicense) DeepCopy() *SmartLicense {
    if in == nil {
        return nil
    }
    out := new(SmartLicense)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicense) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.ListMeta.DeepCopyInto(&out.ListMeta)
    if in.Items != nil {
        in, out := &in.Items, &out.Items
        *out = make([]SmartLicense, len(*in))
        for i := range *in {
            (*in)[i].DeepCopyInto(&(*out)[i])
        }
    }
}
// DeepCopy is an autogenerated deep copy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}

// DeepCopy is an autogenerated deep copy function, copying the receiver, creating a new SmartLicenseSpec.
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseSpec)
in.DeepCopyInto(out)
return out
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {
    *out = *in
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseStatus.
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseStatus)
in.DeepCopyInto(out)
return out
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: EntitlementService)

// MockEntitlementService is a mock of EntitlementService interface
type MockEntitlementService struct {
    ctrl     *gomock.Controller
    recorder *MockEntitlementServiceMockRecorder
}

// MockEntitlementServiceMockRecorder is the mock recorder for MockEntitlementService
type MockEntitlementServiceMockRecorder struct {
    mock *MockEntitlementService
}

// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
mock.recorder = &MockEntitlementServiceMockRecorder{mock}
return mock
}
// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}

// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Notify", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify", reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}

// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement", reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
const (  
secretName = "secretTest"
)

var _ = Describe("SecretHandler", func() {
var handler handler.EventHandler  
var mockCtrl *gomock.Controller  
var mockQueue *mocks.MockRateLimitingInterface  
var coreClient client.Client

BeforeEach(func() {
  mockCtrl = gomock.NewController(GinkgoT())
  mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
  coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
  handler = handlers.SecretHandler(coreClient)
})

AfterEach(func() {
  mockCtrl.Finish()
})

It("should do nothing where there are no smart license objects", func() {
  handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
      ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
  }, mockQueue)
})

It("should not add request because secret is not used in SmartLicense object", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name:      "some_secret",
        Namespace: defaultNamespace,
      },
    },
  }
  Status: v1.SmartLicenseStatus{
    RegistrationState: v1.RegistrationFailed,
  }
})
handler.Update(event.UpdateEvent{
  ObjectNew: &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
  },
  }, mockQueue)
})

It("should not add request because SmartLicense is registered", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name:      smartLicenseName,
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.Registered,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))
})

handler.Update(event.UpdateEvent{
  ObjectNew: &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
  },
  }, mockQueue)
})

It("should not add request because SmartLicense is deregistered", func() {
  smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
      TokenSecret: corev1.SecretReference{
        Name:      smartLicenseName,
        Namespace: defaultNamespace,
      },
    },
    Status: v1.SmartLicenseStatus{
      RegistrationState: v1.Deregistered,
    },
  }
  Expect(coreClient.Create(context.TODO(), smartLicenseObject))
})
handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
}, mockQueue)
})

It("should add request because SmartLicense status is registration failed", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      secretName,
                Namespace: defaultNamespace,
            },
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.RegistrationFailed,
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))
}

mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
}, mockQueue)
})

It("should add request for SmartLicense even if secret is in different namespace", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name:      secretName,
                Namespace: "test-namespace",
            },
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.RegistrationFailed,
        },
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))
}
mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: "test-namespace"},
    },
    }, mockQueue)
})
})

# License Broker

License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).

## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:
```
```
```shell

golang -w GOPRIVATE="css.cisco.com/*"
```
metadata:

checksum/license-config: {{ include "aegis.configmap.standard" (list $ "config" "kasa.licensebroker.config") | sha256sum }}

spec:

securityContext:
# 65532 is ID of nonroot user group
fsGroup: 65532

{{- if eq $global.platform "eks" }}
dnsPolicy: ClusterFirstWithHostNet
hostNetwork: true
{{- end }}

{{- if ($.Values.global.platform | eq "azure") }}
{{- /* https://github.com/kubernetes-sigs/azuredisk-csi-driver/issues/815
azure disk seems to ignore fsgroup setting right now for v1.2.0 release,
need an init container to fix permissions */}}
initContainers:
  - name: change-ownership
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    command: ['sh', '-c', 'chown -R 65532:65532 /home/nonroot']
    volumeMounts:
      - mountPath: /home/nonroot
        name: disk
    securityContext:
      # Files or directories created with HostPath on the host are only writable by root. Which means, you either
      # need to run your container process as root or modify the file permissions on the host to be writable by
      # non-root user.
      runAsUser: 0
      capabilities:
        add:
          - DAC_OVERRIDE
          - FOWNER

containers:

  - name: manager
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
    env:
      {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
    args:
      - --zap-log-level={{ $.Values.logLevel }}
      - --zap-encoder={{ $.Values.logFormat }}
      - --webhook-port={{ $.Values.webhookPort }}
      - --metrics-port={{ $.Values.metricsPort }}
      - --license-server-port={{ $.Values.licenseServerPort }}
    ports:
- containerPort: {{ $.Values.webhookPort }}
  name: webhook-server
  protocol: TCP

resources:
  requests:
    cpu: {{ $.Values.managerCoreRequest }}
    memory: {{ $.Values.managerMemoryRequest }}

limits:
  cpu: {{ $.Values.managerCoreLimit }}
  memory: {{ $.Values.managerMemoryLimit }}

securityContext:
  allowPrivilegeEscalation: false

- name: license-server

  image: {{ include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) }}
  imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}

  command:
    - "java"
    - "-Xms{{ $.Values.licenseServerXms }}"
    - "-Xmx{{ $.Values.licenseServerXmx }}"
    - "-jar"
    - "sa-server-all.jar"
    - "--configFile"
    - "/etc/licensing/server-id.json"
    - "--port"
    - {{ $.Values.licenseServerPort | quote }}

  ports:
    - containerPort: {{ $.Values.licenseServerPort }}
      protocol: TCP

securityContext:
  # 65532 is ID of nonroot user
  runAsUser: 65532
  allowPrivilegeEscalation: false

env:
  {{ include "aegis.containers.standardEnv" (list $) | indent 12 }}

resources:
  requests:
    cpu: {{ $.Values.licenseServerCoreRequest }}
    memory: {{ $.Values.licenseServerMemoryRequest }}

limits:
  cpu: {{ $.Values.licenseServerCoreLimit }}
  memory: {{ $.Values.licenseServerMemoryLimit }}

volumeMounts:
  - mountPath: /home/nonroot
    name: disk
  - mountPath: /etc/licensing/server-id.json
    name: license-config
    subPath: server-id.json

volumes:
- name: disk
  persistentVolumeClaim:
    claimName: {{ include "aegis.metadata.fullname" (list $ "server") }}
- name: license-config
  configMap:
    name: {{ include "aegis.metadata.fullname" (list $ "config") }}
    {{- if ne $global.platform "kind" }}
    imagePullSecrets:
      - name: regsfcn
    {{- end }}
  terminationGracePeriodSeconds: 10
{{- end }}

{{ include "aegis.services.deployment" (list $ "configurer" "kasa.licensebroker.server") -}}
{{- define "kasa.licensebroker.server" -}}
{{- $ := first . -}}
apiVersion: v1
kind: Service
metadata:
  name: {{ include "aegis.metadata.fullname" (list $ "server") }}
spec:
  ports:
    - protocol: TCP
      port: 80
      targetPort: {{ $.Values.licenseServerPort }}
type: ClusterIP
{{- end -}}

cloud.google.com/go v0.26.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLiCk0CImMTw=
cloud.google.com/go v0.34.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLiCk0CImMTw=
cloud.google.com/go v0.38.0/go.mod h1:990N+gfupTy94rShfmMCWGj0LpTmnzTSpqbd1dvSRU=
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cloud.google.com/go v0.46.3/go.mod h1:a6bKKbmY7er1ml7TEH4lsAktm/khTSZK8w33B4RAG0=
cloud.google.com/go v0.51.0 h1:PVKAVQWClRGUSiZkGW3QLeLKaWq7KYv/MW1EboG8bfM=
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cloud.google.com/go/datastore v1.0.0/go.mod h1:LXYbyblFSglQ5pkeyhO+Qmw7ukd3C+oP7TkLGzqphYE=
cloud.google.com/go/pubsub v1.0.1/go.mod h1:R0Gpsv3s5REJCy4fxDixWD93iHIJMoZTyQ2kNnGrt3I=
cloud.google.com/go/storage v1.0.0/go.mod h1:1htSnM/ZE7ZV8YYJWCy8RULGVqBDMpoyjwiyRyan+URw=
css.cisco.com/licensing/client-agent v0.1.11 h1:LC+Lm0do+wx2/x7xne9ao6KToG7WbO1QX7TvB5x2xpo=
css.cisco.com/licensing/client-agent v0.1.11/go.mod h1:Y2jdZP6Je7nWHkzof3f34BMIv1vETPbwbCBIrVRM=
dmitri.shuraylov.com/gpu/ml v0.0.0-20190408044501-666a987793e9/go.mod
h1:H6x/7gZCbc22OMCxBHrMx7a5I7Hp+++hsVxbQBYO7hU=
github.com/Azure/go-ansiterm v0.0.0-20170929234023-d6e3b3328b78/go.mod
h1:LmzpDX56iTiv29bbRTsUNlaFuhWRQBWjQdVyAevI8= github.com/Azure/go-autorest/autorest v0.9.0/go.mod
h1:xyHB1BMZTOcaDH9U7I0+g046+BFDTQ8rEZB0s4Yfa6bl= github.com/Azure/go-autorest/autorest v0.9.6/go.mod
h1:FA/iAG9t/K7sb5I5qQ+RSTUDAmGFqj0vUdVNNX8q630= github.com/Azure/go-autorest/autorest/adal v0.5.0/go.mod
h1:8Z9fGy2Mpx0PvDjBIpEgQTmVqGhiHBW7RJJeCiWzS0= github.com/Azure/go-autorest/autorest/adal v0.8.2/go.mod
h1:ZJuHCITQtx4355RJ2iMIOxPYt3d2C7T7tJQCVZn3Q= github.com/Azure/go-autorest/autorest/date v0.0.0/go.mod
h1:plVp3oPSKw2DNj1BiJWF/7wvR+r+UD/ELuzDCXwHUVAN= github.com/Azure/go-autorest/autorest/date v0.0.2/go.mod
h1:veORJHLEh643/Ioh9+vPmf1lj9AEBM5FuBIXLmly0g= github.com/Azure/go-autorest/autorest/mocks v0.0.0/go.mod
h1:OTyCOPRA2IgIlWxXyBee2F5Gr4kF2zd2J5cFRaIDN0= github.com/Azure/go-autorest/autorest/mocks v0.2.0/go.mod
h1:OTyCOPRA2IgIlWxXyBee2F5Gr4kF2zd2J5cFRaIDN0= github.com/Azure/go-autorest/autorest/mocks v0.3.0/go.mod
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github.com/pelletier/go-toml v1.2.0/go.mod h1:5z9KED0ma1S8yP61duit58dfprGBbd/94h7iaic=  
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github.com/prometheus/client_golang v0.9.1/go.mod h1:7SWBe2y4D6OKWSNQUaRYY/AAxPKyh/dDVN+NZv0KFw=  
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github.com/prometheus/procfs v0.0.0-20190507164030-5867b95ac084/go.mod h1:VjFzjK7qMq7bho0r+GuxiXLJLNApMmp2qUWDplCzz2dUR/wM=  
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- golang.org/x/tools v0.0.0-20180221164845-07fd8470d635/go.mod
- golang.org/x/tools v0.0.0-20180917221912-90fa682c2a6e/go.mod
- golang.org/x/tools v0.0.0-201810011042414-18f49cf54d09/go.mod
- golang.org/x/tools v0.0.0-2018100114222345-bf090417da8b/go.mod
- golang.org/x/tools v0.0.0-2018103021726-6c7e314b6563/go.mod
- golang.org/x/tools v0.0.0-201901125230254-d66bd3c5d5a6/go.mod
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- golang.org/x/tools v0.0.0-20191012520004-8de300cfc20a/go.mod
- golang.org/x/tools v0.0.0-20191029041327-9cc4af7d6b2c/go.mod
package controllers

import (  v1 "css.cisco.com/kasa/license-broker/api/v1"   "github.com/onsi/ginkgo"   "github.com/onsi/gomega" autoscalingv1 "k8s.io/api/autoscaling/v1" metav1 "k8s.io/apimachinery/pkg/apis/meta/v1" "k8s.io/apimachinery/pkg/apis/meta/v1" "strings"   
)

var _ = Describe("Common Test", func() {
  It("serialNumber", func() {
    serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())
    Expect(len(serialNum)).Should(Equal(11))
    Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))
    Expect(serialNum).Should(Equal("F0529A6CDD9"))
  })

  It("containsString", func() {
    list := []string{"one", "two", "three"}
    Expect(containsString(list, "three")).Should(BeTrue())
    Expect(containsString(list, "four")).Should(BeFalse())
  })
})

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It("removeString", func() {
    list := []string{"one", "two", "three"}
    Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
    Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
})

It("filterLicensesByState", func() {
    licenses := []v1.SmartLicense{
        {
            ObjectMeta: metav1.ObjectMeta{
                Name: "license1",
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Deregistered,
            },
            {
                ObjectMeta: metav1.ObjectMeta{
                    Name: "license2",
                },
                Status: v1.SmartLicenseStatus{
                    RegistrationState: v1.Registered,
                },
            }
    }
    filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
    Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
        ObjectMeta: metav1.ObjectMeta{
            Name: "license1",
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Deregistered,
        },
    }}))
    filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
    Expect(filteredLicenses).Should(BeEmpty())
})

It("filterLicensesByKind", func() {
    var licenses v1.SmartLicenseList
    licenses.Items = []v1.SmartLicense{
        {
            Spec: v1.SmartLicenseSpec{
                ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
            },
        },
    }
    filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
    Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
        ObjectMeta: metav1.ObjectMeta{
            Name: "license1",
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Deregistered,
        },
    }}))
    filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
    Expect(filteredLicenses).Should(BeEmpty())
})
filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")

filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
Expect(filteredLicenses).Should(BeNil())

filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")

It("pendingLicenseExists", func() {
licenses := []v1.SmartLicense{ {
{ Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance}, }, {
Status: v1.SmartLicenseStatus{LicenseState: v1.OutOfCompliance}, }, }

Expect(pendingLicenseExists(licenses)).Should(BeFalse())
licenses = append(licenses, v1.SmartLicense{ Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState }, })

Expect(pendingLicenseExists(licenses)).Should(BeTrue())
})
It("setLicenseLabel", func() {
meta := metav1.ObjectMeta{}
res := setLicenseLabel(&meta, LicenseHolderLabel, true)
Expect(res).Should(BeTrue())

val, ok := meta.Labels[LicenseHolderLabel]
Expect(ok).Should(BeTrue())
Expect(val).Should(Equal("true"))

res = setLicenseLabel(&meta, LicenseHolderLabel, true)
Expect(res).Should(BeFalse())

res = setLicenseLabel(&meta, LicenseHolderLabel, false)
Expect(res).Should(BeTrue())

_, ok = meta.Labels[LicenseHolderLabel]
Expect(ok).Should(BeFalse())
})
})
---
title: "Licensing the Cluster"
weight: 2
description: >
Learn how to license a scalable cluster, understand the components involved, and the implications of an unlicensed cluster
---

Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing.
There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.
/**************************************************************************
* Copyright (c) 2021 Cisco Systems, Inc.
* All rights reserved.
* Unauthorized redistribution prohibited.
***************************************************************************/
# Smart Licensing

* Licensing a kASA cluster involves licensing every ASA instance running in the cluster. Since the ASA instances are ephemeral, a license server runs locally in your cluster to manage the license lifecycle of these ASA instances. This server is responsible for registering the set of ASA instances you license with the Cisco Smart Software Manager, obtain or release the licenses based on the number of cores those instances use, and releasing all the licenses back to your Smart account when you deregister the cluster.

* After kASA bundle is successfully installed with licensing enabled, to license the cluster, you need a token from
your Smart Account that has Secure Firewall (SFW) licenses.
Go to [software.cisco.com](www.software.cisco.com) and navigate to Smart Software Licensing. Find `asac-dev` virtual account that has the SFW licenses and generate a token from it.

For development purposes, we have created a token that you can use:

```
YTRkNWFlM2MtZWEzLWI2MDEtZmIzZmRjZGQ2ODJiLTE2NDgzMjc5O0OUDU2MDN8bGpoZE
xXdGNxSDkvY0h3cnndUjFpVmpGbEZ2YVBwTTdUEI0MWhZ0AmStTRT0%3D%0A
```

If this token has expired, please send an email to sfcn-controlplane@cisco.com

* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc) and a service type (e.g. 'Deployment' or 'HorizontalPodAutoscaler').

* Examples of the secret and the Smart License object are located [here](../../license-broker/config/samples/sfcn.cisco.com_v1_smartlicense.yaml).

Licensing setup comprises two components - the License Server, and the License Controller.

References to Server and Controller in this document mean the License Server and License Controller.

1. User creates a Smart License resource and applies it to the Kubernetes API Server
2. Kubernetes API Server sends a notification to License Controller.
3. License Controller inspects the configuration in the Smart License resource

1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server, which then talks to CSSM to reserve the licenses and responds back to the Controller
2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server
4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.
5. The License Server checks its pool to see if it has sufficient licenses to grant the request

1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates this status to ASAc.
2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.

## Packaging

Licensing components are packaged into two Kubernetes Deployment resources targeting different namespaces and distributed via Helm as part of the `sfcn-bundle` Helm chart

### License Broker

The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

{{% alert title="Note" color="primary" %}}
License Broker is set to be deployed once per Cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode).
{{% /alert %}}

The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.

### License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the [Controller](#license-controller), sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses
needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.

## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the License Server[{{< relref "#license-server" >}}]. It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests]({{< relref "monitoring#unauthorized-requests" >}}) for more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the
form of events on that resource.

### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart License resource in the same namespace.

Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  # license type can be blank or not set explicitly to let the system use the default value
  # At present, there is only one license type for kASA, so this field is reserved for future use.
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by obtaining a token from the [Virtual Account]({{< relref "terminology#smart-and-virtual-accounts">}}) and doing a base64 encoding of that text. This can be done from a shell as follows

```shell
echo "your-token" | base64
```

And, use that content in the Secret as follows

```yaml
apiVersion: v1
kind: Secret
metadata:
  name: cssm-token
  namespace: cisco-systems
data:
```

---

**Open Source Used In kASA v1.5 5762**
# this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
token:
"TXpJMk1UVXhOV1V0Tm1Jd1ppMDBORFUzTFRnd09ETXRNamMyWm1JMVltWTBORGhTFRFMk16YzBNamcyJTBBT5VBMk16QjhVSFE1U25WVGNNHbEpRMEZWU2paSk5FeDRZbHAxYnpkdGFHcGFZblJQVDFGWFoyMURjR3h4JTBBVFUxVkJEMCUzRwQQ=="

```
{{% alert title="Note" color="primary" %}}
The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account
is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual
account as you are expecting the number of vCPUs in your cluster namespace.
{{% /alert %}}

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`. The resource
specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a
minimum of 1 license
and upto 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA
license
type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request for upto 10
vCPUs.
Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing
configuration
thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

{{% alert title="Warning" color="warning" %}}
Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the License
Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the license configuration.
In the example here, the Deployment replica count would be set to 2.
{{% /alert %}}

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual
account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of
replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the
resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more replicas, the license
Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to the account.
Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.
### Using the Scaling Factor

When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient number of licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to retry the operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the `scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or down, it reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may ask the pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the pod is assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its pool. Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the virtual account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following configuration, the Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this number to the number of vCPUs the enforcer pods will be using.

```
yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  # scaling factor of 4 implies the license reservations change in increments/decrements of 4
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates unregistration and on successfully unregistering from the virtual account, the Controller deletes the resource.

### The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

#### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

{{% alert title="Note" color="primary" %}}

It is recommended that a CPU limit be specified on all the containers where the ASA is running. If you prefer to take advantage of burstable CPU of the Node, be advised that the licensed cores would be that of the Node rather than the Pod.

{{% /alert %}}

### Licensing ASA

When the ASA comes up, it does not hold a license and therefore runs at a low-bandwidth mode, typically 100kbps and has very restricted capabilities and features it supports. The Manager tries to get a license from the License Server and if successful communicates the status to ASA. Once licensed, ASA runs at its full potential.

The Manager periodically verifies the status of the license it obtained, with the License Server, and if the license is not valid anymore either because the License Server has insufficient licenses, or the Manager failed to verify the validity despite several retries, it will revoke the license of ASA and keeps retrying to fetch the license.
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  creationTimestamp: null
name: broker-role
rules:
- apiGroups:
  - apps
  resources:
  - deployments
  verbs:
  - get
  - list
  - update
  - watch
- apiGroups:
  - apps
  resources:
  - replicasets
  verbs:
  - get
  - list
  - watch
- apiGroups:
  - autoscaling
  resources:
  - horizontalpodautoscalers
  verbs:
  - get
  - list
  - update
  - watch
- apiGroups:
  - ""
  resources:
  - pods
  verbs:
  - delete
  - get
  - list
  - update
  - watch
- apiGroups:
  - ""
  resources:
  - secrets

---
verbs:
- get
- list
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses
verbs:
- create
- delete
- get
- list
- patch
- update
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses/status
verbs:
- get
- patch
- update

apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into versioned archives
# to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They're included as
# a dependency of application charts to inject those utilities and functions into the rendering
# pipeline. Library charts do not define any templates and therefore cannot be deployed.
type: application

# This is the chart version. This version number should be incremented each time you make changes
# to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
version: 0.1.0

# This is the version number of the application being deployed. This version number should be
# incremented each time you make changes to the application. Versions are not expected to
# follow Semantic Versioning. They should reflect the version the application is using.
appVersion: 1.16.0
dependencies:
- name: aegis-common
  version: "0.1.0"
  repository: "file://../aegis-common"
module css.cisco.com/kasa/license-broker

go 1.14

require (
  css.cisco.com/kasa/pkg/predicates v0.0.0
  css.cisco.com/licensing/client-agent v0.1.11
  github.com/go-logr/logr v0.3.0
  github.com/golang/mock v1.3.1
  github.com/onsi/ginkgo v1.14.1
  github.com/onsi/gomega v1.10.2
  k8s.io/api v0.19.2
  k8s.io/apimachinery v0.19.2
  k8s.io/client-go v0.19.2
  k8s.io/utils v0.0.0-20200912215256-4140de9c8800
  sigs.k8s.io/controller-runtime v0.7.2
)

replace css.cisco.com/kasa/pkg/predicates v0.0.0 => ../pkg/predicates

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: AllotmentService)

// Package mocks is a generated GoMock package.
package mocks

import (
  proto "css.cisco.com/licensing/client-agent/proto"
  service "css.cisco.com/licensing/client-agent/service"
  gomock "github.com/golang/mock/gomock"
  reflect "reflect"
)

// MockAllotmentService is a mock of AllotmentService interface
type MockAllotmentService struct {
  ctrl *gomock.Controller
  recorder *MockAllotmentServiceMockRecorder
}

// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService
type MockAllotmentServiceMockRecorder struct {
  mock *MockAllotmentService
}

// NewMockAllotmentService creates a new mock instance
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {
    mock := &MockAllotmentService{ctrl: ctrl}
    mock.recorder = &MockAllotmentServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {
    return m.recorder
}

// LeaseAllotment mocks base method
func (m *MockAllotmentService) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "LeaseAllotment", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register", reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
}

// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReleaseAllotment", reflect.TypeOf((*MockAllotmentService)(nil).ReleaseAllotment), arg0)
}
// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReleaseAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReleaseAllotment), arg0)
}

// ReportAllotment mocks base method
func (m *MockAllotmentService) ReportAllotment(arg0 *proto.AllotmentReport) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReportAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Status mocks base method
func (m *MockAllotmentService) Status(arg0 *proto.Tenant) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Status", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Status indicates an expected call of Status
func (mr *MockAllotmentServiceMockRecorder) Status(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Status",
        reflect.TypeOf((*MockAllotmentService)(nil).Status), arg0)
}

---
title: "Terminology"
weight: 1
description: >
Terms and acronyms of Cisco Smart Licensing and their descriptions
---

### Cisco Smart Software Manager (CSSM)
Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any licensing activity outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed [here](https://software-stage.cisco.com).

There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html) often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.

{{% alert title="Warning" color="warning" %}}
kASA Licensing currently supports only direct access to CSSM. The system is NOT tested for accessing CSSM from behind an HTTPS proxy or via Satellite, and the behavior is unknown; though, in theory, it may work.{{% /alert %}}

### Smart License

Smart License is the license(_noun_) that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license(_verb_) a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that license from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).
### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.

Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited to. The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account. You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased. This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation
License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product.

The reservation process requires connectivity to internet and only on successful reservation can you use the product in Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR).

PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does not mean the product supports it. You should check the product documentation to verify the support for license reservation.

{{% alert title="Warning" color="warning" %}}

KASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.

{{% /alert %}}

### References

If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

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****************************************************************/

package integ_tests

import (  
"context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
var _ = Describe("SmartLicense Webhook Test", func() {
    const defaultNamespace = "default"

    var defaultCount uint32 = 1

    var secret *corev1.Secret
    var hpa *autoscalingv1.HorizontalPodAutoscaler

   BeforeEach(func() {
        secret = &corev1.Secret{
            Data:       map[string][]byte{"token": []byte("MTIz")},
        }
        Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())
        hpa = &autoscalingv1.HorizontalPodAutoscaler{
            Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
                MaxReplicas:   3,
            },
        }
        Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
    })

    AfterEach(func() {
        Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
        Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
    })

    Context("Mutating Webhook", func() {
        It("should fill in values on creation", func() {
            license := &v1.SmartLicense{
                Spec: v1.SmartLicenseSpec{
                },
                }
            err := k8sClient.Create(testCtx, license)
            Expect(err).ShouldNot(HaveOccurred())
            err = k8sClient.Get(testCtx, types.NamespacedName{...})
Namespace: defaultNamespace,
Name: "foo",
}, license)
Expect(err).ShouldNot(HaveOccurred())
Expect(license.Spec.Action).To(Equal(v1.Register))
Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
Expect(license.Spec.ScalingFactor).To(Equal(&defaultCount))
})
})

Context("Validating Webhook", func() {

It("should pass for valid object", func() {

license := &v1.SmartLicense{
Spec: v1.SmartLicenseSpec{
},
}
Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
})

It("has fields validations", func() {
//given
var zeroLicenses uint32 = 0
license := &v1.SmartLicense{
Spec: v1.SmartLicenseSpec{
MinLicenseCount: &zeroLicenses,
MaxLicenseCount: &zeroLicenses,
ScalingFactor: &zeroLicenses,
},
}

//when
err := k8sClient.Create(testCtx, license)

//then
Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: [" + "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1"]"))
})
It("should return error if max value is less then min value", func() {
//given
var minLicenses uint32 = 5
var maxLicenses uint32 = 3
license := &v1.SmartLicense{
  Spec: v1.SmartLicenseSpec{
    MinLicenseCount: &minLicenses,
    MaxLicenseCount: &maxLicenses,
  },
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))
})

It("should return error when creating license with non-REGISTER action", func() {
//given
license := &v1.SmartLicense{
  Spec: v1.SmartLicenseSpec{
    Action:      v1.Deregister,
  },
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))
})

It("should return error when secret does not exist", func() {
//given
license := &v1.SmartLicense{

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.TokenSecret: Name "secret" not found in defaultNamespace."))
})

It("should return error when secret does not exist", func() {
//given
license := &v1.SmartLicense{

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.TokenSecret: Name "secret" not found in defaultNamespace."))
})
Spec: v1.SmartLicenseSpec{
}

//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
})

It("should return error when secret does not token key", func() {
    //given
    secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
    Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
    license := &v1.SmartLicenseSpec{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))
})

It("should return error when invalid scalingRef kind is specified", func() {
    //given
    license := &v1.SmartLicenseSpec{
        Spec: v1.SmartLicenseSpec{
        },
    }

    //when
    err := k8sClient.Create(context.TODO(), license)

    //then
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```go
it("should return error when scalingRef does not exist", func() {
    // given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    },

    // when
    err := k8sClient.Create(context.TODO(), license)

    // then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found"))
})

it("should not allow changing licenseType after registration", func() {
    // given
    license := &v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
        },
    }

    Expect(k8sClient.Create(context.TODO(), license)).To(Succeed())
    license.Status.RegistrationState = v1.Registered
    Expect(k8sClient.Status().Update(context.TODO(), license)).To(Succeed())

    // when
    license.Spec.LicenseType = "buzz"
    err := k8sClient.Update(context.TODO(), license)

    // then
    Expect(err).To(HaveOccurred())
    Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})
```
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: broker-role-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: broker-role
subjects:
- kind: ServiceAccount
  name: default
  namespace: system

package controllers_test

import (
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

package handlers_test

import (
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

func TestHandlers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {

package integ_tests

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "github.com/go-logr/logr"
    "github.com/onsi/ginkgo"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/client-go/rest"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
)

func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))
    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }

    close(done)
    if err := mgr.Start(ctx); err != nil {
        return err
    }
    return nil
}
package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "fmt"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
    "strconv"
}

const {
    epDeploymentName = "epDeployment"
    initialDeploymentReplicas int32 = 3
}

var _ = Describe("Deployment License Controller Test", func () {

deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
var {
    reconciler *controllers.DeploymentLicenseReconciler
    fakeClient client.Client
    mockCtrl *gomock.Controller
    deployment *appsv1.Deployment
    smartLicense *v1.SmartLicense
    recorder *record.FakeRecorder
    replicasCalculatorMock *mocks.MockReplicasCalculator
}

BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    recorder = record.NewFakeRecorder(1024)
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

    reconciler = controllers.DeploymentLicenseReconciler{}
    fakeClient = client.Client{}
    mockCtrl = gomock.Controller{}
    deployment = appsv1.Deployment{}
    smartLicense = v1.SmartLicense{}
    recorder = record.FakeRecorder{}
    replicasCalculatorMock = mocks.MockReplicasCalculator{}

})
reconciler = &controllers.DeploymentLicenseReconciler{
    Client: fakeClient,
    Log:    logf.NullLogger{},
    Recorder: recorder,
    ReplicasCalculator: replicasCalculatorMock,
}

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        LicenseType: licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor: &scalingFactor,
    },
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name: epDeploymentName,
        Namespace: defaultNs,
        Annotations: map[string]string{
            controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
        },
    },
    Spec: appsv1.DeploymentSpec{
        Replicas: &replicas,
    },
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
    mockCtrl.Finish()
})

It("should skip if Deployment does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
})
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_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())
}

It("should skip if Deployment SmartLicense does not exist", func() {
Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if SmartLicense is in deregistered state", func() {
smartLicense.Status.RegistrationState = v1.Deregistered
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if registered SmartLicense has enough licenses", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(4), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(2), nil)
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
})
It("should an event if initial replica number annotation is incorrect", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(2), nil)
deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(HaveOccurred())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial-
replicas-count label is not correct. Please, update it to correct number.")))
})

It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
*deployment.Spec.Replicas = 0
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(25), nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())
Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
})

It("should send a warning if deployment controlled by HPA", func() {
replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
gomock.Any()).Return(int32(4), nil)

hpa := &autoscalingv1.HorizontalPodAutoscaler{
  ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
  Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
  }

  hpa := &autoscalingv1.HorizontalPodAutoscaler{
  ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
  Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
MaxReplicas: initialHPAMaxReplicas,
}
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(BeNil())
Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf("Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", epDeploymentName, epHpaName, epHpaName))))
Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled Deployment to initial replicas number 3")))
})
})
package handlers

import (  "context"  v1 "css.cisco.com/kasa/license-broker/api/v1"  "fmt"  coreV1 "k8s.io/api/core/v1"  "k8s.io/apimachinery/pkg/types"  "k8s.io/client-go/util/workqueue"  ctrl "sigs.k8s.io/controller-runtime"  "sigs.k8s.io/controller-runtime/pkg/client"  "sigs.k8s.io/controller-runtime/pkg/event"  "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
    return handler.Funcs{
        UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
            if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
                licenseList := v1.SmartLicenseList{
                } err := c.List(context.TODO(), &licenseList)
                if err != nil {
                    secretLog.Error(err,
                        "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
                    panic(err.Error())
                }
            }
        }
    }
}
for _, smartLicense := range licenseList.Items {
    if smartLicense.Spec.TokenSecret.Name == secret.Name &&
        if smartLicense.Status.RegistrationState == v1.RegistrationFailed ||
        smartLicense.Status.RegistrationState == v1.DeregistrationFailed {
            q.Add(ctrl.Request{
                NamespacedName: types.NamespacedName{
                    Namespace: smartLicense.Namespace,
                    Name:      smartLicense.Name,
                }
            })
        }
    } else {
        secretLog.Error(fmt.Errorf("cannot cast %T to Secret", evt.ObjectNew), "event is ignored")
    }
}

package v1_test

import {
    v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
    "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1/mocks"
    dispatcherMock "cisco.com/kasa/operator/enforcementpoint/dispatcher/mocks"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    clientagent "css.cisco.com/licensing/client-agent"
    lca "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
}

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-
var _ = Describe("SmartLicense Controller Test", func() {

    const (
        podName = "sfcn-enforcer"
        podNamespace = "sfcn-system"
        nodeName = "aws-eks-node0"
    )

    var tenant, podNamespacedName = &clientagent.Tenant{
        Name: podNamespace + "/" + podName,
        Attributes: map[string]string{
            "role": "license-requestor",
        },
    }, types.NamespacedName{
        Namespace: podNamespace,
        Name: podName,
    }

    newPod := func(name, namespace, nodeName string) *coreV1.Pod {
        return &coreV1.Pod{
            TypeMeta: metaV1.TypeMeta{
                Kind: "Pod",
                APIVersion: "v1",
            },
            ObjectMeta: metaV1.ObjectMeta{
                Name: name,
                Namespace: namespace,
                Labels: tenant.Attributes,
            },
            Spec: coreV1.PodSpec{NodeName: nodeName, Containers: []coreV1.Container{
                Name: "ep-container",
                Resources: coreV1.ResourceRequirements{
                    Limits: map[coreV1.ResourceName]resource.Quantity{
                        "cpu": resource.MustParse("2000m"),
                    },
                },
            }},
        }
    }

    newNode := func(name string) *coreV1.Node {
        return &coreV1.Node{
TypeMeta: metaV1.TypeMeta{Kind: "Node", APIVersion: "v1"},
ObjectMeta: metaV1.ObjectMeta{Name: name},
    "cpu": resource.MustParse("4"),
},
}
}

var (  
pod              *coreV1.Pod  
node             *coreV1.Node  
reconciler       *v1.SmartLicenseReconciler  
fakeClient       client.Client  
mockCtrl         *gomock.Controller  
licensingClient  *mocks.MockLicensingClient  
allotmentService *mocks.MockAllotmentService  
dispatcher       *dispatcherMock.MockGatewayClient  
recorder         *record.FakeRecorder  
)

resetRecorder := func() {
    recorder = record.NewFakeRecorder(1024)
    reconciler.Recorder = recorder
}

reconcileAndExpectFail := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred()) // failure is determined by requeue after duration
    Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration}))
}

reconcileAndExpectSuccess := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamepacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred())
    Expect(result).To(Equal(ctrl.Result{ }))
}

recordedEvents := func() []string {
    close(recorder.Events)
    var events []string
    for event := range recorder.Events {
        events = append(events, event)
    }
    return events
}
lastRecordedEvent := func() string {
    events := recordedEvents()
    if len(events) == 0 {
        return ""
    }
    return events[0]
}

BeforeEach(func() {
    pod = newPod(podName, podNamespace, nodeName)
    node = newNode(nodeName)
    data := []client.Object{pod, node}
    mockCtrl = gomock.NewController(GinkgoT())
    scheme := runtime.NewScheme()
    Expect(coreV1.AddToScheme(scheme)).To(Succeed())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
    allotmentService = mocks.NewMockAllotmentService(mockCtrl)
    licensingClient = mocks.NewMockLicensingClient(mockCtrl)
    dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
    recorder = record.NewFakeRecorder(1024)
    reconciler = &v1.SmartLicenseReconciler{
        CoreClient: coreV1Client.New(fakeClient, context.Background),
        Licenser: licensingClient,
        Log: logf.NullLogger{},
        Recorder: recorder,
        Dispatcher: dispatcher,
    }
    licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
})

It("should revoke ASAc license after failing multiple attempts of registration", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(fmt.Errorf("test registration failure"), nil)
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().RevokeLicense().Times(1)
    numAttempts := 0
    for numAttempts < v1.MaxRetryAttempts {
        reconcileAndExpectFail()
        numAttempts += 1
        if numAttempts == 1 {
            // on the first attempt expect an event is recorded
            Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
        } else {
            Expect(lastRecordedEvent()).Should(BeEmpty())
        }
    }
    reconcileAndExpectFail()
It("should verify the license status and request on successful registration", func() {
  ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
    Name: "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
  })
  Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
  ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})

It("should revoke ASAc license after successful registration but fails to get a lease", func() {
  allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
  dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
  dispatcher.EXPECT().GrantLicense(true)
  reconcileAndExpectSuccess()
  Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),
      HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),
      HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified"))
})
PoolName: podNamespae,
Tenant:  tenant,
NumCores: 2, // this is the limit specified for the container
}).Return(nil, fmt.Errorf("test insufficient cores")).AnyTimes()

numAttempts := 0
for numAttempts < v1.MaxRetryAttempts { 
  reconcileAndExpectFail()
  numAttempts += 1
  if numAttempts == 1 {
    // on the first attempt expect an event is recorded
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
  } else {
    Expect(lastRecordedEvent()).Should(BeEmpty())
  }
  reconcileAndExpectFail()
  Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because it failed to obtain a license"))
}

It("should revoke ASAc license when server requests to the release the allotment", func() {
  _ = os.Setenv("POD_NAME", podName)
  _ = os.Setenv("POD_NAMESPACE", podNamespace)
  dispatcher.EXPECT().RevokeLicense().Times(1)
  allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
    ContextId: "test-context",
    Tenant:    tenant,
  })).Return(nil)

  reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
  })

  Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license"))
})

It("should report the allotment it holds when the server requests so", func() {
  _ = os.Setenv("POD_NAME", podName)
_ = os.Setenv("POD_NAMESPACE", podNamespace)

allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
    ContextId: "test-context",
    Tenant:    tenant,
    NumCores:  2,
})).Return(nil)

It("ReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_REPORT_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
})
Expect(lastRecordedEvent()).Should(BeEmpty())
}

It("should mark tenant as unregistered if license server is unavailable and retry again", func() {
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil,
        fmt.Errorf("some error occures: %w", lca.ErrLicenseServerUnavailable))
    res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).Should(BeNil())
    Expect(res).ShouldNot(BeNil())
    Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
})

AfterEach(func() {
    mockCtrl.Finish()
})

****************************************************************************
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****************************************************************************
const SFCNProductld = "SFW"

const {
    registrationReason = "Registration"
    deregistrationReason = "Deregistration"
    FinalizerName = "sfcn.cisco.com/license-degistration-finalizer"
}

// SmartLicenseReconciler reconciles a SmartLicense object

type SmartLicenseReconciler struct {
    Client          client.Client
    LicensingClient licensing.LicensingClient
    Log             logr.Logger
    Recorder        record.EventRecorder
    Scheme          *runtime.Scheme
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v1.SmartLicense{}, builder.WithPredicates(&corePredicate.GenerationChangedPredicate{})).
        Watches(&source.Channel{Source: oobChangeNotifier}, &handler.EnqueueRequestForObject{}).
        Complete(r)
}

// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses,verbs=get;list;watch;create;update;patch;delete
func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := r.Log.WithValues("smartlicense", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    var license v1.SmartLicense
    if err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("SmartLicense does not exist, nothing to reconcile")
            return ctrl.Result{}, client.IgnoreNotFound(err)
        }
    } else {
        // the license is being deleted, need to deregister it first
        return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
    }

    switch license.Spec.Action {
    case v1.Register:
        err := r.registerPlatform(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
        }

        err = r.scaleEntitlements(&license)
        if err != nil {
            r.recordFailureAndUpdateStatus(&license, registrationReason, err)
            return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
        }

        if err = r.recordSuccessAndUpdateStatus(&license, registrationReason); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
        }
    }
case v1.Deregister:
err := r.deregisterPlatform(license)
if err != nil {
    r.recordFailureAndUpdateStatus(license, deregistrationReason, err)
    return ctrl.Result{}, nil
}
if err = r.recordSuccessAndUpdateStatus(license, deregistrationReason); err != nil {
    return ctrl.Result{}, nil
}

default:
// should not happen due to CRD validation, but not returning an error as subsequent reconciliations will not fix the issue anyway
return ctrl.Result{}, nil
}

func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
    license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
    if err := r.Client.Update(context.Background(), license); err != nil {
        return nil
    }
    log := r.licenseLogger(license).Info("added finalizer")
}
return nil
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
log := r.licenseLogger(license)
if containsString(license.ObjectMeta.Finalizers, FinalizerName) {
    if license.Status.RegistrationState == v1.Registered {
        if err := r.deregisterPlatform(license); err != nil {
            //TODO: return error and do not remove finalizer when corner cases are tested
            log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
        } else {
            log.Info("removing finalizer without deregistration as platform is not registered")
        }
    license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
}
if err := r.Client.Update(context.Background(), license); err != nil {
    return err
}
log.Info("removed finalizer")
return nil
}

func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {
    licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
    log := r.licenseLogger(license)
    token, err := r.getToken(license)
    if err != nil {
        return fmt.Errorf("failed to retrieve licensing token: %w", err)
    }
    log.Info("trying to register platform", "platformName", licenseNsName.String())
    deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client,
ctrl.Log.WithName("listeners").WithName("DeregistrationListener"), r.Recorder, oobChangeNotifier)
    registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
        Uuid:       string(license.UID),
        Name:       licenseNsName.String(),
        SerialNumber: serialNumber(licenseNsName.String()),
        ProductId:  SFCNProductId,
        PoolName:   license.Namespace,
    }, token, deregistrationListener)
    if err != nil {
        license.Status.RegistrationState = v1.RegistrationFailed
        license.Status.LicenseState = v1.Unlicensed
        return fmt.Errorf("failed to complete registration call: %w", err)
    }
    log.Info("registered the platform in CSSM", "registrationInfo", registration)
    license.Status.RegistrationState = v1.Registered
    // we don't want to change license state to Pending if a platform is already registered and a user just updates some field.
    if !registration.IsRegistered {
        license.Status.LicenseState = v1.PendingLicenseState
    }
    license.Status.AccountDomain = registration.SmartAccountName
    license.Status.AccountName = registration.VirtualAccountName
    license.Status.ContextId = registration.ContextId
    license.Status.ExportControlled = registration.ExportControlled

    entitlementListener := &listeners.EntitlementListener{
        Log: ctrl.Log.WithName("listeners").WithName("EntitlementListener"),
        Client: r.Client,
        LicenseNsName: licenseNsName,
    }
if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
if errors.Is(err, licensing.ErrDuplicateListener) {
log.Info("entitlement listener is already added", "contextId", registration.ContextId)
return nil
}
return fmt.Errorf("failed to subscribe to entitlement notifications: %w", err)
}
log.Info("added entitlement listener", "contextId", registration.ContextId)
return nil
}

func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
if license.Status.RegistrationState != v1.Registered {
return fmt.Errorf("platform must be registered before license reservation")
}
log := r.licenseLogger(license)

log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
err := r.LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
ContextId: license.Status.ContextId,
EntitlementId: license.Spec.LicenseType,
MinEntitlements: *license.Spec.MinLicenseCount,
MaxEntitlements: *license.Spec.MaxLicenseCount,
ScalingFactor: *license.Spec.ScalingFactor,
})
if err != nil {
return fmt.Errorf("failed to enable licensing scaling: %w", err)
}

log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
log := r.licenseLogger(license)

state := license.Status.RegistrationState
if state == v1.Deregistered {
log.Info("platform is already deregistered, skipping deregistration")
return nil
}

err := r.LicensingClient.Registration().Deregister(license.Status.ContextId)
if err != nil {
license.Status.RegistrationState = v1.DeregistrationFailed
return fmt.Errorf("failed to complete deregistration call: %w", err)
}
log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
license.Status.RegistrationState = v1.Deregistered
license.Status.LicenseState = v1.Unlicensed
license.Status.EstimatedMaxReplicas = 0
license.Status.CoresPerLicense = 0
license.Status.LicenseNumber = 0
return nil
}

func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
    secretNamespacedName := types.NamespacedName{
        Namespace: license.Spec.TokenSecret.Namespace,
        Name:      license.Spec.TokenSecret.Name,
    }
    var tokenSecret coreV1.Secret
    if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
        return "", fmt.Errorf("failed to get token secret: %w", err)
    }
    return string(tokenSecret.Data[v1.TokenKeyName]), nil
}

func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error) {
    r.Recorder.Event(license, coreV1.EventTypeWarning, reason,
        fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
    license.Status.ErrorReason = err.Error()
    if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
        r.Log.Error(statusErr, "failed to update SmartLicense status")
    }
}

func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
    r.Recorder.Event(license, coreV1.EventTypeNormal, reason, "SmartLicense state updated.")
    license.Status.ErrorReason = ""
    if err := r.Client.Status().Update(context.Background(), license); err != nil {
        return err
    }
    return nil
}

func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
    return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
}

package controllers_test

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/registration.go css.cisco.com/licensing/client-agent RegistrationService
//go:generate mockgen -package=mocks -destination=./mocks/entitlement.go css.cisco.com/licensing/client-agent EntitlementService

called ToMock(), func() 

    smartLicenseName = "license-sample"
    secretName = "secret-sample"
    defaultNs = "default"
    licenseType = "L-ASAV10S-STD"
    secretToken = "MTIz"
})

var (  
    minLicenseCount uint32 = 1
    maxLicenseCount uint32 = 5
    newMaxLicenseCount uint32 = 10
    scalingFactor uint32 = 2
})

var _ = Describe("SmartLicense Controller Test", func() {

    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}
    
    var reconciler *controllers.SmartLicenseReconciler
    var fakeClient client.Client
    var mockCtrl *gomock.Controller
    var licensingClient *mocks.MockLicensingClient

var registrationService *mocks.MockRegistrationService
var entitlementService *mocks.MockEntitlementService

var (  
smartLicense *v1.SmartLicense
secret *corev1.Secret
)

BeforeEach(func() {  
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()  
registrationService = mocks.NewMockRegistrationService(mockCtrl)
entitlementService = mocks.NewMockEntitlementService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
reconciler = &controllers.SmartLicenseReconciler{  
Client: fakeClient,
LicensingClient: licensingClient,
Log: logf.NullLogger{},
Recorder: record.NewFakeRecorder(1024),
}
licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()  
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()  
secret = &corev1.Secret{  
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},
Data: map[string][]byte{"token": []byte(secretToken)},
}
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())  
smartLicense = &v1.SmartLicense{  
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{  
Action: v1.Register,
TokenSecret: corev1.SecretReference{  
Name: secretName,
Namespace: defaultNs,
},
LicenseType: licenseType,
MinLicenseCount: &minLicenseCount,
MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,
},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())
})
AfterEach(func() {
    mockCtrl.Finish()
})

Context("platform registration", func() {
    It("should register platform in licensing system", func() {
        registrationService.EXPECT().Register(&licensing.Platform{
            Uuid:         string(smartLicense.UID),
            Name:         licenseNsName.String(),
            SerialNumber: "8B201B63BB8",
            ProductId:    controllers.SFCNProductId,
            PoolName:     defaultNs,
        }, secretToken, gomock.Any()).Return(&licensing.Registration{
            ContextId:          "testContextId",
            SmartAccountName:   "TestAccountName",
            VirtualAccountName: "TestVirtualName",
            ExportControlled:   true,
            IsRegistered:       false,
        }, nil)
        entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
        entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
            ContextId:       "testContextId",
            EntitlementId:   licenseType,
            MinEntitlements: minLicenseCount,
            MaxEntitlements: maxLicenseCount,
            ScalingFactor:   scalingFactor,
        }).Return(nil)
        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
        Expect(err).To(BeNil())
        Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
        Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
        Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
        Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
        Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
        Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
        Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
        Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))
    })
    It("should ignore ErrDuplicateListener error", func() {
        registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
            gomock.Any()).Return(&licensing.Registration{
            ContextId:    "testContextId",
            IsRegistered: false,
        }, nil)
        entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
    })
    It("should register platform in licensing system", func() {
        registrationService.EXPECT().Register(&licensing.Platform{
            Uuid:         string(smartLicense.UID),
            Name:         licenseNsName.String(),
            SerialNumber: "8B201B63BB8",
            ProductId:    controllers.SFCNProductId,
            PoolName:     defaultNs,
        }, secretToken, gomock.Any()).Return(&licensing.Registration{
            ContextId:          "testContextId",
            SmartAccountName:   "TestAccountName",
            VirtualAccountName: "TestVirtualName",
            ExportControlled:   true,
            IsRegistered:       false,
        }, nil)
        entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
        entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
            ContextId:       "testContextId",
            EntitlementId:   licenseType,
            MinEntitlements: minLicenseCount,
            MaxEntitlements: maxLicenseCount,
            ScalingFactor:   scalingFactor,
        }).Return(nil)
        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
        Expect(err).To(BeNil())
        Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
        Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
        Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
        Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
        Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
        Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
        Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
        Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))
    })
})
fmt.Errorf("entitlement listener already exists: %w", licensing.ErrDuplicateListener))

entitlementService.EXPECT().ScaleEntitlement(gomock.Any()).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
}
}

Context("platform deregistration", func() {
It("should deregister platform in licensing system", func() {
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
smartLicense.Status.ContextId = "testContextId"
smartLicense.Status.RegistrationState = v1.Registered
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
registrationService.EXPECT().Deregister("testContextId").Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
})

It("should skip deregistration if platform is already deregistered", func() {
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
smartLicense.Status.RegistrationState = v1.Deregistered
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
})

It("should deregister platform on resource deletion", func() {
smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)

...
now := metav1.Now()
smartLicense.DeletionTimestamp = &now
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
smartLicense.Status.RegistrationState = v1.Registered
smartLicense.Status.ContextId = "testContextId"
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
registrationService.EXPECT().Deregister("testContextId").Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
// cannot check finalizer removal due to a bug in fakeClient: https://github.com/kubernetes/client-go/issues/607
// Expect(smartLicense.Finalizers).ShouldNot(ContainElement(finalizerName))
}
})
})

Context("smart license updating", func() {
It("license state should not be updated", func() {
Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
licenseStateBeforeUpdate := smartLicense.Status.LicenseState
smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

registrationService.EXPECT().Register(gomock.Any(), gomock.Any(), gomock.Any()).Return(&licensing.Registration{
ContextId: "testContextId",
IsRegistered: true,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
ContextId: "testContextId",
EntitlementId: licenseType,
MinEntitlements: minLicenseCount,
MaxEntitlements: newMaxLicenseCount,
ScalingFactor: scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
// Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))
})
})
})
}

package subscribers
import (  licensing "css.cisco.com/licensing/client-agent"  "css.cisco.com/licensing/client-agent/proto"  "github.com/go-logr/logr"  coreV1 "k8s.io/api/core/v1"  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  "sigs.k8s.io/controller-runtime/pkg/event"  "strings"
)

func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
    return &subscriptionListener{
        channel: channel,
        log:     log,
    }
}

type subscriptionListener struct {
    channel chan event.GenericEvent
    log     logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)
    switch e.Type {
    case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED,
        proto.AllotmentEvent_ALLOTMENT_DENIED:
        l.log.V(1).Info("scheduling event for PodLicenseReconciler")
        l.sendEventToChannel(e.Tenant.Name)
    }
}

func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
        Name:      namespacedName[1],
        Namespace: namespacedName[0],
    }}
    l.channel <- event.GenericEvent{Object: pod}
package listeners

import {
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/licensing/client-agent/proto"
  "fmt"
  "github.com/go-logr/logr"
  corev1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/tools/record"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/event"
  "time"
}

func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger, recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
  return &deregistrationListener{
    log:             log,
    client:          client,
    licenseNsName:   licenseNsName,
    recorder:        recorder,
    notifierChannel: notifierChannel,
    retries:         int{
    const MaxRetries = 10
    
    type deregistrationListener struct {
      log     logr.Logger
      client  client.Client
      licenseNsName types.NamespacedName
      recorder record.EventRecorder
      notifierChannel chan event.GenericEvent
      retries int
    }

    // OnAutoDeregistration updates SmartLicense status to be in deregistered state.
    // The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
    func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
      log := d.log.WithValues("smartlicense", d.licenseNsName)
      log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)

      if err := d.warnSmartLicenseDeregistered(msg); err != nil {
        if err := d.warnSmartLicenseDeregistered(msg); err
    }
if d.retries < MaxRetries {
    log.Error(err, "failed to process auto-deregistration event. retrying...")
    d.retries++
    time.Sleep(1 * time.Second)
    d.OnAutoDeregistration(platform, msg)
    return
}
log.Error(err, "failed to process auto-deregistration event")
return
}
d.retries = 0
log.V(1).Info("successfully processed auto-deregistration event")
}

func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
    var license v1.SmartLicense
    if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.LicenseNumber = 0
    license.Status.CoresPerLicense = 0
    license.Status.EstimatedMaxReplicas = 0
    if err := d.client.Status().Update(context.Background(), &license); err != nil {
        return fmt.Errorf("failed to update SmartLicense status: %w", err)
    }
    d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
    d.notifierChannel <- event.GenericEvent{Object: &license}
    return nil
}

package controllers

import {
    "context"
    "errors"
    "fmt"
    "strconv"
type PodLicenseReconciler struct {
    Client client.Client
    LicensingClient licensing.LicensingClient
    Log     logr.Logger
    Recorder record.EventRecorder
}

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent) error {
    return ctrl.NewControllerManagedBy(mgr).
    For(&corev1.Pod{}, builder.WithPredicates(
        &predicates.LabelExistsPredicate{Key: LicenseHolderLabel}).
        Watches(&source.Channel{Source: eventChannel}, &handler.EnqueueRequestForObject{})).
    Complete(c)
}

// Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
// a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
// On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {


log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
}

pod := coreV1.Pod{
podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
err := c.Client.Get(ctx, podNsName, &pod)
if err != nil {
  if apiErrors.IsNotFound(err) {
    log.Info("Pod does not exist, releasing allotments it might still hold")
    return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
  }
  return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
}

status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
if err != nil {
  return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
}

shouldHaveLicensingLabel := status != nil && status.NumCores != 0
changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
if changed {
  if err = c.Client.Update(ctx, &pod); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
  }
  log.Info("updated Pod labels")
}

deployment, err := c.findPodDeployment(&pod)
if err != nil {
  return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
}

if deployment == nil {
  log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
  if err := c.Client.Delete(context.Background(), &pod); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
  }
  c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration."))
  log.Info("deleted orphan Pod")
  return ctrl.Result{}, nil
}

licenseList := v1.SmartLicenseList{
  return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)

serviceRole := getDeploymentServiceRole(deployment)
serviceRoleIsRegistered, err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole)
if err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
}
if !serviceRoleIsRegistered {
    if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
}
else {
    if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
    if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
}

return ctrl.Result{}, nil

// releaseAllotmentsIfAny releases licensing allotments that Pod held in the licence-server
func (c *PodLicenseReconciler) releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
    log := c.Log.WithValues("pod", nsName.String())

    tenant := &licensing.Tenant{Name: nsName.String()}
    status, err := c.LicensingClient.Allotment().Status(tenant)
    if err != nil {
        if errors.Is(err, licensing.ErrNotRegistered) {
            log.Info("Pod tenant is not registered in license server, nothing to release")
            return nil
        }
        return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    if status != nil && status.NumCores != 0 {
        log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
        if err := c.LicensingClient.Allotment().ReleaseAllotment(&licensing.AllotmentRelease{
            ContextId: status.ContextId,
            Tenant:    tenant,
        }); err != nil {
            return fmt.Errorf("failed to release Pod allotments: %w", err)
        }
    }

    return nil
}
log.Info("successfully released Pod allotments")
return nil
}

log.Info("Pod does not hold any allotments, nothing to release")
return nil
}

func (c *PodLicenseReconciler) podLogger(pod *coreV1.Pod) logr.Logger {
}

func toLicenseTenant(pod coreV1.Pod) *licensing.Tenant {
podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each
// service role
// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is
// scaled down.
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment,
reconciledName types.NamespacedName) error {
log := c.Log.WithValues("pod", reconciledName.String())
log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the
namespace")

trialDeploymentList := appsv1.DeploymentList{ }
labelSelector := labels.NewSelector()
trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals,
[]string{"true"})
if err == nil {
labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
}
serviceRole := getDeploymentServiceRole(deployment)
serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals,
[]string{serviceRole})
if err == nil {
labelSelector = labelSelector.Add(*serviceLabelRequirement)
}
if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
Namespace: deployment.Namespace,
LabelSelector: labelSelector,
}); err != nil {
return fmt.Errorf("failed to fetch Deployments with trial license label")
}
log.Info("Length of trial deployment list", "length", len(trialDeploymentList.Items))

var allowedReplicas int32 = 0
trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name == deployment.Name
if trialDeploymentIsAbsent || isDeploymentInTrial {
    log.Info("Deployment has to be marked as trial license holder")
    allowedReplicas = 1
}

trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
scaleDownRequired := *deployment.Spec.Replicas > allowedReplicas
if scaleDownRequired || trialLabelUpdated {
    initialReplicasNumber := strconv.Itoa(int(pointer.Int32PtrDerefOr(deployment.Spec.Replicas, 1)))
    log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
    deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
    deployment.Spec.Replicas = &allowedReplicas
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
}
c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown", fmt.Sprintf("Decreased Deployment's Replicas to %d "+"as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. "+"Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas))

// throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
// If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList []v1.SmartLicense, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
    if err != nil {
        return fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }
    if !containsString(licensedDeploymentNames, deployment.Name) {
        log.Info("scaling down Pod's Deployment to 0 as it requested license but does not belong to any licensed EP deployment")
        *deployment.Spec.Replicas = 0
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment resource: %w", err)
        }
    }
c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown", fmt.Sprintf("Decreased Deployment's Replicas to 0 "+"as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. "+"Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas))

    // throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
    // If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.
"as it requested license but does not belong to any licensed EP deployment. "+
"Please, check SmartLicense resources to update licensing configuration.")
log.Info("scaled down Pod's Deployment to 0")
return nil

log.Info("verified that Pod belongs to the licensed Deployment")
return nil

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
fnc (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName
	types.NamespacedName) error {
  log := c.Log.WithValues("pod", reconciledName.String())
  if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
    if err := c.Client.Update(context.Background(), deployment); err != nil {
      return fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("removed Deployment trial license label")
  }
  return nil
}

// getLicensedDeploymentNames collects names of all Deployments that have a corresponding SmartLicense
resource.
fnc (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
  var deploymentNames []string
  for _, license := range licenseList {
    switch license.Spec.ScalingRef.Kind {
    case v1.DeploymentKind:
      deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
    case v1.HPAKind:
      hpa := &autoscalingv1.HorizontalPodAutoscaler{}
      hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
      if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
        return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
      }
      deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
    default:
    }
  }
  return deploymentNames, nil
}

// findPodDeployment tries to find Pod's Deployment if Pod is managed by Deployment.
// If Pod is not managed by Deployment controller, `nil` is returned.
fnc (c *PodLicenseReconciler) findPodDeployment(pod *coreV1.Pod) (*appsv1.Deployment, error) {
log := c.podLogger(pod)
if len(pod.OwnerReferences) !\(\neq\) 1 || pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind !\(\neq\) "ReplicaSet"
{
    log.Info("pod is not owned by ReplicaSet")
    return nil, nil
}

replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
replicaSet := &appsv1.ReplicaSet{}
if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
    return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
}

if len(replicaSet.OwnerReferences) !\(\neq\) 1 || !*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind !\(\neq\) "Deployment"
{
    log.Info("pod's ReplicaSet is not owned by Deployment")
    return nil, nil
}

deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
deployment := &appsv1.Deployment{}
if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
    return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
}

return deployment, nil

// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in
// registeredLicenses.
// It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified
// service role label.
func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense, namespace string, serviceRole string) (bool, error) {
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
    if err != nil {
        return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }

    for _, deploymentName := range licensedDeploymentNames {
        deployment := &appsv1.Deployment{}
        deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
        err := c.Client.Get(context.Background(), deploymentNsName, deployment)
        if err != nil {
            return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
        }

        if getDeploymentServiceRole(deployment) == serviceRole {
            return true, nil
        }
    }
    return false, nil
}
func getDeploymentServiceRole(deployment *appsv1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

package controllers

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/pkg/predicates"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/source"
    "strconv"
    "time"
)

//go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator

type ReplicasCalculator interface {
    CalculateMaxLicensedReplicas/licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error)
}

type DeploymentLicenseReconciler struct {
    client.Client
    Log           logr.Logger
    Recorder      record.EventRecorder
    ReplicasCalculator
}
func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
    For(&appsv1.Deployment{}, builder.WithPredicates(
        &predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey:
            InitialReplicasNumberAnnotation}).
    Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.DeploymentHandler()).
    Complete(c)
}

// Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value
// when it exceeds the replicas allowed by licensing config.
func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := c.Log.WithValues("deployment", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    deployment := &appsv1.Deployment{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("Deployment does not exist, nothing to reconcile")
        }
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }

    licenseList := v1.SmartLicenseList{}
        return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
    }

    registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
    deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

    labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
    if labelsChanged {
        if err = c.Client.Update(ctx, deployment); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
        }
        log.Info("updated Deployment labels")
    }

    if len(deploymentLicenses) == 0 {
        log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
        return ctrl.Result{}, nil
    }
if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentControlledByHPA", fmt.Sprintf("%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s HPA", deployment.Name, hpa.Name, hpa.Name))
}

if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
    initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
    if err != nil {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "WrongInitialReplicasNumber", fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
        return ctrl.Result{}, err
    }
    log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
    *deployment.Spec.Replicas = int32(initialReplicasCountInt)
    // delete initial replicas number from Deployment annotations to don't back to initial number on each reconciliation
    delete(deployment.Annotations, InitialReplicasNumberAnnotation)
    if err = c.Client.Update(context.Background(), deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    c.Recorder.Event(deployment, corev1.EventTypeNormal, "ScaledDeploymentToInitialReplicasNumber", fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))
}

if *deployment.Spec.Replicas > maxLicensedReplicas {
    log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas", *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
*deployment.Spec.Replicas = maxLicensedReplicas

if err = c.Client.Update(context.Background(), deployment); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.Recorder.Event(deployment, corev1.EventTypeError, "DeploymentScaledDown", fmt.Sprintf("Decreased Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", maxLicensedReplicas))
log.Info("successfully scaled down deployment to max license limit", "updatedReplicas", *deployment.Spec.Replicas)
return ctrl.Result{}, nil
}

log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas", *deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment *appsv1.Deployment) (*autoscalingv1.HorizontalPodAutoscaler, error) {
    hpaList := &autoscalingv1.HorizontalPodAutoscalerList{
    if err != nil {
        return nil, err
    }

    for _, hpa := range hpaList.Items {
            return &hpa, err
        }
    }

    return nil, err
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: RegistrationService)

// Package mocks is a generated GoMock package.
package mocks

import (  proto "css.cisco.com/licensing/client-agent/proto"  service "css.cisco.com/licensing/client-agent/service"  gomock "github.com/golang/mock/gomock"  reflect "reflect"  )
// MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {
    ctrl     *gomock.Controller
    recorder *MockRegistrationServiceMockRecorder
}

// MockRegistrationServiceMockRecorder is the mock recorder for MockRegistrationService
type MockRegistrationServiceMockRecorder struct {
    mock *MockRegistrationService
}

// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister", reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener) (*service.Registration, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
    ret0, _ := ret[0].(*service.Registration)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}
// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
        reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}

val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistrylessTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val getPublicTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String, String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra

val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(":")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

ext {
    set("publishImages", listOf(
        project.findProperty("imageName") as String,
        project.findProperty("licenseServerImageName") as String
    ))
}

tasks {

    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }

    named("dockerBuild") {

doLast {
  exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./Dockerfile -t $imageNameForPush ../".split(" "))
  }
  val artifactoryUser = project.findProperty("artifactoryUser")!! as String
  val artifactoryApiKey = project.findProperty("artifactoryApiKey")!! as String
  val saArtifactoryUrl = project.findProperty("saArtifactoryUrl")!! as String
  val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
  if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
    exec {
      setWorkingDir("bin")
      commandLine = listOf("
        "bash", ",","c",
        "curl -f -u $artifactoryUser:$artifactoryApiKey -O $downloadUrl"
      )
    }
  }
  exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
  }
  }
}

named("promoteImage") {
  val licenseServerImageName: String? by project
  onlyIf {
    licenseServerImageName != null
  }
  doLast {
    val sourceTag: String? by project
    val sourceRepo: String? by project
    val imageTag: String? by project
    if (sourceTag == null || sourceRepo == null || imageTag == null) {
      val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please, specify them with: -Psourcetag=<srcImageTag> -Psourcerepo=<sourceRepoName> -PimageTag=<targetImageTag>"
      logger.error(msg)
      throw GradleException(msg)
    }
    val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
    val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split("")[0]
    promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
  }
}
named("check") {  
doLast {  
    execCommands(listOf(  
      "go fmt ./...",  
      "go vet ./...")  
    ))  
  }  
}

named("test") {  
doLast {  
    execCommands(listOf(  
      "go test -coverpkg=./... -coverprofile cover.out ./...",  
      "go tool cover -func=cover.out -o ${project.name}-cover.txt"  
    ))  
  }  
}

named("publish") {  
  val licenseServerImageName: String? by project  
  onlyIf {  
    licenseServerImageName != null  
  }  
  doLast {  
    println(execCommand("docker push $serverImageNameForPush"))  
  }  
}

named("manifests") {  
  dependsOn("controller-gen")  
  description = "Generates manifests for k8s deployment using Helm"  
  doLast {  
    execHelmCommand("helm dependency update")  
    val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")} . --namespace $systemNamespace --set nameOverride=licenseapi")  
    buildDir.deleteRecursively()  
    buildDir.mkdir()  
    File("$buildDir/license-broker.yaml").writeText(stdOut)  
  }  
}

named<Copy>("generateValuesFile") {  
  expand(  
    "platform" to project.findProperty("platform")!!),
"registry" to project.findProperty("dockerRegistry")!!,
"artifactoryRepo" to project.findProperty("imageDirectory")!!,
"controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
"licenseServerImage" to getRegistrylessTaggedImage(project.findProperty("licenseServerImageName")!! as String),
"defaultImagePullPolicy" to project.findProperty("imagePullPolicy")!!,
"logLevel" to project.findProperty("logLevel")!!,
"logFormat" to project.findProperty("logFormat")!!,
"licenseServerTransportUrl" to project.findProperty("licenseServerTransportUrl")!!
)
)
named("generateControllerGenFiles") {
dependsOn("controller-gen")
doLast {
    execCommand("$controllerGen $crdOpts rbac:roleName=broker-role webhook paths=./...
output:crd:artifacts:config=config/crd")
}
}

register("generate") {
dependsOn("controller-gen")
description = "Executes code generators"
doLast {
    execCommand("$controllerGen object:headerFile=./hack/boilerplate.go.txt paths=./...")
}
}

register("uninstall") {
description = "Removes k8s objects from the active cluster"
dependsOn("manifests")
doLast {
    exec {
        ignoreExitValue = true
        commandLine("kubectl delete -f $buildDir".split(" "))
    }
}
}

named("deploy") {
dependsOn(":installCertManager")
dependsOn("manifests")
doLast {
    exec {
        commandLine("kubectl apply -f $buildDir".split(" "))
    }
    createRegistrySecret(systemNamespace)
}
named("loadImagesToKind") {
    doLast {
        val clusterName: String by project
        execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")
        execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
    }
}

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Cisco End User License Agreement

package integ_tests

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/rest"
    "path/filepath"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
    "sigs.k8s.io/controller-runtime/pkg/envtest/printer"
    "sigs.k8s.io/controller-runtime/pkg/log/zap"
    "strings"
    "testing"
    "time"

    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {
    RegisterFailHandler(Fail)
    SetDefaultEventuallyTimeout(time.Minute)
RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite", []Reporter{printer.NewLineReporter{}})

var _ = BeforeSuite(func(done Done) {
    logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))
    By("bootstrapping test environment")
    apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
    apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
    testEnv = &envtest.Environment{
        WebhookInstallOptions: envtest.WebhookInstallOptions{
            Paths: []string{filepath.Join("..", "config", "webhook")},
        },
        CRDDirectoryPaths: []string{filepath.Join("..", "config", "crd")},
        KubeAPIServerFlags: apiServerFlags,
        ControlPlaneStartTimeout: 100 * time.Second,
        ControlPlaneStopTimeout: 100 * time.Second,
    }
    var err error
    cfg, err = testEnv.Start()
    Expect(err).ToNot(HaveOccurred())
    Expect(cfg).ToNot(BeNil())
    err = v1.AddToScheme(scheme.Scheme)
    Expect(err).ToNot(HaveOccurred())
    k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
    Expect(err).ToNot(HaveOccurred())
    Expect(k8sClient).ToNot(BeNil())
    By("running webhook server")
    go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done), envtest.StartTimeout
    var _ = AfterSuite(func(done Done) {
        By("tearing down the test environment")
        cancelCtx()
        Expect(testEnv.Stop()).ToNot(HaveOccurred())
    }, envtest.StopTimeout)
    close(done), envtest.StopTimeout

    func errCauses(err error) []string {
        var causes []string
        if statusError, ok := err.(*errors.StatusError); ok {

for _, cause := range statusError.Status().Details.Causes {
    causes = append(causes, strings.Split(cause.Message, ": ")[2])
}
}
return causes

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package v1

import (
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    v1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
)

const TokenKeyName = "token"

type RegistrationAction string

const (    Register RegistrationAction = "REGISTER"
    Deregister RegistrationAction = "DEREGISTER"
)

// SmartLicenseSpec defines the desired state of SmartLicense
type SmartLicenseSpec struct {
    // Action is the desired state of the Smart Agent license registration.
    // +kubebuilder:validation:Enum=REGISTER;DEREGISTER
    // +optional
    Action RegistrationAction `json:"action"`

    // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.
    TokenSecret v1.SecretReference `json:"tokenSecret"`

    // LicenseType defines the type of license to request/release, usually the SKU of the license.
    // The default value is a SFW license tag being able to handle 1vCPU.
    // +optional
    LicenseType string `json:"licenseType"`

    // MinLicenseCount is a minimum number of licenses SFCN reserves for the product.
    // The default value is 1.
    // +optional
MinLicenseCount *uint32 `json:“minLicenseCount,omitempty”``

// MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.
// The default value is equal to MinLicenseCount.
// +optional
MaxLicenseCount *uint32 `json:“maxLicenseCount,omitempty”``

// ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when
// scaling up or down.
// The default value is 1.
// +optional
ScalingFactor *uint32 `json:“scalingFactor,omitempty”``

// ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA
// resources are supported.
ScalingRef autoscalingv1.CrossVersionObjectReference `json:“scalingRef,omitempty”`` }

type LicenseState string

cost (PendingLicenseState LicenseState = "PENDING"
Unlicensed LicenseState = "UNLICENSED"
InCompliance LicenseState = "IN_COMPLIANCE"
OutOfCompliance LicenseState = "OUT_OF_COMPLIANCE"
Overage LicenseState = "OVERAGE"
)

cost (DeploymentKind = "Deployment"
HPAKind = "HorizontalPodAutoscaler"
)

type RegistrationState string

cost (PendingRegistrationState RegistrationState = "PENDING"
Registered RegistrationState = "REGISTERED"
RegistrationFailed RegistrationState = "REGISTRATION_FAILED"
Deregistered RegistrationState = "DEREGISTERED"
DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
)

// SmartLicenseStatus defines the observed state of SmartLicense
type SmartLicenseStatus struct {

    // AccountDomain is the account domain in Cisco Software Central.
    AccountDomain string `json:"accountDomain,omitempty”"
// AccountName is the name of the virtual account in Cisco Software Central.
AccountName string `json:"accountName,omitempty"

// RegistrationState is the registration status of the SFCN product in Cisco Software Central.
// +kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DEREGISTRATION_FAILED
RegistrationState RegistrationState `json:"registrationState,omitempty"

// LicenseState is the state of the reserved licenses.
// +kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVERAGE
LicenseState LicenseState `json:"licenseState,omitempty"

// ErrorReason specifies the error due to which the SFCN product was not registered in Cisco Software Central.
ErrorReason string `json:"errorReason,omitempty"

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
LicenseNumber uint32 `json:"licenseNumber,omitempty"

// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicense,omitempty"

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicas,omitempty"

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlled,omitempty"

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextId,omitempty"

// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
    metav1.TypeMeta `json:"",inline"
    metav1.ObjectMeta `json:"metadata,omitempty"
}
Spec SmartLicenseSpec `json:"spec,omitempty"
Status SmartLicenseStatus `json:"status,omitempty"
}

// +kubebuilder:object:root=true

// SmartLicenseList contains a list of SmartLicense
type SmartLicenseList struct {
  metav1.TypeMeta `json:""`
  metav1.ListMeta `json:"metadata,omitempty"
  Items []SmartLicense `json:"items"
}

func init() {
  SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}

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*******************************************************************************

// Package v1 contains API Schema definitions for the sfcn.cisco.com v1 API group
// +kube:object:generate=true
// +groupName=sfcn.cisco.com
package v1

import {
  "k8s.io/apimachinery/pkg/runtime/schema"
  "sigs.k8s.io/controller-runtime/pkg/schema"
}

var {
  // GroupVersion is group version used to register these objects

  // SchemeBuilder is used to add go types to the GroupVersionKind scheme
  SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}

  // AddToScheme adds the types in this group-version to the given scheme.
  AddToScheme = SchemeBuilder.AddToScheme
}

domain: sfcn.cisco.com
repo: css.cisco.com/kasa/license-broker
resources:
- group: sfcn.cisco.com
  kind: SmartLicense
version: v1
version: "2"
package controllers

import (  
  "crypto/md5"
  "fmt"
)

v1 "css.cisco.com/kasa/license-broker/api/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
)

const (LicenseHolderLabel = "sfcn.cisco.com/license-holder"
   TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder"
   ServiceRoleLabel = "sfcn.cisco.com/service-role"
   // DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set
   DefaultServiceRole = "default"
   InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"
)

// serialNumber generates platform's Serial Number for SmartLicense resource.
// According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {
    return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName)))[0:11]
}

func containsString(slice []string, s string) bool {
    for _, item := range slice {
        if item == s {
            return true
        }
    }
    return false
}

func removeString(slice []string, s string) (result []string) {
    for _, item := range slice {
        if item == s {
            continue
        }
        result = append(result, item)
    }
    return
}

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {
var filteredLicenses []v1.SmartLicense
for _, license := range licenseList {
    if license.Status.RegistrationState == state {
        filteredLicenses = append(filteredLicenses, license)
    }
}
return filteredLicenses

// filterLicensesByKind filters SmartLicenses by given kind and name properties of ScalingRef field and returns the result.
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// pendingLicenseExists returns true if any license in the list is in Pending state.
func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status.LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

// setLicenseLabel makes sure that the licensing label is present when `shouldBePresent` is `true`
// and that the label is absent when `shouldBePresent` is `false`.
func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
        return true
    }
    if _, ok := meta.Labels[label]; ok && !shouldBePresent {
        delete(meta.Labels, label)
        return true
    }
    return false
package services

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "math"
    "sigs.k8s.io/controller-runtime/pkg/client"
)

    return &ReplicasCalculator{client, logger}
}

type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and calculates maximum amount of replicas based on licensing. // If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    var maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 && deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods", "deployment", deployment.Name)
        // it can be a scenario when we have spec.Replicas = 5, but Status.ReadyReplicas = 0. So, we just return desired replicas by a user.
        return *deployment.Spec.Replicas, nil
    }
    var err error
    if coresQuantity == 0 && deployment.Status.ReadyReplicas != 0 {
        coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
        if err != nil {
            return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
        }
    }
    return maxLimit, err
}
r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores", coresQuantity)

for _, license := range licenses {
    if license.Status.LicenseState == v1.InCompliance {
        maxLicensedCores := int(*license.Spec.MaxLicenseCount) * int(license.Status.CoresPerLicense)
        maxLicensedReplicas := int32(maxLicensedCores / int(coresQuantity))

        r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)
        maxLimit += maxLicensedReplicas
        license.Status.EstimatedMaxReplicas = maxLicensedReplicas
    }
}

if err := r.Client.Status().Update(ctx, &license); err != nil {
    return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
}

// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil
}

func (r *ReplicasCalculator) getCoresQuantity(deployment *appsv1.Deployment) uint32 {
    coresQuantity := resource.MustParse("0")
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
            return 0
        }
        coresQuantity.Add(containerLimit)
    }
    return uint32(coresQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
    podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    if err != nil {
        return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
    }
    pods := corev1.PodList{}
    if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
        return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
    }
    return
// TODO: do not rely on the fact that all nodes have the same CPU limit
pod := pods.Items[0]

node := corev1.Node{}
nodNsName := types.NamespacedName{Name: pod.Spec.NodeName}
if err := r.Client.Get(ctx, nodNsName, &node); err != nil {
    return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
}

r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPULimit, nil

1.353 go-restful v2.9.5+incompatible
1.353.1 Available under license :

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1.354 go-autorest-auth v0.5.7
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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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Alain Vongsouvanhalainv <alainv@google.com>
Andrew Gerrand <adg@golang.org>
Brad Fitzpatrick <bradfitz@golang.org>
Eric Koleda <ekoleda+devrel@googlers.com>
Francesc Campoy <campoy@golang.org>
Garrick Evans <garrick@google.com>
Glenn Lewis <gmlewis@google.com>
Ivan Krasin <krasin@golang.org>
Jason Hall <jasonhall@google.com>
Johan Euphrosine <proppy@google.com>
Kostik Shtoyk <kostik@google.com>
Kunpei Sakai <namusyaka@gmail.com>
Matthew Whisenhunt <matt.whisenhunt@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Nick Craig-Wood <nickcw@gmail.com>
Robbie Trencheny <me@robbiet.us>
Ross Light <light@google.com>
Sarah Adams <shadams@google.com>
Scott Van Woudenberg <scottvw@google.com>
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* golang.org/x/tools/go/analysis - https://github.com/golang/tools

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# Please keep the list sorted.

Aaron Jacobs <jacobsa@google.com> <aaronjjacobs@gmail.com>
Alex Reece <awreece@gmail.com>
David Symonds <dsymonds@golang.org>
Ryan Barrett <ryanb@google.com>

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package spec

// License information for the exposed API.

// For more information: http://goo.gl/8us55a#licenseObject
type License struct {
    Name string `json:"name,omitempty"
    URL  string `json:"url,omitempty"
}
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package simulator
import (
    "github.com/vmware/govmomi/object"
    "github.com/vmware/govmomi/vim25/methods"
    "github.com/vmware/govmomi/vim25/mo"
    "github.com/vmware/govmomi/vim25/soap"
    "github.com/vmware/govmomi/vim25/types"
)

// EvalLicense is the default license
var EvalLicense = types.LicenseManagerLicenseInfo{
    LicenseKey: "00000-00000-00000-00000-00000",
    EditionKey: "eval",
    Name:       "Evaluation Mode",
    Properties: []types.KeyAnyValue{
        {Key: "feature",
         Value: types.KeyValue{
             Key:   "serialuri:2",
             Value: "Remote virtual Serial Port Concentrator",
         },
        },
        {Key: "feature",
         Value: types.KeyValue{
             Key:   "dvs",
             Value: "vSphere Distributed Switch",
         },
        },
    }
}

type LicenseManager struct {
    mo.LicenseManager
}

func NewLicenseManager(ref types.ManagedObjectReference) object.Reference {
    m := &LicenseManager{}
    m.Self = ref
    m.Licenses = []types.LicenseManagerLicenseInfo{EvalLicense}

    if Map.IsVPX() {
        am := Map.Put(&LicenseAssignmentManager{ }).Reference()
        m.LicenseAssignmentManager = &am
    }

    return m
}
func (m *LicenseManager) AddLicense(req *types.AddLicense) soap.HasFault {
    body := &methods.AddLicenseBody{
        Res: &types.AddLicenseResponse{},
    }

    for _, license := range m.Licenses {
        if license.LicenseKey == req.LicenseKey {
            body.Res.Returnval = licenseInfo(license.LicenseKey, license.Labels)
            return body
        }
    }

    m.Licenses = append(m.Licenses, types.LicenseManagerLicenseInfo{
        LicenseKey: req.LicenseKey,
        Labels:     req.Labels,
    })

    body.Res.Returnval = licenseInfo(req.LicenseKey, req.Labels)

    return body
}

func (m *LicenseManager) RemoveLicense(req *types.RemoveLicense) soap.HasFault {
    body := &methods.RemoveLicenseBody{
        Res: &types.RemoveLicenseResponse{},
    }

    for i, license := range m.Licenses {
        if req.LicenseKey == license.LicenseKey {
            m.Licenses = append(m.Licenses[:i], m.Licenses[i+1:]...)
            return body
        }
    }

    return body
}

func (m *LicenseManager) UpdateLicenseLabel(req *types.UpdateLicenseLabel) soap.HasFault {
    body := &methods.UpdateLicenseLabelBody{
    }

    for i := range m.Licenses {
        license := &m.Licenses[i]

        if req.LicenseKey != license.LicenseKey {
            continue
        }

        body.Res = new(types.UpdateLicenseLabelResponse)
    }
for j := range license.Labels {
    label := &license.Labels[j]

    if label.Key == req.LabelKey {
        if req.LabelValue == "" {
            license.Labels = append(license.Labels[:i], license.Labels[i+1:...])
        } else {
            label.Value = req.LabelValue
        }
        return body
    }
}

license.Labels = append(license.Labels, types.KeyValue{
    Key:   req.LabelKey,
    Value: req.LabelValue,
})

return body

body.Fault_ = Fault("", &types.InvalidArgument{InvalidProperty: "licenseKey"})
return body

type LicenseAssignmentManager struct {
    mo.LicenseAssignmentManager
}

func (m *LicenseAssignmentManager) QueryAssignedLicenses(req *types.QueryAssignedLicenses) soap.HasFault {
    body := &methods.QueryAssignedLicensesBody{
        Res: &types.QueryAssignedLicensesResponse{},
    }
}

// EntityId can be a HostSystem or the vCenter InstanceUuid
if req.EntityId != "" {
    if req.EntityId != Map.content().About.InstanceUuid {
        id := types.ManagedObjectReference{
            Type: "HostSystem",
            Value: req.EntityId,
        }
        if Map.Get(id) == nil {
            return body
        }
    }
}
body.Res.Returnval = []types.LicenseAssignmentManagerLicenseAssignment{
    EntityId: req.EntityId,
    AssignedLicense: EvalLicense,
}

return body

func licenseInfo(key string, labels []types.KeyValue) types.LicenseManagerLicenseInfo {
    info := EvalLicense

    info-LicenseKey = key
    info.Labels = labels

    return info
}

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package migration

import "fmt"

// Notice is a migration warning
type Notice struct {
    Plugin     string
    Option     string
    Severity   string // 'deprecated', 'removed', or 'unsupported'
    ReplacedBy string
    Additional string
    Version    string
}

func (n *Notice) ToString() string {
    s := ""
    if n.Option == "" {
        s += fmt.Sprintf("Plugin %v", n.Plugin)
    } else {
        s += fmt.Sprintf("Option %v in plugin %v", n.Option, n.Plugin)
    }
    if n.Severity == unsupported {
        s += "is unsupported by this migration tool in " + n.Version + "."
    } else if n.Severity == newdefault {
        s += "is added as a default in " + n.Version + "."
    }
    return s
}
} else {
    s += "is " + n.Severity + " in " + n.Version + "."
}
if n.ReplacedBy != "" {
    s += fmt.Sprintf(` It is replaced by "%v"`, n.ReplacedBy)
}
if n.Additional != "" {
    s += " " + n.Additional
}
return s
}

const (  
    deprecated  = "deprecated"  // deprecated, but still completely functional  
    ignored     = "ignored"     // if included in the corefile, it will be ignored by CoreDNS  
    removed     = "removed"     // completely removed from CoreDNS, and would cause CoreDNS to exit if present in the corefile  
    newdefault  = "newdefault"  // added to the default corefile. CoreDNS may not function properly if it is not present in the corefile.  
    unsupported = "unsupported" // the plugin/option is not supported by the migration tool  
)

// The following statuses are used for selecting/filtering notifications  
all = "all" // show all statuses  
)

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{% endpanel %}

{% panel style="info", title="TL;DR" %}
- Copy files to and from Containers in a cluster
{% endpanel %}

# Copying Container Files

## Motivation

- Copying files from Containers in a cluster to a local filesystem
- Copying files from a local filesystem to Containers in a cluster

{% panel style="warning", title="Install Tar" %}
Copy requires that *tar* be installed in the container image.

Open Source Used In kASA v1.5 6552
## Local to Remote

Copy a local file to a remote Pod in a cluster.

- Local file format is `<path>`
- Remote file format is `<pod-name>:<path>`

```bash
kubectl cp /tmp/foo_dir <some-pod>:/tmp/bar_dir
```

## Remote to Local

Copy a remote file from a Pod to a local file.

- Local file format is `<path>`
- Remote file format is `<pod-name>:<path>`

```bash
kubectl cp <some-pod>:/tmp/foo /tmp/bar
```

## Specify the Container

Specify the Container within a Pod running multiple containers.

- `-c <container-name>`

```bash
kubectl cp /tmp/foo <some-pod>:/tmp/bar -c <specific-container>
```
## Namespaces

Set the Pod namespace by prefixing the Pod name with `&lt;namespace&gt;/`.

- `&lt;pod-namespace&gt;/&lt;pod-name&gt;&lt;path&gt;`

```bash
kubectl cp /tmp/foo &lt;some-namespace&gt;/&lt;some-pod&gt;:/tmp/bar
```

```
```
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SOFTWARE.

Paul Borman <borman@google.com>
bmatsuo
shawnps
theory
jboverfelt
dsymonds
cd1
wallclockbuilder
dansouza

# The list of people who have contributed code to the cmux repository.
#
# Auto-generated with:
# git log --oneline --pretty=format:%an <%aE> | sort -u
#
Andreas Jaekle <andreas@jaekle.net>
Dmitri Shuralyov <shurcooL@gmail.com>
Ethan Mosbaugh <emosbaugh@gmail.com>
Soheil Hassas Yeganeh <soheil.h.y@gmail.com>
Soheil Hassas Yeganeh <soheil@cs.toronto.edu>
Tamir Duberstein <tamir@cockroachlabs.com>
Tamir Duberstein <tamird@gmail.com>
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Abhijeet Kasurde <akasurde@redhat.com>
abrarshivani <abrarshivani@users.noreply.github.com>
Adam Shannon <adamkshannon@gmail.com>
Alessandro Cortiana <alessandro.cortiana@gmail.com>
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Cdric Blomart <cblomart@gmail.com>
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Omar Kohl <omarkohl@gmail.com>
Parham Alvani <parham.alvani@gmail.com>
Pierre Gronljer <pierre.gronljer@corp.ovh.com>
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Rowan Jacobs <rojacobs@pivotal.io>
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Salar Onur <salar@vmware.com>
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Steve Purcell <steve@sanityinc.com>
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Thibaut Ackermann <thibaut.ackermann@alcatel-lucent.com>
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Uwe Bessle <Uwe.Bessle@iteratec.de>
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Witold Krecicki <wpk@culm.net>
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Yuya Kusakabe <yuya.kusakabe@gmail.com>
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Anton Povarov <anton.povarov@gmail.com>
Brian Goff <cpuguy83@gmail.com>
Clayton Coleman <ccooleman@redhat.com>
Denis Smirnov <denis.smirnov.91@gmail.com>
DongYun Kang <ceram1000@gmail.com>
Dwayne Schultz <dschultz@pivotal.io>
Georg Apitz <gapitz@pivotal.io>
Gustav Paul <gustav.paul@gmail.com>
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John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
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tomb - support for clean goroutine termination in Go.

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1.369 golang-protobuf-extensions v1.0.2-
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1.376 go-homedir v1.1.0

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Alain Vongsouvanhalainv <alainv@google.com>
Andrew Gerrand <adg@golang.org>
Brad Fitzpatrick <bradfitz@golang.org>
Eric Koleda <ekoleda+devrel@googlers.com>
Francesc Campoy <campoy@golang.org>
Garrick Evans <garrick@google.com>
Glenn Lewis <gmllewis@google.com>
Ivan Krasin <krasin@golang.org>
Jason Hall <jasonhall@google.com>
Johan Euphrosine <proppy@gmail.com>
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Kunpei Sakai <namusyaka@gmail.com>
Matthew Whisenhunt <matt.whisenhunt@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Nick Craig-Wood <nickcw@gmail.com>
Robbie Trencheny <me@robbiet.us>
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Kai Backman <kaib@golang.org>
Marc-Antoine Ruel <maruel@chromium.org>
Nigel Tao <nigeltao@golang.org>
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Dustin Sallings <dustin@spy.net>
Jason Mooberry <jasonmoo@me.com>
Sergey Shepelev <temotor@gmail.com>
Alex Edwards <ajmedwards@gmail.com>
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layout: "api"
page_title: "/sys/license - HTTP API"
sidebar_title: "<code>/sys/license</code>"
sidebar_current: "api-http-system-license"
description: |
The `/sys/license` endpoint is used to view and update the license used in Vault.
---

# `/sys/license`

-> **Enterprise Only** These endpoints require Vault Enterprise.

The `/sys/license` endpoint is used to view and update the license used in Vault.

## Read License

This endpoint returns information about the currently installed license.

<table>
<thead>
<tr>
<th>Method</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>GET</code></td>
<td><code>/sys/license</code></td>
</tr>
</tbody>
</table>

### Sample Request

```
$ curl 
   --header "X-Vault-Token: ..."
   http://127.0.0.1:8200/v1/sys/license
```

### Sample Response

```
```json
{
  "data": {
    "expiration_time": "2017-11-14T16:34:36.546753-05:00",
```
"features": [ 
  "UI",
  "HSM",
  "Performance Replication",
  "DR Replication"
],
"license_id": "temporary",
"start_time": "2017-11-14T16:04:36.546753-05:00"
},
"warnings": [
  "time left on license is 29m33s"
]}
```

## Install License

This endpoint is used to install a license into Vault.

<table>
<thead>
<tr>
<th align="left">Method</th>
<th align="left">Path</th>
</tr>
</thead>
<tbody>
<tr>
<td align="left"><code>PUT</code></td>
<td align="left"><code>/sys/license</code></td>
</tr>
</tbody>
</table>

### Parameters

- `text` *(string: <required>)* The text of the license.

*DR Secondary Specific Parameters*

- `dr_operation_token` *(string: <required>)* - DR operation token used to authorize this request.

### Sample Payload

```json
{
  "text": "01ABCDEFG..."
}
```

### Sample Request

```
$ curl
   --header "X-Vault-Token: ..."
   --request PUT
   --data @payload.json
   http://127.0.0.1:8200/v1/sys/license
```
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mgo - MongoDB driver for Go

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package github

import (
    "context"
    "fmt"
)

// LicensesService handles communication with the license related
// methods of the GitHub API.
/
// GitHub API docs: https://developer.github.com/v3/licenses/
type LicensesService service

// RepositoryLicense represents the license for a repository.
type RepositoryLicense struct {
    Name *string `json:"name,omitempty"
    Path *string `json:"path,omitempty"

    SHA *string `json:"sha,omitempty"
    Size *int  `json:"size,omitempty"
// License represents an open source license.
type License struct {
    Key  *string `json:"key,omitempty"`
    Name *string `json:"name,omitempty"`
    URL  *string `json:"url,omitempty"`
    SPDXID         *string   `json:"spdx_id,omitempty"`
    HTMLURL        *string   `json:"html_url,omitempty"`
    Featured       *bool     `json:"featured,omitempty"`
    Description    *string   `json:"description,omitempty"`
    Implementation *string   `json:"implementation,omitempty"`
    Permissions    *[]string `json:"permissions,omitempty"`
    Conditions     *[]string `json:"conditions,omitempty"`
    Limitations    *[]string `json:"limitations,omitempty"`
    Body           *string   `json:"body,omitempty"`
}

func (l License) String() string {
    return Stringify(l)
}

// List popular open source licenses.
//
// GitHub API docs: https://developer.github.com/v3/licenses/#list-all-licenses
func (s *LicensesService) List(ctx context.Context) ([][]*License, *Response, error) {
    req, err := s.client.NewRequest("GET", "licenses", nil)
    if err != nil {
        return nil, nil, err
    }
    var licenses [][]*License
    resp, err := s.client.Do(ctx, req, &licenses)
    if err != nil {
        return nil, resp, err
    }
    return licenses, resp, nil
}
// Get extended metadata for one license.

// GitHub API docs: https://developer.github.com/v3/licenses/#get-an-individual-license
func (s *LicensesService) Get(ctx context.Context, licenseName string) (*License, *Response, error) {
    u := fmt.Sprintf("licenses/%s", licenseName)
    req, err := s.client.NewRequest("GET", u, nil)
    if err != nil {
        return nil, nil, err
    }

    license := new(License)
    resp, err := s.client.Do(ctx, req, license)
    if err != nil {
        return nil, resp, err
    }

    return license, resp, nil
}

Anton Povarov <anton.povarov@gmail.com>
Brian Goff <cpuguy83@gmail.com>
Clayton Coleman <ccoleman@redhat.com>
Denis Smirnov <denis.smirnov.91@gmail.com>
DongYun Kang <ceram1000@gmail.com>
Dwayne Schultz <dschultz@pivotal.io>
Georg Apitz <gapitz@pivotal.io>
Gustav Paul <gustav.paul@gmail.com>
Johan Brandhorst <johan.brandhorst@gmail.com>
John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
Laurent <laurent@adyoulike.com>
Patrick Lee <patrick@dropbox.com>
Peter Edge <peter.edge@gmail.com>
Roger Johansson <rogeralsing@gmail.com>
Sam Nguyen <sam.nguyen@sendgrid.com>
Sergio Arbeo <serabe@gmail.com>
Stephen J Day <stephen.day@docker.com>
Tamir Duberstein <tamird@gmail.com>
Todd Eisenberger <teisenberger@dropbox.com>
Tormod Erevik Lea <tormodlea@gmail.com>
Vyacheslav Kim <kane@sendgrid.com>
Walter Schulze <awalterschulze@gmail.com>
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// Features is a bitmask of feature flags
type Features uint

const FeatureNone Features = 0

func (f Features) HasFeature(flag Features) bool {
    return false
}

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import: ../../fossene/db/schema/thing.yml

fields:
  site: string
  author: root
1.382 netty-transport 4.1.51.Final

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*/
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- /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources.jar/io/netty/channel/DefaultEventLoopGroup.java
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 */
/**
 * Handles an I/O event or intercepts an I/O operation, and forwards it to its next handler in
 * its {@link ChannelPipeline}.  
 *
 * <h3>Sub-types</h3>
 * <p>
 * {@link ChannelHandler} itself does not provide many methods, but you usually have to implement one of its
 * subtypes:
 * <ul>
 * <li>{@link ChannelInboundHandler} to handle inbound I/O events, and</li>
 * <li>{@link ChannelOutboundHandler} to handle outbound I/O operations.</li>
 * </ul>
 * </p>
 * <p>
 * Alternatively, the following adapter classes are provided for your convenience:
 * <ul>
 * <li>{@link ChannelInboundHandlerAdapter} to handle inbound I/O events, </li>
 * <li>{@link ChannelOutboundHandlerAdapter} to handle outbound I/O operations, and</li>
 * <li>{@link ChannelDuplexHandler} to handle both inbound and outbound events</li>
 * </ul>
 * </p>
 * <p>
 * For more information, please refer to the documentation of each subtype.
 * </p>
 *
 * <h3>The context object</h3>
 * <p>
 * A {@link ChannelHandler} is provided with a {@link ChannelHandlerContext}
 * object. A {@link ChannelHandler} is supposed to interact with the
 * {@link ChannelPipeline} it belongs to via a context object. Using the
 */
* context object, the [@link ChannelHandler] can pass events upstream or
downstream, modify the pipeline dynamically, or store the information
* (using [@link AttributeKey]s) which is specific to the handler.
*
* <h3>State management</h3>
*
* A [@link ChannelHandler] often needs to store some stateful information.
* The simplest and recommended approach is to use member variables:
* <pre>
* public interface Message {
*     // your methods here
* }
*
* public class DataServerHandler extends [@link SimpleChannelInboundHandler]<Message> {
*
*     <b>private boolean loggedIn;</b>
*
*     <b>@code @Override</b>
*     public void channelRead0([@link ChannelHandlerContext] ctx, Message message) {
*         if (message instanceof LoginMessage) {
*             authenticate((LoginMessage) message);
*             <b>loggedIn = true;</b>
*         } else (message instanceof GetDataMessage) {
*             if (<b>loggedIn</b>) {
*                 ctx.writeAndFlush(fetchSecret((GetDataMessage) message));
*             } else {
*                 fail();
*             }
*         }
*     }
*     ...
* }
* </pre>
*
* Because the handler instance has a state variable which is dedicated to
* one connection, you have to create a new handler instance for each new
* channel to avoid a race condition where a unauthenticated client can get
* the confidential information:
* <pre>
* // Create a new handler instance per channel.
* // See [@link ChannelInitializer#initChannel(Channel)].
* public class DataServerInitializer extends [@link ChannelInitializer]<@link Channel> {
*     <b>@code @Override</b>
*     public void initChannel([@link Channel] channel) {
*         channel.pipeline().addLast("handler", <b>new DataServerHandler()</b>);
*     }
* }
* </pre>
* <h4>Using {@link AttributeKey}s</h4>
* Although it's recommended to use member variables to store the state of a
* handler, for some reason you might not want to create many handler instances.
* In such a case, you can use {@link AttributeKey}s which is provided by
* {@link ChannelHandlerContext}:
* <pre>
* public interface Message {
*  // your methods here
* }
*
* {<code>@Sharable</code>}
* public class DataServerHandler extends {<code>@link SimpleChannelInboundHandler</code>&lt;Message&gt; { 
*  private final {<code>@link AttributeKey</code>&lt;@link Boolean&gt; auth =
*   {<code>@link AttributeKey</code>#valueOf(String) AttributeKey.valueOf("auth"));
*   
*   {<code>@code @Override</code>}
*   public void channelRead({<code>@link ChannelHandlerContext</code> ctx, Message message) {
*    {<code>@link Attribute</code>&lt;@link Boolean&gt; attr = ctx.attr(auth);
*    if (message instanceof LoginMessage) {
*      authenticate((LoginMessage) o);
*      attr.set(true);
*    } else (message instanceof GetDataMessage) {
*      if (&lt;b&gt;Boolean.TRUE.equals(attr.get())&lt;/b&gt;) {
*        ctx.writeAndFlush(fetchSecret((GetDataMessage) o));
*      } else {
*        fail();
*      }
*   }
*   }
*   ...
* } }
* </pre>
* Now that the state of the handler is attached to the {<code>@link ChannelHandlerContext</code>}, you can add the
* same handler instance to different pipelines:
* <pre>
* public class DataServerInitializer extends {<code>@link ChannelInitializer</code>&lt;@link Channel&gt; { 
*   private static final DataServerHandler &lt;b&gt;SHARED&lt;/b&gt; = new DataServerHandler();
*   
*   {<code>@code @Override</code>}
*   public void initChannel({<code>@link Channel</code> channel) {
*    channel.pipeline().addLast("handler", &lt;b&gt;SHARED&lt;/b&gt;);
*   }
* } }
* </pre>
*
The `@Sharable` annotation

In the example above which used an `@link AttributeKey`, you might have noticed the `@Sharable` annotation.

If a `@link ChannelHandler` is annotated with the `@Sharable` annotation, it means you can create an instance of the handler just once and add it to one or more `@link ChannelPipeline`s multiple times without a race condition.

If this annotation is not specified, you have to create a new handler instance every time you add it to a pipeline because it has unshared state such as member variables.

This annotation is provided for documentation purpose, just like the JCIP annotations.

Additional resources worth reading

Please refer to the `@link ChannelHandler`, and `@link ChannelPipeline` to find out more about inbound and outbound operations, what fundamental differences they have, how they flow in a pipeline, and how to handle the operation in your application.

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Found in path(s):
* /opt/cola/permits/1135840359_1613613123.36/0/jcommander-1-78-sources-2-
  jar/com/beust/jcommander/validators/NoValidator.java
* /opt/cola/permits/1135840359_1613613123.36/0/jcommander-1-78-sources-2-
  jar/com/beust/jcommander/validators/PositiveInteger.java
* /opt/cola/permits/1135840359_1613613123.36/0/jcommander-1-78-sources-2-
  jar/com/beust/jcommander/validators/NoValueValidator.java
* /opt/cola/permits/1135840359_1613613123.36/0/jcommander-1-78-sources-2-
  jar/com/beust/jcommander/IParameterValidator.java
* /opt/cola/permits/1135840359_1613613123.36/0/jcommander-1-78-sources-2-
  jar/com/beust/jcommander/IParameterValidator2.java

1.389 ncurses 6.1+20181013 2+deb10u2
1.389.1 Available under license:

Upstream source https://invisible-island.net/ncurses/ncurses-examples.html

Current ncurses maintainer: Thomas Dickey <dickey@invisible-island.net>

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1.390 kubernetes-klog v2.2.0

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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/UnpooledDirectByteBuf.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/Unpooled.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/PooledByteBufAllocator.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/package-info.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/UnpooledDirectByteBuf.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/PoolChunk.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/ByteBufFactory.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/ByteBufRegion.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/ByteBufUtil.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/ByteBufAllocator.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/ByteBufAllocatorFactory.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/UnpooledByteBufAllocator.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/UnpooledHeapByteBuf.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/PoolArena.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/ByteBufAllocator.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/SlicedByteBuf.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/PoolChunkList.java

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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/search/AbstractSearchProcessorFactory.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/search/SearchProcessor.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/search/SearchProcessorFactory.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/search/MultiSearchProcessor.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/search/AbstractMultiSearchProcessorFactory.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/search/BitapSearchProcessorFactory.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/search/AhoCorasicSearchProcessorFactory.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1.jar/io/netty/buffer/UnpooledSlicedByteBuf.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1.jar/io/netty/buffer/UnsafeByteBufUtil.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1.jar/io/netty/buffer/PoolArenaMetric.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1.jar/io/netty/buffer/UnpooledUnsafeHeapByteBuf.java
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jar/io/netty/buffer/EmptyByteBuf.java
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jar/io/netty/buffer/ReadOnlyUnsafeDirectByteBuf.java
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jar/io/netty/buffer/ByteBufProcessor.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/PooledByteBufAllocatorMetric.java
* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-jar/io/netty/buffer/ByteBufAllocatorMetricProvider.java
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  jar/io/netty/buffer/AbstractUnpooledSlicedByteBuf.java
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  jar/io/netty/buffer/PooledSlicedByteBuf.java
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-
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* /opt/cola/permits/1199756627_1630579409.55/0/netty-buffer-4-1-63-final-sources-1-
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1.406 oklog-run v1.0.0

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Subject: Re: XZ utils for Debian
Date: Sun, 19 Jul 2009 13:28:23 +0300
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/stream/ChunkedStream.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/stream/ChunkedFile.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/SslHandler.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/NotSslRecordException.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/timeout/ReadTimeoutException.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/logging/LogLevel.java
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  jar/io/netty/handler/ssl/ApplicationProtocolNegotiator.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/OpenSslServerSessionContext.java
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jar/io.netty.handler.ssl/JdkSslServerContext.java
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* /opt/cola/permits/1168237012_1621962037.41/netty-handler-4.1-63-final-sources-1-
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jar/io.netty.handler.ssl/util/FingerprintTrustManagerFactory.java
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
jar/io/netty/handler/ssl/util/LazyJavaxX509Certificate.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1.jar/io/netty/handler/ssl/SslMasterKeyHandler.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1.jar/io/netty/handler/address/DynamicAddressConnectHandler.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1.jar/io/netty/handler/ssl/util/SimpleKeyManagerFactory.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1.jar/io/netty/handler/ssl/util/KeyManagerFactoryWrapper.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1.jar/io/netty/handler/ssl/util/TrustManagerFactoryWrapper.java
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1jar/io/netty/handler/ssl/OpenSslKeyMaterial.java
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1jar/io/netty/handler/ssl/OpenSslCachingKeyMaterialProvider.java
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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1jar/io/netty/handler/ssl/ExtendedOpenSslSession.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1jar/io/netty/handler/ssl/OpenSslTlsv13X509ExtendedTrustManager.java
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jar/io/netty/handler/ssl/oospsi/package-info.java
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  jar/io/netty/handler/traffic/TrafficCounter.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/traffic/ChannelTrafficShapingHandler.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/traffic/GlobalTrafficShapingHandler.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/traffic/package-info.java

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* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/ReferenceCountedOpenSslClientContext.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/PemPrivateKey.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/Java8SslUtils.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/ReferenceCountedOpenSslContext.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/ReferenceCountedOpenSslServerContext.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/DelegatingSslContext.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
  jar/io/netty/handler/ssl/utils/X509TrustManagerWrapper.java
* /opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-
Found in path(s):
  */opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-jar/io/netty/handler/ipfilter/IpSubnetFilter.java
  */opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-jar/io/netty/handler/ssl/sslClosedEngineException.java
  */opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-jar/io/netty/handler/ssl/SslHandshakeTimeoutException.java
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  */opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-jar/io/netty/handler/logging/ByteBufFormat.java
  */opt/cola/permits/1168237012_1621962037.41/0/netty-handler-4-1-63-final-sources-1-jar/io/netty/handler/ipfilter/IpSubnetFilterRuleComparator.java

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1.420 nghttp2 1.42.0-r1

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set terminal pngcairo font 'Sans, 8' lw 1 size 1400,1024
set xtics rotate by -45
set style histogram errorbars gap 2 lw 1
set style fill solid border -1
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1.432 fsnotify 1.4.9
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1.433 elfutils 0.182-r0

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```bash
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```

Found in path(s):
* /opt/cola/permits/1141673004_1616092057.55/0/elfutils-0-182-r0-tar-gz/usr/bin/eu-make-debug-archive

1.434 go-connections v0.4.0

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1.435 x-net v0.0.0-20201110031124-
69a78807bb2b

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1.436 goautoneg v0.0.0-20191010083416-a7dc8b61c822

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1.437 jackson 2.12.0

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1.438 base-files 9.9+deb9u7

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1.452 vault-api 1.0.4
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```java
/**
 * Base constructor.
 * <p>
 * The authorizer attempts to perform matching (including the use of the wildcard) in accordance with RFC 6125.
 * </p>
 * <p>
 * Known suffixes is a list of public domain suffixes that can't be used as wild cards for
 * example *.com, or c*c.com, as a dns wildcard could match every/most .com domains if a registrar were issue it.
 * If *.com is in the known suffixes list will not be allowed to match.
 * </p>
 * <p>
 * @param knownSuffixes a set of suffixes that cannot be wild-carded, e.g. { ".com", ".net", ".org" }
 * /

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1089947271_1601369618.24/0/bcpkix-fips-1-0-3-sources-jar/org/bouncycastle/est/jcajce/JsseDefaultHostnameAuthorizer.java
```

**1.454 kubernetes-klog v2.2.0**

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Java ClassMate library was originally written by Tatu Saloranta (tatu.saloranta@iki.fi)

Other developers who have contributed code are:

* Brian Langel

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func TestLicense(t *testing.T) {
    t.Parallel()
    err := filepath.Walk(".", func(path string, fi os.FileInfo, err error) error {
        if err != nil {
            return err
        }
        if ext := filepath.Ext(path); ext != ".go" && ext != ".proto" {
            return nil
        }
        if strings.HasSuffix(path, ".pb.go") {
            // .pb.go files are generated from the proto files.
            // .proto files must have license headers.
            return nil
        }
        if path == "bigtable/cmd/cbt/cbtdoc.go" {
            // Automatically generated.
            return nil
        }
        if path == "cmd/go-cloud-debug-agent/internal/debug/elf/elf.go" {
            // BSD license, which is compatible, is embedded in the file.
            return nil
        }
        src, err := ioutil.ReadFile(path)
        if err != nil {
            return nil
        }
        src = src[:300] // Ensure all of the sentinel values are at the top of the file.
        // Find license
        for _, sentinel := range sentinels {
            if !bytes.Contains(src, []byte(sentinel)) {
                t.Errorf("%v: license header not present. want %q", path, sentinel)
                return nil
            }
        }
    })
}

var sentinels = []string{
    "Copyright",
    "Google",
    "Licensed under the Apache License, Version 2.0 (the "License");",
}
if err != nil {
    t.Fatal(err)
}
}

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1.467 log-rotate 3.18.0-r0

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Bundle-SymbolicName: io.netty.resolver
Implementation-Version: 4.1.63.Final
Built-By: root
Bnd-LastModified: 1617274739124
Bundle-ManifestVersion: 2
Implementation-Vendor-Id: io.netty
Bundle-DocURL: https://netty.io/
Bundle-Vendor: The Netty Project
Import-Package: io.netty.util;version="[4.1,5)";io.netty.util.concurrent;version="[4.1,5)";io.netty
y.util.internal.logging;version="[4.1.5)",sun.nio.ch;resolution=opti
onal.org.eclipse.jetty.npn;version="[1,2)";resolution=optional.org.e
cclipse.jetty.alpn;version="[1,2)";resolution=optional
Require-Capability: osgi.ee;filter="(&amp; osgi.ee=JavaSE)(version=1.6))"
Tool: Bnd-2.4.1.201501161923
Implementation-Vendor: The Netty Project
Export-Package: io.netty.resolver;uses="io.netty.util.concurrent";ver
sion="4.1.63"
Bundle-Name: Netty/Resolver
Bundle-Version: 4.1.63.Final
Created-By: Apache Maven Bundle Plugin
Build-Jdk: 1.8.0_272
Implementation-URL: https://netty.io/netty-resolver/

Found in path(s):
* /opt/cola/permits/1168236991_1621962039.06/0/netty-resolver-4-1-63-final-jar/META-INF/MANIFEST.MF

1.479 bridgeutils 1.32.1
1.479.1 Available under license :

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* /opt/cola/permits/1168237001_1621962030.66/0/netty-transport-4-1-63-final.jar/META-INF/native-
image/io.netty/transport/native-image.properties
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Manifest-Version: 1.0
Implementation-Title: Netty/Transport
Bundle-Description: Netty is an asynchronous event-driven network appl
ication framework for rapid development of maintainable high perfo
rmance protocol servers and clients.
Automatic-Module-Name: io.netty.transport
Bundle-License: https://www.apache.org/licenses/LICENSE-2.0
Bundle-SymbolicName: io.netty.transport
Implementation-Version: 4.1.63.Final
Built-By: root
Bnd-LastModified: 1617274755207
Bundle-ManifestVersion: 2
Implementation-Vendor-Id: io.netty
Bundle-DocURL: https://netty.io/
Bundle-Vendor: The Netty Project
Import-Package: io.netty.buffer;version="[4.1,5)",io.netty.resolver;version="[4.1,5)",io.netty.util;version="[4.1,5)",io.netty.util.concurrent;version="[4.1,5)",io.netty.util.internal;version="[4.1,5)",io.netty.util.internal.logging;version="[4.1,5)",sun.nio.ch;resolution:=optional,org.eclipse.jetty.npn;version="[1,2)";resolution:=optional,org.eclipse.jetty.alpn;version="[1,2)";resolution:=optional
Require-Capability: osgi.ee;filter:="(&(osgi.ee=JavaSE)(version=1.6))"
Tool: Bnd-2.4.1.201501161923
Implementation-Vendor: The Netty Project
el.nio.io.netty.channel.socket";version="4.1.63"
Bundle-Name: Netty/Transport
Bundle-Version: 4.1.63.Final
Created-By: Apache Maven Bundle Plugin
Build-Jdk: 1.8.0_272
Implementation-URL: https://netty.io/netty-transport/

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1.481 brotli 1.0.9-r3
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```yaml
{{- $global := default (dict) $.Values.global -}}

{{- $dataPlaneNamespace := include "aegis.namespace.dataPlaneNamespace" (list $) -}}

{{- if ($global.platform | eq "azure") }}

{{ include "kasa.licensebroker.storageAzureDisk" (list $ "azure-disk-sc") }}

{{- else if ($global.platform | ne "aws") | and ($global.platform | ne "eks") }}

{{ include "kasa.licensebroker.storageLocal" (list $ "broker") }}

{{- end }}

---

apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: {{ template "aegis.metadata.fullname" (list $ "server") }}
labels: {{ include "aegis.metadata.standardLabels" (list $) | nindent 4 }}

spec:
  accessModes:
    - ReadWriteOnce
  volumeMode: Filesystem

  {{- if ($global.platform | eq "aws") | or ($global.platform | eq "eks") }}
  storageClassName: "gp2" {{/* EKS and AWS have a default 'gp2' StorageClass so reusing it here */}}
  {{- else if ($global.platform | eq "azure") }}
  storageClassName: {{ include "aegis.metadata.fullname" (list $ "azure-disk-sc") }} {{/* example yaml has 'managed-csi' as the name which is vague af */}}
  {{- else if ($global.platform | eq "kind") }}
  storageClassName: "standard" {{/* Kind has a default 'standard' StorageClass so reusing it here */}}
  {{- end }}

storageClassName: {{ include "aegis.metadata.fullname" (list $ "broker") }}
{{- end }}
resources:
  requests:
    storage: {{ $.Values.licenseServerStorage }}

{{- define "kasa.licensebroker.storageLocal" -}}
  {{ $ := first . -}}
  {{ $storageName := last . -}}
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  {{ template "aegis.metadata.standard" (list $ $storageName) }}
  provisioner: kubernetes.io/no-provisioner
  reclaimPolicy: Delete
  volumeBindingMode: WaitForFirstConsumer
{{- end -}}

{{- define "kasa.licensebroker.storageAzureDisk" -}}
  {{ $ := first . -}}
  {{ $storageName := last . -}}
  apiVersion: storage.k8s.io/v1
  kind: StorageClass
  {{ template "aegis.metadata.standard" (list $ $storageName) }}
  provisioner: disk.csi.azure.com
  parameters:
    {{- /* TODO: parameterize the sku and other params https://github.com/kubernetes-sigs/azuredisk-csi-driver/blob/v1.2.0/docs/driver-parameters.md */}}
  reclaimPolicy: Delete
  volumeBindingMode: WaitForFirstConsumer
  allowVolumeExpansion: true
{{- end -}}

{{- define "kasa.validate.eula" -}}
  {{ $ := first . -}}
  {{ $acceptValues := list "yes" "agree" }}
  {{ if $.Release.IsInstall | and (not ($acceptValues | has $.Values.global.acceptEULA)) -}}
    {{ $.Files.Get "eula/EULA.txt" }}
  {{- end -}}
{{- end -}}

package services_test

import (v1 "css.cisco.com/kasa/license-broker/api/v1"
"k8s.io/client-go/kubernetes/scheme"
"testing"

. "github.com/onsi/ginkgo"
func TestControllers(t *testing.T) {
  RegisterFailHandler(Fail)
  RunSpecs(t, "Services Suite")
}

var _ = BeforeSuite(func() {
  _ = v1.AddToScheme(scheme.Scheme)
})

package listeners_test

import (　
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/listeners"
  licensing "css.cisco.com/licensing/client-agent"
  "github.com/golang/mock/gomock"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
  corev1 "k8s.io/api/core/v1"
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/kubernetes/scheme"
  "k8s.io/client-go/tools/record"
  "sigs.k8s.io/controller-runtime/pkg/client"
  "sigs.k8s.io/controller-runtime/pkg/client/fake"
  "sigs.k8s.io/controller-runtime/pkg/controller"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
}

var _ = Describe("Deregistration Listener Test", func() {

  licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

  var listener licensing.DeregistrationListener
  var fakeClient client.Client
  var mockCtrl *gomock.Controller
  var recorder *record.FakeRecorder
  var smartLicense *v1.SmartLicense
  var notifier chan event.GenericEvent

 BeforeEach(func() {
    smartLicense = &v1.SmartLicense{
      ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
      Spec: v1.SmartLicenseSpec{

Action: v1.Register,
LicenseType: licenseType,
]
Status: v1.SmartLicenseStatus{
  RegistrationState: v1.Registered,
  LicenseState: v1.InCompliance,
  ErrorReason: "",
},
}

mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()
recorder = record.NewFakeRecorder(1024)
notifier = make(chan event.GenericEvent, 10)

listener = listeners.NewDeregistrationListener(licenseNsName, fakeClient, logf.NullLogger{}, recorder, notifier)
}

AfterEach(func() {
  mockCtrl.Finish()
})

It("should update SmartLicense status on deregistration event", func() {
  listener.OnAutoDeregistration(&licensing.Platform{Name: "foo", ProductId: "bar"}, "something happened")

  Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
  Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(0)))
  Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(0)))
  Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
  Expect(recorder.Events).Should(HaveLen(1))
  Expect(recorder.Events).Should(Receive(HavePrefix("Warning Deregistered Deregistered SmartLicense in response to out-of-band event from License Server")))
  Expect(notifier).Should(Receive(&event.GenericEvent{
    Object: smartLicense,
  }))
})
}

package controllers_test

import (  
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers"
const (  
epHpaName                   = "epHPA"  
initialHPAMaxReplicas int32 = 3
)

var _ = Describe("HPA License Controller Test", func() {

hpaNsName := types.NamespacedName{Namespace: defaultNs, Name: epHpaName}
var (  
reconciler       *controllers.HPALicenseReconciler  
fakeClient       client.Client  
mockCtrl         *gomock.Controller  
hpa              *autoscalingv1.HorizontalPodAutoscaler  
smartLicense     *v1.SmartLicense  
recorder         *record.FakeRecorder  
replicasCalculatorMock *mocks.MockReplicasCalculator
)

BeforeEach(func() {
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
recorder = record.NewFakeRecorder(1024)
replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)

reconciler = &controllers.HPALicenseReconciler{  
Client:      fakeClient,  
Log:         logf.NullLogger{},  
Recorder:    recorder,  
ReplicasCalculator: replicasCalculatorMock,
}
smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action:          v1.Register,
        LicenseType:     licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor:   &scalingFactor,
    },
    Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

deployment := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:      "ep",
        Namespace: defaultNs,
    },
    Spec: appsv1.DeploymentSpec{Replicas: pointer.Int32Ptr(1)},
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

hpa = &autoscalingv1.HorizontalPodAutoscaler{
    ObjectMeta: metav1.ObjectMeta{
        Name:      epHpaName,
        Namespace: defaultNs,
    },
    Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
        MaxReplicas: initialHPAMaxReplicas,
    },
}
Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

AfterEach(func() {
    Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
    Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
})

It("should skip if HPA does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), hpa)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
})
It("should skip if HPA SmartLicense does not exist", func() {
    Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(initialHPAMaxReplicas, nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(initialHPAMaxReplicas))
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset HPA MaxReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(), gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())
    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
    Expect(hpa.Spec.MinReplicas).Should(BeNil())
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})
It("should reset HPA MaxReplicas and MinReplicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    hpa.Spec.MaxReplicas = 10
    hpa.Spec.MinReplicas = pointer.Int32Ptr(5)
    Expect(fakeClient.Update(context.TODO(), hpa)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
    Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
    Expect(*hpa.Spec.MinReplicas).Should(Equal(int32(2)))
    Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas MinReplicas] to 2 ")))})

It("should count MaxReplicas based on all registered SmartLicense resource", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense2 := &v1.SmartLicense{
        Spec:      smartLicense.Spec,
    }
    Expect(fakeClient.Create(context.TODO(), smartLicense2)).To(Succeed())
    smartLicense3 := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: "smartLicense3", Namespace: defaultNs},
        Spec:      smartLicense.Spec,
        Status:    v1.SmartLicenseStatus{RegistrationState: v1.RegistrationFailed, EstimatedMaxReplicas: 3},
    }
    Expect(fakeClient.Create(context.TODO(), smartLicense3)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: hpaNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), hpaNsName, hpa)).To(Succeed())
Expect(hpa.Spec.MaxReplicas).Should(Equal(int32(2)))
Expect(hpa.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning HPAScaledDown Decreased HPA's [MaxReplicas] to 2 ")))
}
}

---

apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  annotations:
    controller-gen.kubebuilder.io/version: v0.4.1
  creationTimestamp: null
  name: smartlicenses.sfcn.cisco.com
spec:
group: sfcn.cisco.com
names:
  kind: SmartLicense
  listKind: SmartLicenseList
  plural: smartlicenses
  singular: smartlicense
scope: Namespaced
versions:
- additionalPrinterColumns:
  - jsonPath: .metadata.creationTimestamp
    name: Age
    type: date
  - jsonPath: .status.registrationState
    name: Registration State
    type: string
  - jsonPath: .status.licenseState
    name: License State
    type: string
  - jsonPath: .status.licenseNumber
    name: License Number
    type: integer
  - jsonPath: .status.accountDomain
    name: Domain
    priority: 1
    type: string
  - jsonPath: .status.accountName
    name: Account
    priority: 1
    type: string
name: v1
schema:
openAPIV3Schema:

description: SmartLicense is the Schema for the smartlicenses API

properties:

apiVersion:

description: 'APIVersion defines the versioned schema of this representation

of an object. Servers should convert recognized schemas to the latest

internal value, and may reject unrecognized values. More info:

https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#resources'

type: string

kind:

description: 'Kind is a string value representing the REST resource this

object represents. Servers may infer this from the endpoint the client

submits requests to. Cannot be updated. In CamelCase. More info:

https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds'

type: string

metadata:

type: object

spec:

description: SmartLicenseSpec defines the desired state of SmartLicense

properties:

action:

description: Action is the desired state of the Smart Agent license

registration.

enum:

- REGISTER

- Deregister

type: string

licenseType:

description: LicenseType defines the type of license to request/release,

usually the SKU of the license. The default value is a SFW license

tag being able to handle 1vCPU.

type: string

maxLicenseCount:

description: MaxLicenseCount is an optional value, the maximum number

of licenses SFCN can reserve for the product. The default value

is equal to MinLicenseCount.

format: int32

type: integer

minLicenseCount:

description: MinLicenseCount is a minimum number of licenses SFCN

reserves for the product. The default value is 1.

format: int32

type: integer

scalingFactor:

description: ScalingFactor is a factor to increment or decrement the

number of licenses SFCN reserves for the product when scaling up

or down. The default value is 1.

format: int32
type: integer

scalingRef:

description: ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.

properties:
  apiVersion:
    description: API version of the referent
    type: string
  kind:
    description: 'Kind of the referent; More info: https://git.k8s.io/community/contributors/devel/sig-architecture/api-conventions.md#types-kinds”
    type: string
  name:
    description: 'Name of the referent; More info: http://kubernetes.io/docs/user-guide/identifiers#names'
    type: string
  required:
    - kind
    - name
  type: object

tokenSecret:

description: TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.

properties:
  name:
    description: Name is unique within a namespace to reference a secret resource.
    type: string
  namespace:
    description: Namespace defines the space within which the secret name must be unique.
    type: string
  required:
    - tokenSecret
  type: object

status:

description: SmartLicenseStatus defines the observed state of SmartLicense properties:

accountDomain:
  description: AccountDomain is the account domain in Cisco Software Central.
  type: string

accountName:
  description: AccountName is the name of the virtual account in Cisco Software Central.
  type: string

contextId:
  description: ContextId is an internal identifier uniquely defining
platform registration.
type: string
coresPerLicense:
  description: CoresPerLicense is number of cores per one requested LicenseType.
  format: int32
  type: integer
derrorReason:
  description: ErrorReason specifies the error due to which the the SFCN product was not registered in Cisco Software Central.
  type: string
estimatedMaxReplicas:
  description: EstimatedMaxReplicas is maximum count of ep pod replicas.
  It is calculated based on MaxLicenseCount and CoresPerLicense.
  format: int32
  type: integer
exportControlled:
  description: ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
  type: boolean
licenseNumber:
  description: LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
  format: int32
  type: integer
licenseState:
  description: LicenseState is the state of the reserved licenses.
  enum:
  - PENDING
  - UNLICENSED
  - IN_COMPLIANCE
  - OUT_OF_COMPLIANCE
  - OVERAGE
  type: string
registrationState:
  description: RegistrationState is the registration status of the SFCN product in Cisco Software Central.
  enum:
  - PENDING
  - REGISTERED
  - REGISTRATION_FAILED
  - Deregistered
  - Deregistration_FAILED
  type: string
type: object

served: true
storage: true
subresources:
  status: {}
status:
  acceptedNames:
    kind: ""
    plural: ""
  conditions: []
  storedVersions: []
FROM dockerhub.cisco.com/asac-dev-docker/css-golang:v1.16 as builder

WORKDIR /workspace
COPY ["license-broker/go.mod", "license-broker/go.sum", "license-broker/"]
COPY ["pkg/predicates/go.mod", "pkg/predicates/go.sum", "pkg/predicates"]

# cache deps before building and copying source so that we don't need to re-download as much
# and so that source changes don't invalidate our downloaded layer
WORKDIR /workspace/license-broker
RUN go mod download

COPY pkg/predicates ../pkg/predicates
COPY license-broker/main.go main.go
COPY license-broker/api api/
COPY license-broker/controllers/ controllers/
COPY license-broker/services/ services/

RUN CGO_ENABLED=0 GOOS=linux GOARCH=amd64 GO111MODULE=on go build -a -o /manager main.go

# Use distroless as minimal base image to package the manager binary
# Refer to https://github.com/GoogleContainerTools/distroless for more details
# FROM gcr.io/distroless/static-debian10:nonroot
# FIXME: azure disk driver unfortunately has a bug right now concerning
# disk permissions on mount, it does not honor the fsGroup.
# Changing this image to use hardened alpine but using
# the same uid/gid as the distroless container for now to prevent
# referencing a third private container in the template.
FROM containers.cisco.com/sto-ccc-cloud9/hardened_alpine:3.13

WORKDIR /
COPY --from=builder /manager /usr/local/bin/manager

RUN addgroup -g 65532 -S nonroot && adduser -u 65532 -S nonroot -G nonroot
USER nonroot
ENTRYPOINT ["manager"]
---
title: "Monitoring Status"
weight: 3
### Smart License Status

When License Controller processes a Smart License resource, it updates that resource's status section to show the current state of registration and compliance besides the Virtual Account details from which the token was obtained.

Depending on the provided scaling criteria, the controller attempts to show an estimated number of replicas that this resource can license based on the number of cores the provided license type is capable of. For kASA system, there is only one license type at the moment that is capable of licensing 1vCPU.

The following is a sample highlighting how the status looks for the provided configuration.

```
```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: "" # omitted to use default value
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
status:
  accountDomain: InternalTestDemoAccount8.cisco.com
  accountName: asac-dev
  contextId: '6947693726752581822'
  coresPerLicense: 1
  estimatedMaxReplicas: 2
  exportControlled: true
  licenseState: IN_COMPLIANCE
  registrationState: REGISTERED
```
The Manager container in the Enforcer (meaning, the Pod running ASA) emits different kinds of licensing events on its Pod depending on the state of the system. Notably, these events along with their types are:

* AwaitingLicense (Warning)
* LicenseCommunicationFailed (Warning)
* LicenseGranted (Normal)
* LicenseVerified (Normal)
* LicenseRevoked (Warning)

`AwaitingLicense`, `LicenseCommunicationFailed`, and `LicenseRevoked` are warning events and should be monitored to make sure the system is operating at full potential and not misconfigured in terms of the number of licenses.

When the ASA comes up successfully, the Manager tries to obtain a license for the [number of cores](#core-calculation) the Pod uses. During this period, the Manager emits an `AwaitingLicense` event on the Pod with appropriate message on the capabilities of ASA. For instance, when the ASA came up for the first time and operating at reduced throughput, this event would read something like

```
Warning     AwaitingLicense     ASA operating at reduced throughput because it was not licensed, requesting for a new license
```

And, if the ASA came up and operating at full potential, then

```
Warning     AwaitingLicense     ASA operating at full potential but not licensed, requesting for a new license
```

The Manager initiates a communication to the License Server to obtain the license. If for whatever reason it could not communicate with the server despite several retries (currently once every 15 seconds up to 5 minutes), it sends a `LicenseCommunicationFailed` warning event with the reasoning behind the failure.

```
Warning     LicenseCommunicationFailed     ASA operating at reduced throughput because of license communication failure
```

When the Manager successfully obtains the license from the server, it emits a `LicenseGranted` event and applies the license to ASA. Periodically, the Manager synchronizes with the License Server (currently, every 15 minutes) to verify the license granted to it and on successful verification, emits a `LicenseVerified` event.
It is possible that the License Server ran out of licenses either because there are too many replicas, or some of the licenses have expired. In that case, the License Server notifies the License Controller about this shortage which tries to scale down the cluster and in the process, the License Server revokes the licenses it granted to some Enforcers. The Manager emits a `LicenseRevoked` event in such cases and keeps retrying to obtain a license again. Eventually, the Enforcer will be granted a license, or it will be removed by Kubernetes because the controller scaled down the cluster.

### Unauthorized Requests

License requests may be granted by the License Server to any pod capable of requesting a licensing, however the License Controller sees a grant as authorized only if that pod belonged to a Deployment/HPA specified in one of the Smart License resources otherwise it considers that pod as unauthorized and takes action to delete that pod and set the number of replicas to 0 on its owners to prevent the Kubernetes from creating such pods. The License Controller will emit an event on the pod that was deleted specifying the reason behind it. It then releases the license back to the License Server after the pod is killed.

This might happen when you have an Enforcer deployment but did not specify that Deployment in a Smart License resource in the same namespace. To remedy that, simply add a Smart License resource with the desired configuration and specify the Deployment of the Enforcer in it.
include a label `sfcn.cisco.com/license-holder=true`. You should be able to use `kubectl` to list all the pods in a namespace that are having this label to identify the pods currently holding a license.

```go
package controllers_test

import {
    "context"
    "errors"
    "fmt"
    "strconv"

    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "github.com/golang/mock/gomock"
    . "github.com/sfncisco/license-holder"
    . "github.com/onfe/ginkgo"
    . "github.com/onfe/gomega"
    apps/v1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    apiErrors "k8s.io/apimachinery/pkg/api/errors"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
}

//go:generate mockgen -package=mocks -destination=./mocks allotment.go css.cisco.com/licensing/client-agent
AllotmentService

const (
    epPodName = "epPod"
    redirectorEpPodName = "redirectorEpPod"
    defaultServiceRole = "default"
    vpnRedirectorServiceRole = "vpnredirector"
    deploymentName2 = "test-deployment-2"
    secondDefaultEpDeploymentName = "secondDefaultEpDeployment"
    redirectorEpDeploymentName = "vpnRedirectorEpDeployment"
    initialRedirectorDeploymentReplicas int32 = 2
)

var controllerTrue = true
```
var _ = Describe("Pod License Controller Test", func() {

podNsName := types.NamespacedName{Namespace: defaultNs, Name: epPodName}
redirectorPodNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpPodName}
deploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}
redirectorDeploymentNsName := types.NamespacedName{Namespace: defaultNs, Name: redirectorEpDeploymentName}

var reconciler *controllers.PodLicenseReconciler
var fakeClient client.Client
var mockCtrl *gomock.Controller
var recorder *record.FakeRecorder

var licensingClient *mocks.MockLicensingClient
var allotmentService *mocks.MockAllotmentService

var pod *corev1.Pod
var deployment *appsv1.Deployment
var redirectorPod *corev1.Pod
var redirectorDeployment *appsv1.Deployment
var smartLicense *v1.SmartLicense

BeforeEach(func() {

pod = &corev1.Pod{
    ObjectMeta: metav1.ObjectMeta{
        Name:            epPodName,
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet", Controller: &controllerTrue}}},
    }
}

replicaSet := &appsv1.ReplicaSet{
    ObjectMeta: metav1.ObjectMeta{
        Name:            "epReplicaSet",
        Namespace:       defaultNs,
        OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: epDeploymentName, Controller: &controllerTrue}}},
    }
}

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:      epDeploymentName,
        Namespace: defaultNs,
        Labels:    map[string]string{controllers.ServiceRoleLabel: defaultServiceRole},
Annotations: map[string]string{
controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))
},
Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

secondDefaultDeployment := &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{
Name: secondDefaultEpDeploymentName,
Namespace: defaultNs,
Labels: map[string]string{
controllers.ServiceRoleLabel: defaultServiceRole,
Annotations: map[string]string{
controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas))
},
},
Spec: appsv1.DeploymentSpec{Replicas: &replicas},
}

redirectorPod = &corev1.Pod{
ObjectMeta: metav1.ObjectMeta{
Name: redirectorEpPodName,
Namespace: defaultNs,
OwnerReferences: []metav1.OwnerReference{ {Kind: "ReplicaSet", Name: "redirectorEpReplicaSet", Controller: &controllerTrue} },
},
}

redirectorReplicaSet := &appsv1.ReplicaSet{
ObjectMeta: metav1.ObjectMeta{
Name: "redirectorEpReplicaSet",
Namespace: defaultNs,
OwnerReferences: []metav1.OwnerReference{ {Kind: "Deployment", Name: redirectorEpDeploymentName, Controller: &controllerTrue} },
},
}

redirectorReplicas := initialRedirectorDeploymentReplicas
redirectorDeployment = &appsv1.Deployment{
ObjectMeta: metav1.ObjectMeta{
Name: redirectorEpDeploymentName,
Namespace: defaultNs,
Labels: map[string]string{
controllers.ServiceRoleLabel: vpnRedirectorServiceRole,
Annotations: map[string]string{
controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(redirectorReplicas))
},
},
Spec: appsv1.DeploymentSpec{Replicas: &redirectorReplicas},
}

smartLicense = &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
Spec: v1.SmartLicenseSpec{
Action: v1.Register,
LicenseType: licenseType,
mockCtrl = gomock.NewController(GinkgoT())
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(
deployment, replicaSet, pod, secondDefaultDeployment,
redirectorDeployment, redirectorReplicaSet, redirectorPod,
smartLicense).Build()
recorder = record.NewFakeRecorder(1024)

licensingClient = mocks.NewMockLicensingClient(mockCtrl)
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()

reconciler = &controllers.PodLicenseReconciler{
    Client: fakeClient,
    LicensingClient: licensingClient,
    Log: logf.NullLogger{}.
    Recorder: recorder,
}

AfterEach(func() {
    mockCtrl.Finish()
})

It("should add the licensing label for licensed pod", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
    Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), podNsName, pod)).To(Succeed())
    Expect(pod.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true").
})

It("should scale deployment replicas to 1 if smart license is in deregistered state", func() {
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String()}).
    Return(&licensing.AllotmentStatusResponse{NumCores: 2}, nil)

    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))

It("should ensure one replica per service role without SmartLicense", func() {
    // initiate reconcile for the pod which is part of deployment with vpnredirector service role and without smart license
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirectorPodNsName.String()}).Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirectorPodNsName})
    Expect(err).To(BeNil())

    // expect the deployment to be scaled to 1 and mark it as trial license holder
    redirDeployment := appsv1.Deployment{}
    Expect(fakeClient.Get(context.TODO(), redirectorDeploymentNsName, &redirDeployment)).To(Succeed())
    Expect(*redirDeployment.Spec.Replicas).Should(Equal(int32(1)))
    Expect(redirDeployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
    Expect(redirDeployment.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(redirDeployment.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirectorDeploymentReplicas))))

    // create another deployment with vpnredirector role
    redirectorEpPodName2 := "redirectorEpPod2"
    redirectorEpDeploymentName2 := "redirectorEpDeployment2"
    replicaSetName2 := "redirectorEpReplicaSet2"
    redirectorPod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:            redirectorEpPodName2,
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: replicaSetName2, Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), redirectorPod2)).To(Succeed())
    redirectorReplicaSet2 := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
            Name:            replicaSetName2,
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: redirectorEpDeploymentName2, Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), redirectorReplicaSet2)).To(Succeed())
    initialRedirector2Replicas := int32(3)
    redirectorDeployment2 := &appsv1.Deployment{
        ObjectMeta: metav1.ObjectMeta{

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Name: redirectorEpDeploymentName2,
Namespace: defaultNs,
Labels: map[string]string{controllers.ServiceRoleLabel: vpnRedirectorServiceRole},
Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(initialRedirector2Replicas))},
Spec: appsv1.DeploymentSpec{Replicas: &initialRedirector2Replicas},

Expect(fakeClient.Create(context.TODO(), redirectorDeployment2)).To(Succeed())

// initiate reconcile for the pod which is part of another deployment with vpnredirector service role and without smart license
redirector2PodNsName := types.NamespacedName{Name: redirectorEpPodName2, Namespace: defaultNs}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: redirector2PodNsName.String()}).Return(nil, nil)
_, err = reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: redirector2PodNsName})
Expect(err).To(BeNil())

// expect the second vpnredirector deployment to be scaled to 0 and keep its initial replica number in its labels
redirDeployment2 := appsv1.Deployment{}
Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Name: redirectorEpDeploymentName2, Namespace: defaultNs}, &redirDeployment2)).To(Succeed())
Expect(*redirDeployment2.Spec.Replicas).Should(Equal(int32(0)))
Expect(redirDeployment2.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(redirDeployment2.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
Expect(redirDeployment2.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(initialRedirector2Replicas))))

Context("on pod removal", func() {

It("should release licensing allotments", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
ContextId: "fooBar",
Tenant: &licensing.Tenant{Name: podNsName.String()},
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(BeNil())

})

It("should requeue request if failed to release licensing allotments", func() {
Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
allotmentService.EXPECT().ReleaseAllotment(&licensing.AllotmentRelease{
ContextId: "fooBar",
Tenant: &licensing.Tenant{Name: podNsName.String()},
).Return(errors.New("failed to release allotments"))

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
Expect(err).To(HaveOccurred())
}

It("should not release licensing allotments if tenant is not registered", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
  Return(nil, fmt.Errorf("unknown tenant: %w", licensing.ErrNotRegistered))

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when NumCores is 0", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
  Return(&licensing.AllotmentStatusResponse{NumCores: 0}, nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

It("should not release licensing allotments when status is nil", func() {
  Expect(fakeClient.Delete(context.TODO(), pod)).To(Succeed())
  allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
  Return(nil, nil)

  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
  Expect(err).To(BeNil())
})

Context("for pod without corresponding SmartLicense", func() {

  It("should remove pod if not belong to any deployment", func() {
    pod.OwnerReferences = nil
    Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
    Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())
  })
})

err = fakeClient.Get(context.TODO(), podNsName, pod)
It("should scale down pod's deployment", func() {
    smartLicense.Spec.ScalingRef.Name = secondDefaultEpDeploymentName
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
    Return(nil, nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: defaultNs, Name: epDeploymentName}, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(0)))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as it requested license but does not belong to any licensed EP deployment")))
})

Context("without SmartLicense resources", func() {
   BeforeEach(func() {
        Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
    })

    It("should scale down Deployment to 1 Replica and mark as trial", func() {
        allotmentService.EXPECT().Status(&licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}).
        Return(nil, nil)

        _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNsName})
        Expect(err).To(BeNil())

        Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
        Expect(*deployment.Spec.Replicas).Should(Equal(int32(1)))
        Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.TrialLicenseHolderLabel, "true"))
        Expect(recorder.Events).Should(HaveLen(1))
        Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 1 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
    })

    It("should scale down Deployment to 0 replicas when another deployment with the same service role exists", func() {
        var replicaCount int32 = 4

        Expect(true).NotTo(BeNil())
        Expect(apiErrors.IsNotFound(err)).To(BeTrue())
        Expect(recorder.Events).Should(HaveLen(1))
        Expect(recorder.Events).Should(Receive(HavePrefix("Warning PodDeleted Deleted Pod as it requested a license but does not belong to any Deployment")))
    })
})
var expectedInitialReplicasNumber int32 = 4

createDeployment := func(name string, role string) *appsv1.Deployment {

    pod := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name: fmt.Sprintf("pod-%s", name),
            Namespace: defaultNs,
            OwnerReferences: []metav1.OwnerReference{
                {Kind: "ReplicaSet", Name: fmt.Sprintf("rs-%s", name), Controller: &controllerTrue},
            },
        },
    }
    Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

    replicaSet := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
            Name: fmt.Sprintf("rs-%s", name),
            Namespace: defaultNs,
            OwnerReferences: []metav1.OwnerReference{
                {Kind: "Deployment", Name: fmt.Sprintf("deployment-%s", name), Controller: &controllerTrue},
            },
        },
    }
    Expect(fakeClient.Create(context.TODO(), replicaSet)).To(Succeed())

    deployment := &appsv1.Deployment{
        ObjectMeta: metav1.ObjectMeta{
            Name: fmt.Sprintf("deployment-%s", name),
            Namespace: defaultNs,
            Labels: map[string]string{controllers.ServiceRoleLabel: role},
            Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
        },
        Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
    }
    Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

    podName := types.NamespacedName{Namespace: pod.Namespace, Name: pod.Name}
    allotmentService.EXPECT().Status(&licensing.Tenant{Name: podName.String(), Attributes: pod.Labels}).
        Return(nil, nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podName})
    Expect(err).To(BeNil())
    return deployment
}

deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
// same service role
deployment2 := createDeployment("second", defaultServiceRole)
// implicitly same service role
deployment3 := createDeployment("third", "")

assertScaledDown := func(d *appsv1.Deployment) {
    Expect(fakeClient.Get(context.TODO(), types.NamespacedName{Namespace: d.Namespace, Name: d.Name}, d)).To(Succeed())
    Expect(*d.Spec.Replicas).Should(Equal(int32(0)))
    Expect(d.Labels).ShouldNot(HaveKey(controllers.TrialLicenseHolderLabel))
    Expect(d.Annotations).Should(HaveKey(controllers.InitialReplicasNumberAnnotation))
    Expect(d.Annotations[controllers.InitialReplicasNumberAnnotation]).Should(Equal(strconv.Itoa(int(expectedInitialReplicasNumber))))
}
assertScaledDown(deployment2)
assertScaledDown(deployment3)

Expect(recorder.Events).Should(HaveLen(2))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's Replicas to 0 as only a single trial Pod requiring license is allowed to be running in unlicensed cluster")))
}

It("should not scale down Deployment to 0 Replica when multiple Deployment with different service roles exist", func() {
    deployment.Labels[controllers.TrialLicenseHolderLabel] = "true"
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    var replicaCount int32 = 1
    pod2 := &corev1.Pod{
        ObjectMeta: metav1.ObjectMeta{
            Name:            "deployment-test-2",
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "ReplicaSet", Name: "epReplicaSet2", Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), pod2)).To(Succeed())
    replicaSet2 := &appsv1.ReplicaSet{
        ObjectMeta: metav1.ObjectMeta{
            Name:            "epReplicaSet2",
            Namespace:       defaultNs,
            OwnerReferences: []metav1.OwnerReference{{Kind: "Deployment", Name: deploymentName2, Controller: &controllerTrue}},
        },
    }
    Expect(fakeClient.Create(context.TODO(), replicaSet2)).To(Succeed())
deployment2 := &appsv1.Deployment{
    ObjectMeta: metav1.ObjectMeta{
        Name:        deploymentName2,
        Namespace:   defaultNs,
        Labels:      map[string]string{controllers.ServiceRoleLabel: "new-service-role"},
        Annotations: map[string]string{controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicaCount))},
    },
    Spec: appsv1.DeploymentSpec{Replicas: &replicaCount},
}

Expect(fakeClient.Create(context.TODO(), deployment2)).To(Succeed())

pod2NsName := types.NamespacedName{Namespace: defaultNs, Name: "deployment-test-2"}
allotmentService.EXPECT().Status(&licensing.Tenant{Name: pod2NsName.String(), Attributes: pod.Labels}).Return(nil, nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: pod2NsName})
Expect(err).To(BeNil())

deployment2Ns := types.NamespacedName{Namespace: defaultNs, Name: deploymentName2}
Expect(fakeClient.Get(context.TODO(), deployment2Ns, deployment2)).To(Succeed())
Expect(*deployment2.Spec.Replicas).Should(Equal(int32(1)))
Expect(deployment2.Labels).Should(HaveKey(controllers.TrialLicenseHolderLabel))
Expect(recorder.Events).ShouldNot(HaveLen(1))

package handlers_test

import (  
v1 "css.cisco.com/kasa/license-broker/api/v1"  
"css.cisco.com/kasa/license-broker/controllers/handlers"  
"css.cisco.com/kasa/license-broker/controllers/handlers/mocks"  
"github.com/golang/mock/gomock"  
). "github.com/onsi/ginkgo"
autoscalingv1 "k8s.io/api/autoscaling/v1"  
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
"k8s.io/apimachinery/pkg/types"  
"sigs.k8s.io/controller-runtime/pkg/event"  
"sigs.k8s.io/controller-runtime/pkg/handler"  
"sigs.k8s.io/controller-runtime/pkg/reconcile"
)

const (  
defaultNamespace = "default"  
smartLicenseName = "smart-license"  
deploymentName = "ep-deployment"  
deploymentName2 = "ep-deployment2"  
hpaName = "ep-hpa"
hpaName2 = "ep-hpa2"
}

var _ = Describe("DeploymentHandler", func() {
  var handler handler.EventHandler
  var mockCtrl *gomock.Controller
  var mockQueue *mocks.MockRateLimitingInterface

 BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
    handler = handlers.DeploymentHandler()
  })

  AfterEach(func() {
    mockCtrl.Finish()
  })

  It("adds request to reconcile Deployment when SmartLicense with Deployment kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
      NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
    handler.Create(event.CreateEvent{
      Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
        },
        }, mockQueue)
  })

  It("ignores request to reconcile Deployment when SmartLicense with HPA kind is created", func() {
    handler.Create(event.CreateEvent{
      Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
        },
        }, mockQueue)
  })

  It("adds requests to reconcile both Deployments when SmartLicense with Deployment kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
      NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
  })
mockQueue.EXPECT().Add(reconcile.Request{
    NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName2},
})

handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
    ObjectNew: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)
}

It("adds request to reconcile Deployment when SmartLicense with Deployment kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: deploymentName},
    })
}
}

handler.Delete(event.DeleteEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
    ObjectNew: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)
}

var _ = Describe("HPAHandler", func() {
    var handler handler.EventHandler
    var mockCtrl *gomock.Controller
    var mockQueue *mocks.MockRateLimitingInterface

   BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
        handler = handlers.HPAHandler()
    })

    AfterEach(func() {

mockCtrl.Finish()

It("adds request to reconcile HPA when SmartLicense with HPA kind is created", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
}

handler.Create(event.CreateEvent{
    Object: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
}, mockQueue)

It("ignores request to reconcile HPA when SmartLicense with Deployment kind is created", func() {
    handler.Create(event.CreateEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
}

It("adds requests to reconcile both HPAs when SmartLicense with HPA kind is updated", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName2},
    })
}

handler.Update(event.UpdateEvent{
    ObjectOld: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
    ObjectNew: &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
        },
    },
})
It("adds request to reconcile Deployment when SmartLicense with HPA kind is deleted", func() {
    mockQueue.EXPECT().Add(reconcile.Request{
        NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: hpaName},
    })
    handler.Delete(event.DeleteEvent{
        Object: &v1.SmartLicense{
            ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
            Spec: v1.SmartLicenseSpec{
            },
        },
    }, mockQueue)
})

package listeners

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    licensing "css.cisco.com/licensing/client-agent"
    licensingProto "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "sigs.k8s.io/controller-runtime/pkg/client"
)

type EntitlementListener struct {
    Log     logr.Logger
    Client  client.Client
    LicenseNsName types.NamespacedName
}

func (l *EntitlementListener) OnEntitlementEvent(event *licensing.EntitlementEvent) {
    log := l.Log.WithValues("smartlicense", l.LicenseNsName)
    log.V(1).Info("received entitlement event", "eventType", event.Type, "message", event.Message)
    if err := l.processEvent(event); err != nil {
        log.Error(err, "failed to process entitlement event")
        return
    }
}
log.V(1).Info("successfully processed entitlement event")

func (l *EntitlementListener) processEvent(event *licensing.EntitlementEvent) error {
    ctx := context.Background()

    var license v1.SmartLicense
    if err := l.Client.Get(ctx, l.LicenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            l.Log.V(1).Info("skipping entitlement event as SmartLicense CR does not exist anymore", "smartlicense", l.LicenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }
    originalLicense := license.DeepCopy()

    switch event.Type {
    case licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE:
        license.Status.LicenseState = v1.OutOfCompliance
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE:
        license.Status.LicenseState = v1.Unlicensed
        license.Status.EstimatedMaxReplicas = 0
    case licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS:
        license.Status.LicenseState = v1.InCompliance
    default:
        return fmt.Errorf("unknown event type: %s", event.Type.String())
    }

    license.Status.CoresPerLicense = uint32(event.CoresPerLicenseType)
    license.Status.LicenseNumber = uint32(event.EntitlementNumber)

    // using patch to avoid conflict errors caused by version mismatch and optimistic lock
    // as events from the server have the latest data, it is admissible to overwrite status without version check
    if err := l.Client.Status().Patch(ctx, &license, client.MergeFrom(originalLicense)); err != nil {
        return fmt.Errorf("failed to patch SmartLicense status: %w", err)
    }
    return nil
}

# Default values for Aegis.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.

global:
    platform: $platform
    imageCredentials:
        # the url to the docker registry, for example dockerhub.cisco.com
        registry: $registry
    artifactoryRepo: $artifactoryRepo
apiGroup: sfcn.cisco.com
fullNamePrefix: sfcn-license-

# Docker image for the controller that manages licensing CRDs and their reconciliation
controllerImage: $controllerImage

# Docker image for the server-agent license server
licenseServerImage: $licenseServerImage

# licenseServerPort is the port where the server-agent license server is listening for requests
licenseServerPort: 17051

# licenseServerTransportUrl is the http transport to make use of to connect to CSSM
licenseServerTransportUrl: $licenseServerTransportUrl

# Default image policy that is used by all pod containers unless being explicitly overwritten
defaultImagePullPolicy: $defaultImagePullPolicy

# log verbosity
logLevel: $logLevel

# zap log encoder
# options: console, json
logFormat: $logFormat

# managerMemoryRequest specifies the amount of memory to allocate per request for manager container
managerMemoryRequest: "20Mi"

# managerCoreRequest specifies the amount of vCPU to allocate per request for manager container
managerCoreRequest: "100m"

# managerMemoryLimit specifies the maximum amount of memory to allocate for manager container
managerMemoryLimit: "100Mi"

# managerCoreLimit specifies the maximum amount of vCPU to allocate for manager container
managerCoreLimit: "100m"

# metricsPort is the port the metric endpoint binds to
metricsPort: 17080

# webhookPort is the port that the webhook server serves at
webhookPort: 17443

# rbacProxyPort is the port that the RBAC proxy server serves at
rbacProxyPort: 17444

# licenseServerMemoryRequest specifies the amount of memory to allocate per request for license-server container
licenseServerMemoryRequest: "256Mi"
# licenseServerXms specifies the amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryRequest as Java requires memory for non-heap memory
licenseServerXms: "128M"

# licenseServerCoreRequest specifies the amount of vCPU to allocate per request for license-server container
licenseServerCoreRequest: "100m"

# licenseServerMemoryLimit specifies the maximum amount of memory to allocate for license-server container
licenseServerMemoryLimit: "768Mi"

# licenseServerXmx specifies the maximum amount of memory to allocate for license-server process.
# The value should be smaller than licenseServerMemoryLimit as Java requires memory for non-heap memory
licenseServerXmx: "512M"

# licenseServerCoreLimit specifies the maximum amount of vCPU to allocate for license-server container
licenseServerCoreLimit: "300m"

# licenseServerStorage specifies the persistent volume size to use for storing licensing data
licenseServerStorage: "1Gi"

# disktype for dynamic azure disk storage on azure platform
# options are Standard_LRS, Premium_LRS, StandardSSD_LRS, UltraSSD_LRS
azureDiskStorageAccountType: "Standard_LRS"

package handlers

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "k8s.io/apimachinery/pkg/types"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue RateLimitingInterface

var log = ctrl.Log.WithName("handlers").WithName("SmartLicense")

// DeploymentHandler handles SmartLicense changes and queues up events for the Deployment that the
// SmartLicense manages.
func DeploymentHandler() handler.EventHandler {
    return handlerWithScalingRefKind(v1.DeploymentKind)
}

// HPAHandler handles SmartLicense changes and queues up events for the HPA that the SmartLicense manages.
func HPAHandler() handler.EventHandler {
func handlerWithScalingRefKind(scalingRefKind string) handler.EventHandler {
    return handler.EnqueueRequestsFromMapFunc(func(obj client.Object) []ctrl.Request {
        smartLicense, ok := obj.(*v1.SmartLicense)
        if !ok {
            log.Error(fmt.Errorf("cannot cast %T to SmartLicense", obj), "event is ignored")
            return []ctrl.Request{}
        }

        if smartLicense.Spec.ScalingRef.Kind != scalingRefKind {
            return []ctrl.Request{}
        }

        return []ctrl.Request{{NamespacedName: types.NamespacedName{
            Namespace: smartLicense.Namespace,
            Name:      smartLicense.Spec.ScalingRef.Name,
        }}}
    })
}

package v1

import (
    "cisco.com/kasa/operator/enforcementpoint/dispatcher"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    "css.cisco.com/kasa/pkg/predicates"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "errors"
    "fmt"
    "github.com/go-logr/logr"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/reconcile"
    "sigs.k8s.io/controller-runtime/pkg/source"
    "strings"
    "time"
)
const (  
  RetryDuration = 15 * time.Second  
  MaxWaitingDuration = 5 * time.Minute  
  MaxRetryAttempts = int(MaxWaitingDuration / RetryDuration)  
  LicenseCmd = "show license feature"  
  UnlicensedResponse = "Licensing Status : Unlicensed"  
  LicensedResponse = "Licensing Status : Licensed"  
)

type licenseEvent int

const (  
  Revoked licenseEvent = iota + 1  
  Awaiting  
  Granted  
  Verified  
  CommunicationFailed  
)

func (l licenseEvent) reasonCode() string {  
  switch l {  
  case Revoked:  
    return "LicenseRevoked"  
  case Awaiting:  
    return "AwaitingLicense"  
  case Granted:  
    return "LicenseGranted"  
  case Verified:  
    return "LicenseVerified"  
  case CommunicationFailed:  
    return "LicenseCommunicationFailed"  
  }  
  return "LicenseActivity"  
}

func (l licenseEvent) eventType() string {  
  switch l {  
  case Awaiting, Revoked, CommunicationFailed:  
    return coreV1.EventTypeWarning  
  default:  
    return coreV1.EventTypeNormal  
  }  
  }

open licenseReconciler struct {  
  Log logr.Logger  
  CoreClient *coreV1Client.CoreV1Client  
}
func (s *SmartLicenseReconciler) RegisterWithPublisher(lsp *dispatcher.LinaStartupPublisher) *SmartLicenseReconciler {
    s.notificationChan = make(chan event.GenericEvent)
    lsp.AddListener(s)
    return s
}

func (s *SmartLicenseReconciler) OnLinaStartup(_ string, _ string) {
    pod := &coreV1.Pod{
    }
    s.Log.Info("lina (re)started, initiating license reconciliation")
    s.notificationChan <- event.GenericEvent{Object: pod}
}

func (s *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    podName := os.Getenv("POD_NAME")
    podNamespace := os.Getenv("POD_NAMESPACE")
    return ctrl.NewControllerManagedBy(mgr).
    Watches(&source.Channel{Source: s.notificationChan}, &handler.EnqueueRequestForObject{}).
    For(&coreV1.Pod{}, builder.WithPredicates(&predicates.NameMatchedPredicate{
        Name: podName,
        Namespace: podNamespace,
    })).Complete(s)
}

// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list

func (s *SmartLicenseReconciler) Reconcile(ctx context.Context, request reconcile.Request) (reconcile.Result, error) {
    s.Log.Info("reconciling license status", "pod", request)
    errResult := reconcile.Result{RequeueAfter: RetryDuration}
    pod, err := s.CoreClient.Pods().Get(request.NamespacedName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec", "namespacedName", request.NamespacedName)
        return errResult
    }
    // Check pod status...
    return reconcile.Result{}, nil
}
return errResult, err
}
if s.lastRecordedEvent == 0 {
    licenseResponse, err := s.Dispatcher.Show(LicenseCmd)
    if err != nil {
        s.Log.Error(err, "failed to fetch license status from ASAc, probably its not up, will retry")
        return errResult, nil
    }
    if strings.Contains(licenseResponse, LicensedResponse) {
        s.Log.Info("ASAc is already licensed, will try to verify its license with the server")
        s.recordEvent(pod, Awaiting, "ASA operating at full potential but not licensed, requesting for a new license")
    } else if strings.Contains(licenseResponse, UnlicensedResponse) {
        s.recordEvent(pod, Awaiting, "ASA operating at reduced throughput because it was not licensed, requesting for a new license")
    }
}

if pod.DeletionTimestamp == nil {
    s.computeRequiredNumCores(pod)
    // (re)register with the license server
    err := s.registerTenantWithLicenseServer(pod)
    if err != nil {
        return errResult, nil
    }
    // registration successful, fetch or request allotment of this tenant
    err = s.syncAllotmentStatus(pod)
    if err != nil {
        return errResult, nil
    }
    err = s.grantASAcLicenseToOperate(pod)
    if err != nil {
        return errResult, nil
    } else {
        err := s.releaseAllotment()
        if err != nil {
            s.Log.Error(err, "pod being deleted but failed to release allotment, will retry")
            return errResult, nil
        }
    }

return reconcile.Result{}, nil

func (s *SmartLicenseReconciler) recordEvent(pod *coreV1.Pod, event licenseEvent, description string) {
    if s.lastRecordedEvent != event || event == Verified { // always record verified events
        s.lastRecordedEvent = event
    }
    s.Recorder.Event(pod, event.eventType(), event.reasonCode(), description)
func (s *SmartLicenseReconciler) computeRequiredNumCores(pod *coreV1.Pod) {
    requiredCoresQuantity := resource.MustParse("0")
    var containerCores = make(map[string]string)
    for _, container := range pod.Spec.Containers {
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            s.Log.Info("container did not specify a cpu limit, as a result cores are computed from node", "container", container.Name)
            if err != nil {
                s.Log.Error(err, "failed to fetch the node of this pod", "pod", pod.Name, "node", pod.Spec.NodeName)
                continue
            }
            // set the required core quantities directly to the capacity of the node
            requiredCoresQuantity = *node.Status.Capacity.Cpu()
            break
        }
        requiredCoresQuantity.Add(containerLimit)
    }
    s.requiredNumCores = uint32(requiredCoresQuantity.Value())
    if len(pod.Spec.Containers) == len(containerCores) {
        s.Log.Info("computed resources usage", "cpu", containerCores)
    }
    s.Log.Info("required number of cores to license", "numCores", s.requiredNumCores)
}

func (s *SmartLicenseReconciler) registerTenantWithLicenseServer(pod *coreV1.Pod) error {
    if !s.isRegistered {
        s.tenant = &lca.Tenant{Name: types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}.String(), Attributes: pod.Labels}
        err := s.Licenser.Allotment().Register(s.tenant, s)
        if err != nil {
            s.numRetriedAttempts = s.numRetriedAttempts + 1
            if s.numRetriedAttempts > MaxRetryAttempts {
                s.Log.Info("failed to communicate with licensing server with in allowed retry attempts", "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
                s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license communication failure (%s), "+"retrieving communication", err.Error()))
                _ = s.revokeASAcLicenseAndRetry()
                return err
            }
            s.Log.Info(fmt.Sprintf("failed to register with licensing server, will retry (reason: %s)", err.Error()),
})
"retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
return err
}
s.recordEvent(pod, Awaiting, "successfullly registered the ASA with license server, awaiting a license")
s.isRegistered = true
}
return nil
}

func (s *SmartLicenseReconciler) revokeASAcLicenseAndRetry() error {
reason, err := s.Dispatcher.RevokeLicense()
if err != nil {
s.Log.Error(err, "failed to revoke license")
return err
}
if reason != "" {
err = fmt.Errorf("ASAc failed to revoke license : %v", reason)
return err
}
s.Log.Info("successfully revoked ASAc license")
s.numRetriedAttempts = 0
return nil
}

func (s *SmartLicenseReconciler) syncAllotmentStatus(pod *coreV1.Pod) error {
allotmentStatus, err := s.Licenser.Allotment().Status(s.tenant)
if err != nil {
if errors.Is(err, lca.ErrLicenseServerUnavailable) {
s.Log.Info("licensing server is unavailable, unregistering the tenant")
s.isRegistered = false
}
s.numRetriedAttempts = s.numRetriedAttempts + 1
if s.numRetriedAttempts > MaxRetryAttempts {
s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
"un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because of license communication failure (%s), "+
"retying communication", err.Error()))
_ = s.revokeASAcLicenseAndRetry()
return err
}
s.Log.Info(fmt.Sprintf("failed to get allotment status from licensing server, will retry (reason: %s)", err.Error()),
"retryDuration", RetryDuration, "numAttempt", s.numRetriedAttempts)
return err
}

if allotmentStatus == nil {
s.Log.Info("a license is not acquired by this pod, requesting one", "pod", s.tenant.Name)
// no allotment was made to this tenant, requesting one
allotment, err := s.Licenser.Allotment().LeaseAllotment(&lca.AllotmentRequest{
    PoolName: pod.Namespace,
    Tenant:   s.tenant,
    NumCores: s.requiredNumCores,
})
if err != nil {
    s.numRetriedAttempts = s.numRetriedAttempts + 1
    if s.numRetriedAttempts > MaxRetryAttempts {
        s.Log.Info("failed to communicate with licensing server with in allowed retry attempts, "+
            "un-licensing ASA and continue retry", "maxRetryAttempts", MaxRetryAttempts)
        s.recordEvent(pod, CommunicationFailed, fmt.Sprintf("ASA operating at reduced throughput because it failed to
            obtain a license (%s), "+
            "retrying the operation", err.Error()))
        _ = s.revokeASAcLicenseAndRetry()
        return err
    }
    s.Log.Info(fmt.Sprintf("failed to acquire a license, will retry (reason: %s)", err.Error()),
        "numAttempt", s.numRetriedAttempts)
    return err
}

s.Log.Info(fmt.Sprintf("successfully leased an allotment from the licensing server")

return nil
}

func (s *SmartLicenseReconciler) grantASAcLicenseToOperate(pod *coreV1.Pod) error {
    if s.allotment != nil {
        s.Log.Info("license status verified, communicating the status to ASA")
        s.recordEvent(pod, Verified, "ASA operating at full potential, license status verified")
        reason, err := s.Dispatcher.GrantLicense(s.allotment.ExportControlled)
        if err != nil {
            s.Log.Error(err, "failed to grant license")
            return err
        }
        if reason != "" {
            err = fmt.Errorf("ASAc failed to set license : %v", reason)
            return err
        }
    }
    s.numRetriedAttempts = 0
    s.Log.Info("successfully granted license to ASA")
} else {
    s.Log.Info("WARN: no allotment present yet called to grant license to ASA, operation skipped")
}
return nil
}

func (s *SmartLicenseReconciler) releaseAllotment() error {
    _ = s.revokeASACLicenseAndRetry()
    if s.allotment != nil {
        err := s.Licenser.Allotment().ReleaseAllotment(&lca.AllotmentRelease{
            ContextId: s.allotment.ContextId,
            Tenant:    s.tenant,
        })
        if err != nil {
            s.Log.Error(err, "failed to release the allotment to server")
            return err
        }
        s.allotment = nil
    }
    return nil
}

func (s *SmartLicenseReconciler) OnAllotmentEvent(event *lca.AllotmentEvent) {
    podName := types.NamespacedName{
        Namespace: os.Getenv("POD_NAMESPACE"),
        Name:      os.Getenv("POD_NAME"),
    }
    pod, err := s.CoreClient.Pods().Get(podName)
    if err != nil {
        s.Log.Error(err, "failed to fetch the pod spec, license release event is not published", "namespacedName", podName)
    }
    switch event.Type {
    case proto.AllotmentEvent_RELEASE_ALLOTMENT:
        s.Log.Info("license requested to be released by the server, un-licensing ASA")
        if err == nil {
            s.recordEvent(pod, Revoked, "ASA operating at reduced throughput because the server revoked its license, retrying to acquire")
        }
        _ = s.releaseAllotment()
    case proto.AllotmentEvent_REPORT_ALLOTMENT:
        s.Log.Info("license requested to be reported to the server")
        _ = s.reportAllotment()
    }
}

func (s *SmartLicenseReconciler) reportAllotment() error {
    if s.allotment != nil {
            ContextId: s.allotment.ContextId,
            Tenant:    s.tenant,
            NumCores: 0,
        })
        if err != nil {
            s.Log.Error(err, "failed to report the allotment to server")
            return err
        }
        s.allotment = nil
    }
    return nil
}
}
err := s.Licenser.Allotment().ReportAllotment(allotment)
if err != nil {
    s.Log.Error(err, "failed to report the allotment to server")
    return err
}

// Code generated by MockGen. DO NOT EDIT.
// Source: k8s.io/client-go/util/workqueue (interfaces: RateLimitingInterface)

// Package mocks is a generated GoMock package.
package mocks

import (
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
    time "time"
)

// MockRateLimitingInterface is a mock of RateLimitingInterface interface
type MockRateLimitingInterface struct {
    ctrl     *gomock.Controller
    recorder *MockRateLimitingInterfaceMockRecorder
}

// MockRateLimitingInterfaceMockRecorder is the mock recorder for MockRateLimitingInterface
type MockRateLimitingInterfaceMockRecorder struct {
    mock *MockRateLimitingInterface
}

// NewMockRateLimitingInterface creates a new mock instance
func NewMockRateLimitingInterface(ctrl *gomock.Controller) *MockRateLimitingInterface {
    mock := &MockRateLimitingInterface{ctrl: ctrl}
    mock.recorder = &MockRateLimitingInterfaceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRateLimitingInterface) EXPECT() *MockRateLimitingInterfaceMockRecorder {
    return m.recorder
}

// Add mocks base method
func (m *MockRateLimitingInterface) Add(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Add", arg0)
// Add indicates an expected call of Add
func (mr *MockRateLimitingInterfaceMockRecorder) Add(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Add",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Add), arg0)
}

// AddAfter mocks base method
func (m *MockRateLimitingInterface) AddAfter(arg0 interface{}, arg1 time.Duration) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddAfter", arg0, arg1)
}

// AddAfter indicates an expected call of AddAfter
func (mr *MockRateLimitingInterfaceMockRecorder) AddAfter(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddAfter",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).AddAfter), arg0, arg1)
}

// AddRateLimited mocks base method
func (m *MockRateLimitingInterface) AddRateLimited(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "AddRateLimited", arg0)
}

// AddRateLimited indicates an expected call of AddRateLimited
func (mr *MockRateLimitingInterfaceMockRecorder) AddRateLimited(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "AddRateLimited",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).AddRateLimited), arg0)
}

// Done mocks base method
func (m *MockRateLimitingInterface) Done(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Done", arg0)
}

// Done indicates an expected call of Done
func (mr *MockRateLimitingInterfaceMockRecorder) Done(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Done",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).Done), arg0)
}
// Forget mocks base method
func (m *MockRateLimitingInterface) Forget(arg0 interface{}) {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "Forget", arg0)
}

// Forget indicates an expected call of Forget
func (mr *MockRateLimitingInterfaceMockRecorder) Forget(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Forget",
refl.reflect.TypeOf((*MockRateLimitingInterface)(nil).Forget), arg0)
}

// Get mocks base method
func (m *MockRateLimitingInterface) Get() (interface{}, bool) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Get")
    ret0, _ := ret[0].(interface{})
    ret1, _ := ret[1].(bool)
    return ret0, ret1
}

// Get indicates an expected call of Get
func (mr *MockRateLimitingInterfaceMockRecorder) Get() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Get",
refl.reflect.TypeOf((*MockRateLimitingInterface)(nil).Get))
}

// Len mocks base method
func (m *MockRateLimitingInterface) Len() int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Len")
    ret0, _ := ret[0].(int)
    return ret0
}

// Len indicates an expected call of Len
func (mr *MockRateLimitingInterfaceMockRecorder) Len() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Len",
refl.reflect.TypeOf((*MockRateLimitingInterface)(nil).Len))
}

// NumRequeues mocks base method
func (m *MockRateLimitingInterface) NumRequeues(arg0 interface{}) int {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "NumRequeues", arg0)
}
ret0, _ := ret[0].(int)
return ret0

// NumRequeues indicates an expected call of NumRequeues
func (mr *MockRateLimitingInterfaceMockRecorder) NumRequeues(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "NumRequeues",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).NumRequeues), arg0)
}

// ShutDown mocks base method
func (m *MockRateLimitingInterface) ShutDown() {
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "ShutDown")
}

// ShutDown indicates an expected call of ShutDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShutDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShutDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShutDown))
}

// ShuttingDown mocks base method
func (m *MockRateLimitingInterface) ShuttingDown() bool {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ShuttingDown")
    ret0, _ := ret[0].(bool)
    return ret0
}

// ShuttingDown indicates an expected call of ShuttingDown
func (mr *MockRateLimitingInterfaceMockRecorder) ShuttingDown() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ShuttingDown",
        reflect.TypeOf((*MockRateLimitingInterface)(nil).ShuttingDown))
}

apiVersion: v1
kind: Secret
metadata:
  name: cssm-token
  namespace: sfcn-system
stringData:
  # this is a token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 1000 uses
token: "NGVmN2EwNjctMzRhZS00M2ZkLTkyODktYjlmMjBmNTYiNjJkLTE2NDYxMTIx%0AO TU2NjF8UnBHL3NzTUU5S1daeDjISmNBYStBMTVvK05qQIhBzTHJJSkk0TE9r%0ARUg4WT0%3D%0A"
---
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: sfcn-system
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: sfcn-system
  minLicenseCount: 1
  maxLicenseCount: 12
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
package listeners_test

import (
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "k8s.io/client-go/kubernetes/scheme"
  "testing"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

const (  
  smartLicenseName = "license-sample"  
  defaultNs = "default"  
  licenseType = "L-ASAV10S-STD"
)

func TestListeners(t *testing.T) {  
  RegisterFailHandler(Fail)  
  RunSpecs(t, "Listeners Suite")
}

var _ = BeforeSuite(func() {  
  _ = v1.AddToScheme(scheme.Scheme)  
})
FROM gcr.io/distroless/java-debian10:nonroot
WORKDIR /
COPY license-broker/bin/sa-server-*-all.jar sa-server-all.jar
ENTRYPOINT ["java", "-jar", "sa-server-all.jar"]
package listeners_test

import (    "context"    v1 "css.cisco.com/kasa/license-broker/api/v1"    "css.cisco.com/kasa/license-broker/controllers/listeners" licensingProto "css.cisco.com/licensing/client-agent/proto" . "github.com/onsi/ginkgo" . "github.com/onsi/gomega" autoscalingv1 "k8s.io/api/autoscaling/v1" corev1 "k8s.io/api/core/v1" metav1 "k8s.io/apimachinery/pkg/apis/meta/v1" "k8s.io/apimachinery/pkg/types" "k8s.io/client-go/kubernetes/scheme" "sigs.k8s.io/controller-runtime/pkg/client" "sigs.k8s.io/controller-runtime/pkg/client/fake" logf "sigs.k8s.io/controller-runtime/pkg/log"
)

const (    epDeploymentName = "epDeployment"    entitlementNumber = 4    coresPerLicenseType = 2)

var _ = Describe("Entitlement Listener Test", func() {
    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

    var listener *listeners.EntitlementListener
    var fakeClient client.Client

    var smartLicense *v1.SmartLicense

   BeforeEach(func() {
        var defaultLicenseCount uint32 = 1
        var maxLicenseCount uint32 = 3
        }
    })
fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).WithObjects(smartLicense).Build()

listener = &listeners.EntitlementListener{
    Log: logf.NullLogger{},
    Client: fakeClient,
    LicenseNsName: licenseNsName,
}

It("should update license status on OUT_OF_COMPLIANCE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:    licensingProto.EntitlementEvent_ENTITLEMENT_OUT_OF_COMPLIANCE,
        Message: "entitlement is out of compliance",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_SUCCESS event", func() {
    event := licensingProto.EntitlementEvent{
        Type:    licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_SUCCESS,
        Message: "granted new entitlement",
        EntitlementSku: licenseType,
        EntitlementNumber: entitlementNumber,
        CoresPerLicenseType: coresPerLicenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})

It("should update license status on ENTITLEMENT_REQUEST_FAILURE event", func() {
    event := licensingProto.EntitlementEvent{
        Type:    licensingProto.EntitlementEvent_ENTITLEMENT_REQUEST_FAILURE,
        Message: "failed to reserve a new entitlement",
        EntitlementSku: licenseType,
    }
    listener.OnEntitlementEvent(&event)
    Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
    Expect(smartLicense.Status.LicenseState).Should(Equal(v1.InCompliance))
    Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
    Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
})
EntitlementNumber: entitlementNumber,
CoresPerLicenseType: coresPerLicenseType,
}
listener.OnEntitlementEvent(&event)

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseNumber).Should(Equal(uint32(entitlementNumber)))
Expect(smartLicense.Status.CoresPerLicense).Should(Equal(uint32(coresPerLicenseType)))
}
}

apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: smartlicense-redirector
  namespace: sfcn-system
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: sfcn-system
  minLicenseCount: 1
  maxLicenseCount: 4
  scalingRef:
    kind: Deployment
    name: sfcn-vpnredirector-enforcer

//***************************************************************
/* Copyright (c) 2021 Cisco Systems, Inc. */
/* All rights reserved. */
/* Unauthorized redistribution prohibited. */
***************************************************************/

package v1

import (  
  "context"
  "fmt"
  appsv1 "k8s.io/api/apps/v1"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  v1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/runtime"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/apimachinery/pkg/util/validation/field"
  ctrl "sigs.k8s.io/controller-runtime"
  "sigs.k8s.io/controller-runtime/pkg/client"
  logf "sigs.k8s.io/controller-runtime/pkg/log"
  "sigs.k8s.io/controller-runtime/pkg/webhook"
// SFWLicenceTag is an entitlement tag of SFW/kASA license
const SFWLicenceTag = "regid.2021-01.com.cisco.SFW_CORE_1C_K,1.0_3c7c1742-2502-45ca-ac89-96bb5a8def84"

var defaultMinLicenseCount uint32 = 1
var defaultScalingFactor uint32 = 1

// log is for logging in this package.
var smartlicenselog = logf.Log.WithName("smartlicense-resource")
var webhookClient client.Client

func (r *SmartLicense) SetupWebhookWithManager(mgr ctrl.Manager) error {
    webhookClient = mgr.GetClient()
    return ctrl.NewWebhookManagedBy(mgr).
        For(r).
        Complete()
}

// +kubebuilder:webhook:path=/mutate-sfcn-cisco-com-v1-smartlicense,mutating=true,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,verbs=create;update,versions=v1,name=msmartlicense.kb.io

var _ webhook.Defaulter = &SmartLicense{}

// Default implements webhook.Defaulter so a webhook will be registered for the type
func (r *SmartLicense) Default() {
    log := smartlicenselog.WithValues("name", r.Name, "namespace", r.Namespace)

    if r.Spec.Action == "" {
        r.Spec.Action = Register
    }

    if r.Spec.LicenseType == "" {
        r.Spec.LicenseType = SFWLicenceTag
    }

    if r.Spec.MinLicenseCount == nil {
        r.Spec.MinLicenseCount = &defaultMinLicenseCount
    }

    if r.Spec.MaxLicenseCount == nil {
        r.Spec.MaxLicenseCount = r.Spec.MinLicenseCount
    }

    if r.Spec.ScalingFactor == nil {
        r.Spec.ScalingFactor = &defaultScalingFactor
    }

    log.V(1).Info("updated SmartLicense default values")
}
// +kubebuilder:webhook:verbs=create;update,path=/validate-sfcn-cisco-com-v1-smartlicense,mutating=false,sideEffects=none,admissionReviewVersions=v1,failurePolicy=fail,groups=sfcn.cisco.com,resources=smartlicenses,versions=v1,name=vsmartlicense.kb.io

var _ webhook.Validator = &SmartLicense{}

// ValidateCreate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateCreate() error {
smartlicenselog.V(1).Info("validate create", "name", r.Name)

var allErrs field.ErrorList
r.validateMinimum(1, r.Spec.MinLicenseCount, "minLicenseCount", &allErrs)
r.validateMinimum(1, r.Spec.MaxLicenseCount, "maxLicenseCount", &allErrs)
r.validateMinimum(1, r.Spec.Scalfactor, "scalingFactor", &allErrs)
r.requireRegisterAction(&allErrs)
r.validateLicenseCount(&allErrs)
r.validateToken(&allErrs)
r.validateScalingRef(&allErrs)

if len(allErrs) == 0 {
    return nil
}
return allErrs.ToAggregate()
}

// ValidateUpdate implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateUpdate(old runtime.Object) error {
smartlicenselog.V(1).Info("validate update", "name", r.Name)

var allErrs field.ErrorList
r.validateLicenseCount(&allErrs)

// avoid validating other objects when SmartLicences is being deleted and updated to remove the finalizer
if r.GetDeletionTimestamp() == nil {
    r.validateToken(&allErrs)
r.validateScalingRef(&allErrs)
}
oldObj := old.(*SmartLicense)
r.requireNoLicenseTypeChange(&allErrs, oldObj)

if len(allErrs) == 0 {
    return nil
}
return allErrs.ToAggregate()
}

// ValidateDelete implements webhook.Validator so a webhook will be registered for the type
func (r *SmartLicense) ValidateDelete() error {
    return nil
}

func (r *SmartLicense) requireRegisterAction(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("action")
    if r.Spec.Action != Register {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, fmt.Sprintf("action must be %s when creating a resource", Register)))
    }
}

func (r *SmartLicense) requireNoLicenseTypeChange(errs *field.ErrorList, old *SmartLicense) {
    path := field.NewPath("spec").Child("licenseType")
    if old.Status.RegistrationState == Registered && old.Spec.LicenseType != r.Spec.LicenseType {
        *errs = append(*errs,
            field.Forbidden(path, "not allowed to change licenseType when the platform is registered, deregister it first"))
    }
}

func (r *SmartLicense) validateLicenseCount(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("maxLicenseCount")

    if r.Spec.MinLicenseCount != nil && r.Spec.MaxLicenseCount != nil && *r.Spec.MaxLicenseCount <
        *r.Spec.MinLicenseCount {
        *errs = append(*errs,
            field.Invalid(path, r.Spec.MaxLicenseCount, "maximum license count must be greater or equal then minimum license count")
    }
}

func (r *SmartLicense) validateToken(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("tokenSecret")

    secret := &v1.Secret{}

    if err := webhookClient.Get(context.TODO(), key, secret); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "token secret is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get token secret: %w", err)))
            return
        }
    }

    if len(secret.Data[TokenKeyName]) == 0 {
        *errs = append(*errs, field.Required(path.Child("data").Child(TokenKeyName), "cannot be empty"))
    }
}
func (r *SmartLicense) validateScalingRef(errs *field.ErrorList) {
    path := field.NewPath("spec").Child("scalingRef")

    if r.Spec.ScalingRef.Kind == "" || r.Spec.ScalingRef.Name == "" {
        *errs = append(*errs, field.Required(path, "kind or name of referenced object cannot be empty"))
        return
    }

    key := types.NamespacedName{Namespace: r.Namespace, Name: r.Spec.ScalingRef.Name}
    var obj client.Object
    switch r.Spec.ScalingRef.Kind {
    case DeploymentKind:
        obj = &appsv1.Deployment{}
    case HPAKind:
        obj = &autoscalingv1.HorizontalPodAutoscaler{}
    default:
        return
    }

    if err := webhookClient.Get(context.TODO(), key, obj); err != nil {
        if errors.IsNotFound(err) {
            *errs = append(*errs, field.Required(path, "referenced object is not found"))
            return
        } else {
            *errs = append(*errs, field.InternalError(path, fmt.Errorf("failed to get referenced object: %w", err)))
            return
        }
    }
}

func (r *SmartLicense) validateMinimum(min uint32, val *uint32, path string, errs *field.ErrorList) {
    if val == nil || *val < min {
        path := field.NewPath("spec").Child(path)
        *errs = append(*errs, field.Invalid(path, val, fmt.Sprintf("must be greater than or equal to %d", min)))
    }
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/kasa/license-broker/controllers (interfaces: ReplicasCalculator)

// Package mocks is a generated GoMock package.
package mocks

import {
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    gomock "github.com/golang/mock/gomock"
}
type MockReplicasCalculator struct {
    ctrl     *gomock.Controller
    recorder *MockReplicasCalculatorMockRecorder
}

type MockReplicasCalculatorMockRecorder struct {
    mock *MockReplicasCalculator
}

func NewMockReplicasCalculator(ctrl *gomock.Controller) *MockReplicasCalculator {
    mock := &MockReplicasCalculator{ctrl: ctrl}
    mock.recorder = &MockReplicasCalculatorMockRecorder{mock}
    return mock
}

func (m *MockReplicasCalculator) EXPECT() *MockReplicasCalculatorMockRecorder {
    return m.recorder
}

func (m *MockReplicasCalculator) CalculateMaxLicensedReplicas(arg0 []v1.SmartLicense, arg1 *v10.Deployment) (int32, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
    ret0, _ := ret[0].(int32)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// CalculateMaxLicensedReplicas indicates an expected call of CalculateMaxLicensedReplicas
func (mr *MockReplicasCalculatorMockRecorder) CalculateMaxLicensedReplicas(arg0, arg1 interface{}) {
    m := (*MockReplicasCalculator)(mr.svc)
    m.ctrl.T.Helper()
    m.ctrl.Call(m, "CalculateMaxLicensedReplicas", arg0, arg1)
}

package services_test

import (  
    "context"
)
const (  
  smartLicenseName = "license-sample"
  defaultNs = "default"
  licenseType = "L-ASAV10S-STD"
)

var (  
  minLicenseCount uint32 = 1
  maxLicenseCount uint32 = 5
  scalingFactor uint32 = 2
)
Replicas: &replicaCount,
Selector: &metav1.LabelSelector{MatchLabels: map[string]string{"role": "enforcer"}},
Template: corev1.PodTemplateSpec{
    Name: "ep-container",
    Resources: corev1.ResourceRequirements{
      Limits: map[corev1.ResourceName]resource.Quantity{
        "cpu": resource.MustParse("2000m"),
      },
    },
  },
} Status: appsv1.DeploymentStatus{ReadyReplicas: replicaCount},

pod := &corev1.Pod{
  ObjectMeta: metav1.ObjectMeta{
    Name:      "ep-pod",
    Namespace: defaultNs,
    Labels:    map[string]string{"role": "enforcer"},
  },
  Spec: corev1.PodSpec{NodeName: "ep-node"},
} Expect(fakeClient.Create(context.TODO(), pod)).To(Succeed())

node = &corev1.Node{
  ObjectMeta: metav1.ObjectMeta{Name: "ep-node"},
      resource.MustParse("4000m")}},
} Expect(fakeClient.Create(context.TODO(), node)).To(Succeed())

Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

smartLicense = v1.SmartLicense{
  ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
  Spec: v1.SmartLicenseSpec{
    Action: v1.Register,
    LicenseType: licenseType,
    MinLicenseCount: &minLicenseCount,
    MaxLicenseCount: &maxLicenseCount,
    ScalingFactor: &scalingFactor,
  },
  Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered, LicenseState: v1.InCompliance, CoresPerLicense:
It("should return default value because license state is not in compliance", func() {
    smartLicense.Status.LicenseState = v1.OutOfCompliance
    Expect(fakeClient.Update(context.TODO(), &smartLicense)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))
})

It("should calculate max estimated replicas because license state is in compliance", func() {
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(2)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
})

It("should calculate max limits based on 2 smart licenses", func() {
    smartLicense2 := v1.SmartLicense{
        Spec: v1.SmartLicenseSpec{
            Action: v1.Register,
            LicenseType: licenseType,
            MinLicenseCount: &minLicenseCount,
            MaxLicenseCount: &maxLicenseCount,
            ScalingFactor: &scalingFactor,
        },
        Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance, CoresPerLicense: 1},
    }
    Expect(fakeClient.Create(context.TODO(), &smartLicense2)).To(Succeed())
licenses = append(licenses, smartLicense2, smartLicense)

maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).ShouldNot(HaveOccurred())
Expect(maxReplicas).Should(Equal(int32(4)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense2)).ShouldNot(HaveOccurred())
Expect(smartLicense2.Status.EstimatedMaxReplicas).Should(Equal(int32(2)))
}

It("should look at node limits if pod containers do not have limits defined", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(1)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(1)))
})

It("should return default value if pod containers do not have limits defined and deployment ready replicas is 0", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    deployment.Status.ReadyReplicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    licenses = append(licenses, smartLicense)
    maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
    Expect(err).ShouldNot(HaveOccurred())
    Expect(maxReplicas).Should(Equal(int32(0)))
    Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
    Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
})

It("should return default value if there is no node defined in pod spec", func() {
    deployment.Spec.Template = corev1.PodTemplateSpec{}
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())
    Expect(fakeClient.Delete(context.TODO(), node)).To(Succeed())
    licenses = append(licenses, smartLicense)
})
maxReplicas, err := replicasCalculator.CalculateMaxLicensedReplicas(licenses, deployment)
Expect(err).Should(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("failed to calculate node's CPU limit"))
Expect(maxReplicas).Should(Equal(int32(0)))

Expect(fakeClient.Get(context.TODO(), licenseNsName, &smartLicense)).ShouldNot(HaveOccurred())
Expect(smartLicense.Status.EstimatedMaxReplicas).Should(Equal(int32(0)))
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: LicensingClient)

// Package mocks is a generated GoMock package.
package mocks

import {
    clientagent "css.cisco.com/licensing/client-agent"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
}

// MockLicensingClient is a mock of LicensingClient interface
type MockLicensingClient struct {
    ctrl   *gomock.Controller
    recorder *MockLicensingClientMockRecorder
}

// MockLicensingClientMockRecorder is the mock recorder for MockLicensingClient
type MockLicensingClientMockRecorder struct {
    mock *MockLicensingClient
}

// NewMockLicensingClient creates a new mock instance
func NewMockLicensingClient(ctrl *gomock.Controller) *MockLicensingClient {
    mock := &MockLicensingClient{ctrl: ctrl}
    mock.recorder = &MockLicensingClientMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockLicensingClient) EXPECT() *MockLicensingClientMockRecorder {
    return m.recorder
}

// Allotment mocks base method
func (m *MockLicensingClient) Allotment() clientagent.AllotmentService {
    m.ctrl.T.Helper()
    return m
}
ret := m.ctrl.Call(m, "Allotment")
ret0, _ := ret[0].(clientagent.AllotmentService)
return ret0

// Allotment indicates an expected call of Allotment
def (mr *MockLicensingClientMockRecorder) Allotment() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Allotment",
    reflect.TypeOf((*MockLicensingClient)(nil).Allotment))
}

// Entitlement mocks base method
def (m *MockLicensingClient) Entitlement() clientagent.EntitlementService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Entitlement")
    ret0, _ := ret[0].(clientagent.EntitlementService)
    return ret0
}

// Entitlement indicates an expected call of Entitlement
def (mr *MockLicensingClientMockRecorder) Entitlement() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Entitlement",
    reflect.TypeOf((*MockLicensingClient)(nil).Entitlement))
}

// Registration mocks base method
def (m *MockLicensingClient) Registration() clientagent.RegistrationService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Registration")
    ret0, _ := ret[0].(clientagent.RegistrationService)
    return ret0
}

// Registration indicates an expected call of Registration
def (mr *MockLicensingClientMockRecorder) Registration() *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Registration",
    reflect.TypeOf((*MockLicensingClient)(nil).Registration))
}

// Subscription mocks base method
def (m *MockLicensingClient) Subscription() clientagent.SubscriptionService {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Subscription")
    ret0, _ := ret[0].(clientagent.SubscriptionService)
    return ret0
}
// Subscription indicates an expected call of Subscription
func (mr *MockLicensingClientMockRecorder) Subscription() *gomock.Call {
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Subscription",
    reflect.TypeOf((*MockLicensingClient)(nil)).Subscription)
}

{{ include "aegis.configmap.standard" (list . "config" "kasa.licensebroker.config") }}

---

{{- define "kasa.licensebroker.config" -}}
{{- $ := first . -}}
{{- $licenseServerName := include "aegis.metadata.fullname" (list $ "broker") }}
{{- $hostname := printf "%s/%s" $.Release.Namespace $licenseServerName }}

type: ConfigMap
kind: ConfigMap
data:
  server-id.json: |
  |
  "name": "{ $licenseServerName }",
  "hostname": "{ $hostname }",
  "ipAddress": "",
  "productId": "SFW",
  "softwareTag": "regid.2021-01.com.cisco.SFW,1.0_6f4891e2-97a4-443b-ad9a-9675b85b504f",
  "serialNumber": "{ $hostname | sha256sum | trunc 11 | upper }",
  "storagePath": "/home/nonroot/licensing/{ $.Release.Namespace }",
  "transportHttpUrl": "{ $.Values.licenseServerTransportUrl }"}
{{- end -}}

package controllers

import {
  "context"
  v1 "css.cisco.com/kasa/license-broker/api/v1"
  "css.cisco.com/kasa/license-broker/controllers/handlers"
  "css.cisco.com/kasa/pkg/predicates"
  "fmt"
  "github.com/go-logr/logr"
  apps/v1 "k8s.io/api/apps/v1"
  autoscalingv1 "k8s.io/api/autoscaling/v1"
  "k8s.io/api/autoscaling/v2beta1"
  core/v1 "k8s.io/api/core/v1"
  "k8s.io/apimachinery/pkg/api/errors"
  "k8s.io/apimachinery/pkg/types"
  "k8s.io/client-go/tools/record"
  ctrl "sigs.k8s.io/controller-runtime"
type HPALicenseReconciler struct {
    client.Client
    Log                logr.Logger
    Recorder           record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *HPALicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v2beta1.HorizontalPodAutoscaler{}, builder.WithPredicates(
            &predicates.LabelExistsPredicate{Key: LicenseHolderLabel}).
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.HPAHandler()).
        Complete(c)
}

// Reconcile reconciles HPA specified in SmartLicense custom resource (CR) and resets its MaxReplicas value
// when it exceeds the replicas allowed by licensing config.
func (c *HPALicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    hpa := &autoscalingv1.HorizontalPodAutoscaler{}
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("HPA does not exist, nothing to reconcile")
        }
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }

    licenseList := v1.SmartLicenseList{}
        return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
    }
    registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
    hpaLicenses := filterLicensesByKind(registeredLicenses, v1.HPAKind, hpa.Name)

    labelsChanged := setLicenseLabel(&hpa.ObjectMeta, LicenseHolderLabel, len(hpaLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA: %w", err)
    }
    log.Info("updated HPA labels")
}

if len(hpaLicenses) == 0 {
    log.Info("skipping HPA reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(hpaLicenses) {
    log.Info("at least one SmartLicense is in pending state, re-queueing the request to process it later")
    return ctrl.Result{}, nil
}

    log.Info("scaled resource is not deployment")
    return ctrl.Result{}, nil
}

deployment, err := c.getDeploymentControlledByHPA(ctx, hpa)
if err != nil {
    return ctrl.Result{}, err
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(hpaLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

if hpa.Spec.MaxReplicas > maxLicensedReplicas {
    hpa.Spec.MaxReplicas = maxLicensedReplicas
    changedFields := []string{"MaxReplicas"}
        changedFields = append(changedFields, "MinReplicas")
    }
    if err = c.Client.Update(context.Background(), hpa); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update HPA resource: %w", err)
    }
    c.Recorder.Event(hpa, corev1.EventTypeWarning, "HPAScaledDown", fmt.Sprintf("Decreased HPA's %s to %d as it is the maximum EP replicas that could be granted a license. Please, check SmartLicense resource to increase the"), hpa.Spec.MaxReplicas, maxLicensedReplicas)
}
limit.

log.Info(fmt.Sprintf("successfully decreased HPA's %s to max license limit", changedFields),
"updatedHPAMaxReplicas", hpa.Spec.MaxReplicas)
return ctrl.Result{}, nil
}
log.Info("skipping HPA update, system has enough licenses to have all HPA's MaxReplicas running",
"hpaMaxReplicas", hpa.Spec.MaxReplicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *HPALicenseReconciler) getDeploymentControlledByHPA(ctx context.Context, hpa
*autoscalingv1.HorizontalPodAutoscaler) (*appsv1.Deployment, error) {
deploymentName := hpa.Spec.ScaleTargetRef.Name
deployment := &appsv1.Deployment{
deployment)
if err != nil {
return nil, err
}
return deployment, err
}

---
apiVersion: admissionregistration.k8s.io/v1
kind: MutatingWebhookConfiguration
metadata:
  creationTimestamp: null
  name: mutating-webhook-configuration
webhooks:
  - admissionReviewVersions:
    - v1
    clientConfig:
      service:
        name: webhook-service
        namespace: system
        path: /mutate-sfcn-cisco-com-v1-smartlicense
    failurePolicy: Fail
    name: msmartlicense.kb.io
    rules:
    - apiGroups:
      - sfcn.cisco.com
      apiVersions:
      - v1
      operations:
      - CREATE
      - UPDATE
      resources:
      - smartlicenses
sideEffects: None

---

apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration
metadata:
  creationTimestamp: null
  name: validating-webhook-configuration
webhooks:
  - admissionReviewVersions:
    - v1
clientConfig:
  service:
    name: webhook-service
    namespace: system
    path: /validate-sfcn-cisco-com-v1-smartlicense
  failurePolicy: Fail
  name: vsmartlicense.kb.io
  rules:
    - apiGroups:
      - sfcn.cisco.com
      apiVersions:
        - v1
      operations:
        - CREATE
        - UPDATE
      resources:
        - smartlicenses
      sideEffects: None

// +build !ignore_autogenerated

/***************************************************************
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****************************************************************/

// Code generated by controller-gen. DO NOT EDIT.

package v1

import (
  "k8s.io/apimachinery/pkg/runtime"
)

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicense) DeepCopyInto(out *SmartLicense) {
  *out = *in

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
out.TypeMeta = in.TypeMeta
in.Spec.DeepCopyInto(&out.Spec)
out.Status = in.Status
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicense.
func (in *SmartLicense) DeepCopy() *SmartLicense {
    if in == nil {
        return nil
    }
    out := new(SmartLicense)
in.DeepCopyInto(out)
    return out
}

// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicense) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseList) DeepCopyInto(out *SmartLicenseList) {
    *out = *in
    out.TypeMeta = in.TypeMeta
    in.ListMeta.DeepCopyInto(&out.ListMeta)
    if in.Items != nil {
        in, out := &in.Items, &out.Items
        for i := range *in {
            (*in)[i].DeepCopyInto(&(*out)[i])
        }
    }
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseList.
func (in *SmartLicenseList) DeepCopy() *SmartLicenseList {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseList)
in.DeepCopyInto(out)
    return out
}
// DeepCopyObject is an autogenerated deepcopy function, copying the receiver, creating a new runtime.Object.
func (in *SmartLicenseList) DeepCopyObject() runtime.Object {
    if c := in.DeepCopy(); c != nil {
        return c
    }
    return nil
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseSpec) DeepCopyInto(out *SmartLicenseSpec) {
    *out = *in
    out.TokenSecret = in.TokenSecret
    if in.MinLicenseCount != nil {
        in, out := &in.MinLicenseCount, &out.MinLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.MaxLicenseCount != nil {
        in, out := &in.MaxLicenseCount, &out.MaxLicenseCount
        *out = new(uint32)
        **out = **in
    }
    if in.ScalingFactor != nil {
        in, out := &in.ScalingFactor, &out.ScalingFactor
        *out = new(uint32)
        **out = **in
    }
    out.ScalingRef = in.ScalingRef
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseSpec.
func (in *SmartLicenseSpec) DeepCopy() *SmartLicenseSpec {
    if in == nil {
        return nil
    }
    out := new(SmartLicenseSpec)
    in.DeepCopyInto(out)
    return out
}

// DeepCopyInto is an autogenerated deepcopy function, copying the receiver, writing into out. in must be non-nil.
func (in *SmartLicenseStatus) DeepCopyInto(out *SmartLicenseStatus) {
    *out = *in
}

// DeepCopy is an autogenerated deepcopy function, copying the receiver, creating a new SmartLicenseStatus.
func (in *SmartLicenseStatus) DeepCopy() *SmartLicenseStatus {
    if in == nil {
        return nil
    }
}
return nil
}
out := new(SmartLicenseStatus)
in.DeepCopyInto(out)
return out
}
// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: EntitlementService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockEntitlementService is a mock of EntitlementService interface
type MockEntitlementService struct {
    ctrl     *gomock.Controller
    recorder *MockEntitlementServiceMockRecorder
}

// MockEntitlementServiceMockRecorder is the mock recorder for MockEntitlementService
type MockEntitlementServiceMockRecorder struct {
    mock *MockEntitlementService
}

// NewMockEntitlementService creates a new mock instance
func NewMockEntitlementService(ctrl *gomock.Controller) *MockEntitlementService {
    mock := &MockEntitlementService{ctrl: ctrl}
    mock.recorder = &MockEntitlementServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockEntitlementService) EXPECT() *MockEntitlementServiceMockRecorder {
    return m.recorder
}

// Notify mocks base method
func (m *MockEntitlementService) Notify(arg0 string, arg1 service.EntitlementEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Notify", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}
// Notify indicates an expected call of Notify
func (mr *MockEntitlementServiceMockRecorder) Notify(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Notify",
    reflect.TypeOf((*MockEntitlementService)(nil).Notify), arg0, arg1)
}

// ScaleEntitlement mocks base method
func (m *MockEntitlementService) ScaleEntitlement(arg0 *proto.EntitlementScalingRequest) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ScaleEntitlement", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ScaleEntitlement indicates an expected call of ScaleEntitlement
func (mr *MockEntitlementServiceMockRecorder) ScaleEntitlement(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ScaleEntitlement",
    reflect.TypeOf((*MockEntitlementService)(nil).ScaleEntitlement), arg0)
}

package handlers_test

import (   //context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/license-broker/controllers/handlers/mocks"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
    "sigs.k8s.io/controller-runtime/pkg/reconcile"
}

const (    secretName = "secretTest"
)
var _ = Describe("SecretHandler", func() {
var handler handler.EventHandler
var mockCtrl *gomock.Controller
var mockQueue *mocks.MockRateLimitingInterface
var coreClient client.Client

BeforeEach(func() {
mockCtrl = gomock.NewController(GinkgoT())
mockQueue = mocks.NewMockRateLimitingInterface(mockCtrl)
coreClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
handler = handlers.SecretHandler(coreClient)
})

AfterEach(func() {
mockCtrl.Finish()
})

It("should do nothing where there are no smart license objects", func() {
handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})

It("should not add request because secret is not used in SmartLicense object", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name: "some_secret",
Namespace: defaultNamespace,
},
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.RegistrationFailed,
},

Expect(coreClient.Create(context.TODO(), smartLicenseObject))

handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})

It("should not add request because SmartLicense is registered", func() {

smartLicenseObject := &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
    Spec: v1.SmartLicenseSpec{
        TokenSecret: corev1.SecretReference{
            Name: smartLicenseName,
            Namespace: defaultNamespace,
        },
        Status: v1.SmartLicenseStatus{
            RegistrationState: v1.Registered,
        },
    }
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

handler.Update(event.UpdateEvent{
    ObjectNew: &corev1.Secret{
        ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
    },
}, mockQueue)
}

It("should not add request because SmartLicense is deregistered", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
                Name: smartLicenseName,
                Namespace: defaultNamespace,
            },
            Status: v1.SmartLicenseStatus{
                RegistrationState: v1.Deregistered,
            },
        }
    }
    Expect(coreClient.Create(context.TODO(), smartLicenseObject))

    handler.Update(event.UpdateEvent{
        ObjectNew: &corev1.Secret{
            ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
        },
    }, mockQueue)
}

It("should add request because SmartLicense status is registration failed", func() {
    smartLicenseObject := &v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
        Spec: v1.SmartLicenseSpec{
            TokenSecret: corev1.SecretReference{
Name: secretName,
Namespace: defaultNamespace,
}
}
Status: v1.SmartLicenseStatus{
RegistrationState: v1.RegistrationFailed,
}
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNamespace},
},
}, mockQueue)
})

It("should add request for SmartLicense even if secret is in different namespace", func() {
smartLicenseObject := &v1.SmartLicense{
ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNamespace},
Spec: v1.SmartLicenseSpec{
TokenSecret: corev1.SecretReference{
Name: secretName,
Namespace: "test-namespace",
},
},
Status: v1.SmartLicenseStatus{
RegistrationState: v1.RegistrationFailed,
}
}
Expect(coreClient.Create(context.TODO(), smartLicenseObject))

mockQueue.EXPECT().Add(reconcile.Request{
NamespacedName: types.NamespacedName{Namespace: defaultNamespace, Name: smartLicenseName},
})

handler.Update(event.UpdateEvent{
ObjectNew: &corev1.Secret{
ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: "test-namespace"},
},
}, mockQueue)
})

})
License Broker

License Broker is the kASA component responsible for licensing. It allows registering kASA platform in the licensing system and let enforcement points (ASAc) acquire and release licenses on demand.

To date, only Smart Software Licensing is supported. To communicate with Smart Software Licensing system, License Broker uses `client-agent` and `server-agent` components from [licensing project](https://bitbucket-eng-sjc1.cisco.com/bitbucket/projects/CSS/repos/licensing/browse).

## Installing `client-agent` dependency

To get the `css.cisco.com/licensing/client-agent` Golang module used by License Broker, make sure you have Cisco CA certificates installed on your machine. See the installation instructions [in the root's README](./../README.md#list-of-tools-required-to-compile-the-project-from-sources).

And make sure to update the GOPRIVATE environment variable to include `css.cisco.com`:
```
```shell
go env -w GOPRIVATE="css.cisco.com/*"
```

```yaml
{{- include "aegis.deployments.configuration" (list . "license-api" (fromYaml `deployment: kasa.licensebroker.deployment rbac: config/rbac/**.yaml crds: config/crd/**.yaml webhooks: config/webhook/manifests.yaml `)) -}}

{{- define "kasa.licensebroker.deployment" -}}
{{- $ := first . -}}
{{- $global := default (dict ) $.Values.global -}}
apiVersion: apps/v1
kind: Deployment
spec:
  {{- if eq $global.platform "eks" }}
    type: Recreate
  {{- end }}
template:
  metadata:
    annotations:
      checksum/license-config: {{ include "aegis.configmap.standard" (list $ "config" "kasa.licensebroker.config") | sha256sum }}
  spec:
    securityContext:
      # 65532 is ID of nonroot user group
      fsGroup: 65532
      {{- if eq $global.platform "eks" }}
dnsPolicy: ClusterFirstWithHostNet
```
hostNetwork: true

{{- if ($Values.global.platform | eq "azure") }}
    {{- /* https://github.com/kubernetes-sigs/azuredisk-csi-driver/issues/815
    azure disk seems to ignore fsgroup setting right now for v1.2.0 release,
    need an init container to fix permissions */}}
{{- end }}

initContainers:
  - name: change-ownership
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    command: [ 'sh', '-c', 'chown -R 65532:65532 /home/nonroot' ]
    volumeMounts:
      - mountPath: /home/nonroot
        name: disk
    securityContext:
    # Files or directories created with HostPath on the host are only writable by root. Which means, you either
    # need to run your container process as root or modify the file permissions on the host to be writable by
    # non-root user.
    runAsUser: 0
    capabilities:
    add:
      - DAC_OVERRIDE
      - FOWNER

containers:
  - name: manager
    image: {{ include "aegis.util.prependRegistry" (list $ $.Values.controllerImage) }}
    imagePullPolicy: {{ $.Values.defaultImagePullPolicy }}
    env:
      {{ include "aegis.containers.standardEnv" (list $) | nindent 12 }}
    args:
      - --zap-log-level={{ $.Values.logLevel }}
      - --zap-encoder={{ $.Values.logFormat }}
      - --webhook-port={{ $.Values.webhookPort }}
      - --metrics-port={{ $.Values.metricsPort }}
      - --license-server-port={{ $.Values.licenseServerPort }}
    ports:
      - containerPort: {{ $.Values.webhookPort }}
        name: webhook-server
        protocol: TCP
    resources:
      requests:
        cpu: {{ $.Values.managerCoreRequest }}
        memory: {{ $.Values.managerMemoryRequest }}
      limits:
        cpu: {{ $.Values.managerCoreLimit }}
        memory: {{ $.Values.managerMemoryLimit }}
    securityContext:
      allowPrivilegeEscalation: false
- name: license-server
  image: [ {{ include "aegis.util.prependRegistry" (list $ $.Values.licenseServerImage) }} ]
  imagePullPolicy: [ {{ $.Values.defaultImagePullPolicy }} ]
  command:
  - "java"
  - "-Xms{{ $.Values.licenseServerXms }}"
  - "-Xmx{{ $.Values.licenseServerXmx }}"
  - "-jar"
  - "sa-server-all.jar"
  - "--configFile"
  - "/etc/licensing/server-id.json"
  - "--port"
  - [ {{ $.Values.licenseServerPort | quote }} ]
  ports:
  - containerPort: [ {{ $.Values.licenseServerPort }} ]
    protocol: TCP
  securityContext:
  # 65532 is ID of nonroot user
  runAsUser: 65532
  allowPrivilegeEscalation: false
  env:
  - [ {{ include "aegis.containers.standardEnv" (list $) | indent 12 }} ]
  resources:
    requests:
      cpu: [ {{ $.Values.licenseServerCoreRequest }} ]
      memory: [ {{ $.Values.licenseServerMemoryRequest }} ]
    limits:
      cpu: [ {{ $.Values.licenseServerCoreLimit }} ]
      memory: [ {{ $.Values.licenseServerMemoryLimit }} ]
  volumeMounts:
  - mountPath: /home/nonroot
    name: disk
  - mountPath: /etc/licensing/server-id.json
    name: license-config
    subPath: server-id.json
  volumes:
  - name: disk
    persistentVolumeClaim:
      claimName: [ {{ include "aegis.metadata.fullname" (list $ "$server") }} ]
  - name: license-config
    configMap:
      name: [ {{ include "aegis.metadata.fullname" (list $ "$config") }} ]
  {{- if ne $global.platform "kind" }}
  imagePullSecrets:
  - name: regsfcn
  {{- end }}
  terminationGracePeriodSeconds: 10
---

```yaml
{{ include "aegis.services.deployment" (list $ "configurer" "kasa.licensebroker.server") -}}

{{- define "kasa.licensebroker.server" -}}
{{- $ := first . -}}

apiVersion: v1
class:
metadata:
  name: {{ include "aegis.metadata.fullname" (list $ "server") }}
spec:
  ports:
    - protocol: TCP
      port: 80
      targetPort: {{ $.Values.licenseServerPort }}
type: ClusterIP
{{- end -}}
```

---

```
cloud.google.com/go v0.26.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLic0ClmMTw=
cloud.google.com/go v0.34.0/go.mod h1:aQUYkXzVsufM+DwF1aE+0xfcU+56JwCaLic0ClmMTw=
cloud.google.com/go v0.38.0/go.mod h1:990N+gfupTy94ShfmMCWGDN0lpTmnzTf2qb1dvSRU=
cloud.google.com/go v0.44.1/go.mod h1:iSa0KzasP4Uvy3f1mN7PiObzGgfLwredwwASm/v6AU=
cloud.google.com/go v0.44.2/go.mod h1:60680Gw3Yr4ixnPRStoxsBcCcT6SA1yMk63TGekxKY=
cloud.google.com/go v0.45.1/go.mod h1:RBPamKRGqWjb87xiPSdkg41CME7QzG3uwTTez+TStjc=
cloud.google.com/go v0.46.3/go.mod h1:a6bKkbmY7erlml7T7E4sAks/mkhTSZK8w33B4RAg0=
cloud.google.com/go v0.51.0 h1:PVkAVWQC1tGUSIZGkW3QLeiKaWq7KY/vMW1EboG8bfM=
cloud.google.com/go v0.51.0 h1:htWJ6gnXH+KgDv+V0zFGDVPip07n3z8ZNj3t1RW0Gcw=
cloud.google.com/go/bigquery v1.0.1/go.mod h1:i/xbL2UIR5RvWAURpBYZTtm/cXjCha91bfbpx4poX++=
cloud.google.com/go/datastore v1.0.0/go.mod h1:LYYbybFLsgQ5pkeyhO+Qwm7ukd3C+pD7TKLgZqHYE=
cloud.google.com/go/pubsub v1.0.1/go.mod h1:R0Gpsv3s54REIJCy4fxDiw9D31HIJoMzTzy26xNgRt3t1=
cloud.google.com/go/storage v1.0.0/go.mod h1:IhtSmNfZTzv8YYJWCGY8RULGvqBDmpoyjwyjrgs+URw=
css.cisco.com/licensing/client-agent v0.1.11 h1:LA+Lcm0d0+w2x7Yxne9a6kToGw0bfQ7V7Btix2x0p0=
css.cisco.com/licensing/client-agent v0.1.11/go.mod h1:Y2jzP6Je7neWHkqzF3/4BMIv1hETPwbwBChrvRM=
dmitri.shuralyov.com/gpu/mtl v0.0.0-2019040844501-6669879733e9/go.mod
h1:H6x/7gZCz22OMCxBBrMx7a517Hp+++=VxbQ4BYO7uH=
github.com/Azure/go-ansi-term v0.0.0-20170929234032-36e3b3328b78/go.mod
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Open Source Used in kASA v1.5  7440
package controllers

import (    v1 "css.cisco.com/kasa/license-broker/api/v1"    . "github.com/onsi/ginkgo"    . "github.com/onsi/gomega" autoscalingv1 "k8s.io/api/autoscaling/v1" metav1 "k8s.io/api/machinery/pkg/apis/meta/v1"    "k8s.io/api/machinery/pkg/types"    "strings"
)

var _ = Describe("Common Test", func() {

It("serialNumber", func() {
    serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())
    Expect(len(serialNum)).Should(Equal(11))
    Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))
    Expect(serialNum).Should(Equal("F0529A6CDD9"))
})

It("containsString", func() {
    list := []string{"one", "two", "three"}
    Expect(containsString(list, "three")).Should(BeTrue())
    Expect(containsString(list, "four")).Should(BeFalse())
})

It("removeString", func() {
    list := []string{"one", "two", "three"}
    Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
    Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
})

It("filterLicensesByState", func() {
    licenses := []v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{            Name: "license1",        },    }
})

var _ = Describe("Common Test", func() {

It("serialNumber", func() {
    serialNum := serialNumber(types.NamespacedName{Namespace: "sfcn-system", Name: "name"}.String())
    Expect(len(serialNum)).Should(Equal(11))
    Expect(strings.ToUpper(serialNum)).Should(Equal(serialNum))
    Expect(serialNum).Should(Equal("F0529A6CDD9"))
})

It("containsString", func() {
    list := []string{"one", "two", "three"}
    Expect(containsString(list, "three")).Should(BeTrue())
    Expect(containsString(list, "four")).Should(BeFalse())
})

It("removeString", func() {
    list := []string{"one", "two", "three"}
    Expect(removeString(list, "two")).Should(Equal([]string{"one", "three"}))
    Expect(removeString(list, "four")).Should(Equal([]string{"one", "two", "three"}))
})

It("filterLicensesByState", func() {
    licenses := []v1.SmartLicense{
        ObjectMeta: metav1.ObjectMeta{            Name: "license1",        },    }
})
filteredLicenses := filterLicensesByState(licenses, v1.Deregistered)
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{
        Name: "license1",
    },
    Status: v1.SmartLicenseStatus{
        RegistrationState: v1.Deregistered,
    },
}))

filteredLicenses = filterLicensesByState(licenses, v1.DeregistrationFailed)
Expect(filteredLicenses).Should(BeEmpty())

It("filterLicensesByKind", func() {
    var licenses v1.SmartLicenseList
    licenses.Items = []v1.SmartLicense{
        {
            Spec: v1.SmartLicenseSpec{
                ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
            },
        },
        {
            Spec: v1.SmartLicenseSpec{
                ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
            },
        },
        {
            Spec: v1.SmartLicenseSpec{
                ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName1"},
            },
        },
    }
})
filteredLicenses := filterLicensesByKind(licenses.Items, "Deployment", "deploymentName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
    Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "Deployment", Name: "deploymentName"},
    },
}}))
filteredLicenses = filterLicensesByKind(licenses.Items, "ReplicaSet", "replicaSetName")
Expect(filteredLicenses).Should(BeNil())
filteredLicenses = filterLicensesByKind(licenses.Items, "HorizontalPodAutoscaler", "hpaName")
Expect(filteredLicenses).Should(Equal([]v1.SmartLicense{ {
    Spec: v1.SmartLicenseSpec{
        ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "hpaName"},
    },
}}))
)

It("pendingLicenseExists", func() {
    licenses := []v1.SmartLicense{
    {
        Status: v1.SmartLicenseStatus{LicenseState: v1.InCompliance},
    },
    {
    },
    }

    Expect(pendingLicenseExists(licenses)).Should(BeFalse())
    licenses = append(licenses, v1.SmartLicense{ Status: v1.SmartLicenseStatus{LicenseState: v1.PendingLicenseState}, })

    Expect(pendingLicenseExists(licenses)).Should(BeTrue())
})

It("setLicenseLabel", func() {
    meta := metav1.ObjectMeta{ }
    res := setLicenseLabel(&meta, LicenseHolderLabel, true)
    Expect(res).Should(BeTrue())

    val, ok := meta.Labels[LicenseHolderLabel]
    Expect(ok).Should(BeTrue())
    Expect(val).Should(Equal("true"))

    res = setLicenseLabel(&meta, LicenseHolderLabel, true)
    Expect(res).Should(BeFalse())
})
Before getting into the details of licensing a cluster, familiarize yourself with the terminology and acronyms of licensing.

There are a lot of terms, use-cases and components involved for licensing that are out of scope of this document, however this section covers the essential terms and functionality that is supported from a cluster licensing perspective, and where possible calls out the functionalities that are not yet supported.

```
res = setLicenseLabel(&meta, LicenseHolderLabel, false)
Expect(res).Should(BeTrue())

_, ok = meta.Labels[LicenseHolderLabel]
Expect(ok).Should(BeFalse())
```
* To be able to scale up (or have both redirector and enforcer deployments at the same time) all services based on ASA, you have to create
a secret with the token above and the Smart License object, which will point to a service name (e.g. `sfcn-vpnredirector-enforcer`, `sfcn-enforcer`, etc)
and a service type (e.g. `Deployment` or `HorizontalPodAutoscaler`).

* Examples of the secret and the Smart License object are located
[here](../../license-broker/config/samples/sfcn.cisco.com_v1_smartlicense.yaml).

---

**Deployment Components**

Understanding the components of Cluster Licensing and their deployment to Kubernetes

resources:
- src: "**.{png,jpg}"  
title: "Image #:counter"

---

Licensing setup comprises two components - the License Server, and the License Controller.
References to Server and Controller in this document mean the License Server and License Controller.

1. User creates a Smart License resource and applies it to the Kubernetes API Server
2. Kubernetes API Server sends a notification to License Controller.
3. License Controller inspects the configuration in the Smart License resource
   1. (3a) License Controller uses the configuration in the Smart License resource to communicate with the License Server,
      which then talks to CSSM to reserve the licenses and responds back to the Controller
   2. (3b) License Controller updates the status of the Smart License resource and sends it to the Kubernetes API Server
4. The Manager in the Enforcer pod sends a request to the License Server for the number of cores it is using.
5. The License Server checks its pool to see if it has sufficient licenses to grant the request
   1. (5a) License Server approves the request and provides the requested licenses to the Manager, which then communicates
      this status to ASAc.
   2. (5b) License Server notifies the License Controller that a license has been granted to the pod running the Manager.

## Packaging

Licensing components are packaged in to two Kubernetes Deployment resources targeting different namespaces and
distributed
via Helm as part of the `sfcn-bundle` Helm chart

### License Broker

The License Broker is a Kubernetes Deployment comprising the Smart License CRD, Webhooks for mutation or validation, the License Controller and the License Server components.

{{% alert title="Note" color="primary" %}}
License Broker is set to be deployed once per Cluster and gets generated either during a full installation (single-tenant mode) or control plane installation (multi-tenant mode).
{{% /alert %}}

The License Broker also exposes a Service resource backed by the License Server Deployment that serves as the endpoint for license communication to pods in the same namespace needing the licenses, in case of kASA, it is the Enforcer pods.

### License Server

The License Server is a critical component responsible for getting the licenses from the Smart Account. Typically, the [Controller](#license-controller), sends a request to the License Server whenever a user posts a Smart License resource and periodically synchronizes with it on the status of the license.

The Server maintains the pool of licenses obtained from the Smart Account used for licensing the cluster and scales them based on the requests for those licenses. When the Server receives a request for a license from any pod, it finds out if the cluster namespace where the Server is running, is configured to obtain the licenses from a Smart Account and the criteria for it. If the Server holds sufficient licenses requested by the pod, the Server grants them to that pod and reserves as many licenses needed in the Smart Account. If it does not have sufficient licenses, the Server checks if it can request for more licenses from the Smart Account based on the configuration criteria, and if allowed, requests the pod to retry the operation and tries to reserve the necessary licenses from the Smart Account. When the Server successfully reserves them, it grants the needed licenses to the pod when it requests again. Similarly, whenever a pod releases the license it was granted either because it is killed by Kubernetes for some reason or is removed by user, the Server tries to release those licenses back to the Smart Account.
## License Controller

The License Controller is responsible for defining the Custom Resource Definition (CRD) for Smart License and processing the Smart License configuration posted to Kubernetes. The Controller is namespace insensitive and processes Smart License resources in any namespace.

Smart License CRD is a namespaced resource and licenses a specific Deployment or an HPA in that namespace. Each instance of the CRD initiates a connection to the Smart Account it represents. Typically, one Smart License resource is posted to a namespace to license one Deployment resource.

However, it is possible to use multiple Smart License resources to license the same Deployment/HPA. However, for kASA system there is only one license type and so having multiple Smart License resources to license the same Deployment/HPA means using different Virtual accounts in each resource. On the other hand, you can use the same Virtual account in multiple Smart License resources to license a different Deployment/HPA, you just need to make sure the Virtual account has sufficient licenses to meet the needs of all the referenced Deployment/HPA resources.

The Controller governs the use of licenses in its namespace and ensures the orphaned licenses are released back to the [License Server](#license-server). It should be noted that the Controller will remove pods that make unauthorized requests for licenses as part of its governance policy. The authorization for license is determined from the Smart License resources in the namespace of the Controller. See [Unauthorized Requests](#unauthorized-requests) for more information.

All actions taken by the Controller against a Smart License resource will be notified in the status of that resource or in the form of events on that resource.

### Licensing a Deployment or HPA

To license a Deployment or HPA in a namespace, ensure the License Controller is deployed to that namespace and post a Smart License resource in the same namespace.

Assuming the namespace is `cisco-systems`, a configuration of such a resource will be as follows

```
yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
```
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  # license type can be blank or not set explicitly to let the system use the default value
  # At present, there is only one license type for kASA, so this field is reserved for future use.
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
...

where the `tokenSecret` is a reference to a Secret resource for the specified name and namespace. It is constructed by obtaining a token from the [Virtual Account]({{< relref "terminology#smart-and-virtual-accounts">}}) and doing a base64 encoding of that text. This can be done from a shell as follows

```
```
  shell
  echo "your-token" | base64
```

And, use that content in the Secret as follows
```
```
  yaml
  apiVersion: v1
  kind: Secret
  metadata:
    name: cssm-token
    namespace: cisco-systems
  data:
    # this is a base64 encoded token from asac-dev virtual account of InternalTestDemoAccount8.cisco.com valid for 100 uses
    token:
      "TXpJMk1UVXhOV1V0Tm1Jd1ppMDBORFUzTFRnd09ETXRNamMyWm1JMVltWTBORGhtTFRFMk16YzBNamcyJTBBTVMk16QjhV5FE1U255VGNHbEpRMEZWU2paSk5FeDRZbHAxYnpkdGFHcGFZbIjQVDFGWFoyMURjR3h4JTBBVFUxVk9EMCUzRCUwQQ=="
```

The default license type for kASA is entitled to 1 vCPUs, so each instance of this entitlement in your virtual account is capable of licensing 1 vCPUs in your cluster. You should have at least as many entitlements in your virtual
account as you are expecting the number of vCPUs in your cluster namespace.

The example resource above is licensing the deployment named `sfcn-enforcer` in the namespace `cisco-systems`. The resource specified a `minLicenseCount` of 1 and a `maxLicenseCount` of 10 which enables the Controller to reserve a minimum of 1 license and upto 10 licenses in the virtual account from which the referenced token was obtained. Since the default kASA license type is entitled to have 1 vCPUs, this resource enables the pods of the referenced Deployment to request for upto 10 vCPUs.

Assuming the `sfcn-enforcer` deployment referenced here deploys pods that require 4 vCPUs each, this licensing configuration thus allows you to have a maximum of 2 replicas of that Deployment which results in the usage of 8 vCPUs.

Specifying more replicas in the Deployment/HPA than what is allowed by the license configuration results in the License Controller resetting the replica count on that Deployment/HPA to the allowed maximum as identified from the license configuration. In the example here, the Deployment replica count would be set to 2.

Using the `scalingRef#kind` as Deployment means the replicas are fixed, and the number of licenses reserved in your virtual account are predetermined. If your system is scalable based on some criteria you defined with an HPA then the number of replicas that need to be licensed keep changing at any point in time. The `minLicenseCount` and `maxLicenseCount` of the resource help to reserve licenses based on the demand of your HPA. When the cluster scales up to have more replicas, the license Server will reserve more licenses in the virtual account and when it scales down, it releases those licenses back to the account. Simply set the `scalingRef` to HPA kind with the name of that HPA to license the cluster namespace for scalability.

### Using the Scaling Factor

When using an HPA/Deployment as the licensed resource, it is possible that the License Server holds insufficient number of licenses in its pool to successfully grant them when a pod requests. In that case, the Server typically asks the pod to retry the operation after a specified time and uses that time to reserve more licenses in the Virtual account. By default, the `scalingFactor` on the Smart License resource is set to 1, meaning each time the Server attempts to scale up or down, it reserves or releases one license of the specified license type.

It is possible that despite scaling up, the Server might still be having an insufficient number of licenses and so may
ask the pod requesting for licenses to retry again. For instance, in the example above, if the number of vCPUs needed by the pod is assumed to be 4, then the Server needs to send the reservation quadruply to be able to have sufficient number in its pool.

Similarly, when scaling down, if a pod is removed, then the Server should have returned four licenses back to the virtual account but may not do so immediately, releasing one license at a time.

`scalingFactor` helps to reserve or release a higher number of licenses in each attempt. With the following configuration, the Server requests or releases 4 licenses in each attempt of scale up or scale down. It is recommended that you set this number to the number of vCPUs the enforcer pods will be using.

```yaml
apiVersion: sfcn.cisco.com/v1
kind: SmartLicense
metadata:
  name: sfcn-enforcer
  namespace: cisco-systems
spec:
  action: "REGISTER"
  tokenSecret:
    name: cssm-token
    namespace: cisco-systems
  licenseType: ""
  minLicenseCount: 1
  maxLicenseCount: 10
  # scaling factor of 4 implies the license reservations change in increments/decrements of 4
  scalingFactor: 4
  scalingRef:
    kind: Deployment
    name: sfcn-enforcer
```

### Unregistering the Cluster Namespace

Each Smart License resource posted to the Kubernetes API Server will show up as a Product instance on your Virtual Account in CSSM. To unregister a particular Smart License, you can either set the `action` to `UNREGISTER` or simply delete the Smart License resource.

Deleting the Smart License resource will not remove the resource immediately, instead the Controller initiates unregistration and on successfully unregistering from the virtual account, the Controller deletes the resource.
## The Manager

The Enforcer pods running the ASA include a Manager component in them that facilitates the deployment of configuration intended for that ASA. This Manager is also responsible for ensuring that ASA is licensed for the number of cores it uses.

### Core Calculation

The Manager tries to obtain its own Pod spec from Kubernetes API Server to calculate the vCPUs needed. It computes the required number of cores as the sum of CPU limits of all the containers in that Pod, rounded to the next integral value. If it does not find a CPU limit for any container in the Pod spec, it simply uses the number of cores of the Node where this Pod is running.

---

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  creationTimestamp: null
name: broker-role
rules:
- apiGroups:
  - apps
  resources:
  - deployments
```
verbs:
- get
- list
- update
- watch
- apiGroups:
  - apps
resources:
- replicasets
verbs:
- get
- list
- watch
- apiGroups:
- autoscaling
resources:
- horizontalpodautoscalers
verbs:
- get
- list
- update
- watch
- apiGroups:
  - ""
resources:
- pods
verbs:
- delete
- get
- list
- update
- watch
- apiGroups:
  - ""
resources:
- secrets
verbs:
- get
- list
- watch
- apiGroups:
- sfcn.cisco.com
resources:
- smartlicenses
verbs:
- create
- delete
- get
- list
- patch
- update
- watch
- apiGroups:
  - sfcn.cisco.com
resources:
- smartlicenses/status
verbs:
- get
- patch
- update
module css.cisco.com/kasa/license-broker

go 1.14

require ( css.cisco.com/kasa/pkg/predicates v0.0.0 css.cisco.com/licensing/client-agent v0.1.11 github.com/go-logr/logr v0.3.0 github.com/golang/mock v1.3.1 github.com/onsi/ginkgo v1.14.1 github.com/onsi/gomega v1.10.2 k8s.io/api v0.19.2 k8s.io/apimachinery v0.19.2 k8s.io/client-go v0.19.2 k8s.io/utils v0.0.0-20200912215256-4140de9c8800 sigs.k8s.io/controller-runtime v0.7.2 )

replace css.cisco.com/kasa/pkg/predicates v0.0.0 => ../pkg/predicates

apiVersion: v2
name: sfcn-license-api
description: "Helm Chart for License Broker of SFCN (Secure Firewall Cloud Native)"

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into versioned archives
# to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They're included as
# a dependency of application charts to inject those utilities and functions into the rendering
# pipeline. Library charts do not define any templates and therefore cannot be deployed.
type: application

# This is the chart version. This version number should be incremented each time you make changes
# to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
# This is the version number of the application being deployed. This version number should be
# incremented each time you make changes to the application. Versions are not expected to
# follow Semantic Versioning. They should reflect the version the application is using.
appVersion: 1.16.0

dependencies:
- name: aegis-common
  version: "0.1.0"
  repository: "file://../aegis-common"

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: AllotmentService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockAllotmentService is a mock of AllotmentService interface
type MockAllotmentService struct {
    ctrl     *gomock.Controller
    recorder *MockAllotmentServiceMockRecorder
}

// MockAllotmentServiceMockRecorder is the mock recorder for MockAllotmentService
type MockAllotmentServiceMockRecorder struct {
    mock *MockAllotmentService
}

// NewMockAllotmentService creates a new mock instance
func NewMockAllotmentService(ctrl *gomock.Controller) *MockAllotmentService {
    mock := &MockAllotmentService{ctrl: ctrl}
    mock.recorder = &MockAllotmentServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockAllotmentService) EXPECT() *MockAllotmentServiceMockRecorder {
    return m.recorder
}

// LeaseAllotment mocks base method
func (m *MockAllotmentService) LeaseAllotment(arg0 *proto.AllotmentRequest) (*proto.AllotmentRequestStatus, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "LeaseAllotment", arg0)
    ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// LeaseAllotment indicates an expected call of LeaseAllotment
func (mr *MockAllotmentServiceMockRecorder) LeaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "LeaseAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).LeaseAllotment), arg0)
}

// Register mocks base method
func (m *MockAllotmentService) Register(arg0 *proto.Tenant, arg1 service.AllotmentEventListener) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1)
    ret0, _ := ret[0].(error)
    return ret0
}

// Register indicates an expected call of Register
func (mr *MockAllotmentServiceMockRecorder) Register(arg0, arg1 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
        reflect.TypeOf((*MockAllotmentService)(nil).Register), arg0, arg1)
}

// ReleaseAllotment mocks base method
func (m *MockAllotmentService) ReleaseAllotment(arg0 *proto.AllotmentRelease) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "ReleaseAllotment", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// ReleaseAllotment indicates an expected call of ReleaseAllotment
func (mr *MockAllotmentServiceMockRecorder) ReleaseAllotment(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReleaseAllotment",
        reflect.TypeOf((*MockAllotmentService)(nil).ReleaseAllotment), arg0)
}

// ReportAllotment mocks base method
func (m *MockAllotmentService) ReportAllotment(arg0 *proto.AllotmentReport) error {

m.ctrl.T.Helper()
ret := m.ctrl.Call(m, "ReportAllotment", arg0)
ret0, _ := ret[0].(error)
return ret0

// ReportAllotment indicates an expected call of ReportAllotment
func (mr *MockAllotmentServiceMockRecorder) ReportAllotment(arg0 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "ReportAllotment",
reflect.TypeOf((*MockAllotmentService)(nil).ReportAllotment), arg0)
}

// Status mocks base method
func (m *MockAllotmentService) Status(arg0 *proto.Tenant) (*proto.AllotmentRequestStatus, error) {
  m.ctrl.T.Helper()
  ret := m.ctrl.Call(m, "Status", arg0)
  ret0, _ := ret[0].(*proto.AllotmentRequestStatus)
  ret1, _ := ret[1].(error)
  return ret0, ret1
}

// Status indicates an expected call of Status
func (mr *MockAllotmentServiceMockRecorder) Status(arg0 interface{}) *gomock.Call {
  mr.mock.ctrl.T.Helper()
  return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Status",
reflect.TypeOf((*MockAllotmentService)(nil).Status), arg0)
}

---
title: "Terminology"
weight: 1
description: >
  Terms and acronyms of Cisco Smart Licensing and their descriptions
---

### Cisco Smart Software Manager (CSSM)

Cisco Software Central often referred to as CSSM is a customer facing application that is used to manage the account needed for licensing a Cisco product and get insight on the consumption of the licenses.

You can access the production CSSM [here](https://software.cisco.com) and it should be the portal used for any licensing activity outside of Cisco. If you wish to explore CSSM for test purpose within Cisco, there is a staging environment that can be accessed [here](https://software-stage.cisco.com).

There is an [On-Prem version of Smart Software Manager](https://www.cisco.com/c/en/us/buy/smart-accounts/software-manager.html)
often referred to as **Satellite** that can run in a customer environment and can connect to CSSM. It must be registered with CSSM before it can be used as the manager for licensing the products. The Satellite can operate both in Connected and Disconnected modes which means the connectivity to CSSM from the Satellite could be up or down.

{{% alert title="Warning" color="warning" %}}
kASA Licensing currently supports only direct access to CSSM. The system is NOT tested for accessing CSSM from behind an HTTPs proxy or via Satellite, and the behavior is unknown; though, in theory, it may work.{{% /alert %}}

### Smart License

Smart License is the license(_noun_) that can be purchased from Cisco Commerce Workspace ([CCW](https://apps.cisco.com/Commerce/home)) to license(_verb_) a Cisco product.

Depending on the product family or type, a license purchased for one product may not work with another product. Unless otherwise stated, a license must be treated as unique to a product. Furthermore, licenses can be specific to features that can be used on a product, and in such cases, typically you will need a license type (often called base license) to license the product, and a type of license for each feature (often called feature license) to enable that feature on the product.

Whatever may be the license type, each such license has a unique identifier that can be referenced to purchase that license from CCW. This identifier is called a SKU (Stock Keeping Unit), pronounced _skew_. Internally, a SKU is often referenced as an _Entitlement_.

You can purchase smart licenses for test purposes on [staging CCW](https://ccw-cstg.cisco.com/Commerce/home) if you're testing your product licensing within Cisco using the [staging CSSM](https://software-stage.cisco.com).

### Smart and Virtual Accounts

A Smart Account is a facility that lets you manage the licenses of your Cisco products. Typically, you will have one Smart Account created for your organization and manage the licenses of all your Cisco products that support Smart Licensing in it.

Creation of a Smart Account requires approval from Cisco and can be created on CSSM. Every Smart Account has a unique identifier called the _Account Domain_ that you can reference to have the licenses you purchase on CCW credited.
The primary advantage of Smart Account is that the licenses are assigned to your Organization/Company for which this account was created and not to the product, that means you can move the licenses from one product to another of same type.

To simplify the license management within the organization, a Smart Account allows you to split the pool of licenses you purchase into what is called a **Virtual Account**. Virtual accounts are created and maintained by your administrator that manages your Smart Account. Typically, these virtual accounts reflect your organization departments or regions or other structure. You can delegate authority and access control on that Virtual account to a member in your organization.

The licenses that are added to your Smart Account usually are added to a Virtual Account that you tag as the default account.
You can move the licenses from one virtual account to another, thereby restricting the number of licenses your department owning the virtual account can use.

### Product Registration

Product registration or simply Registration is a process of licensing your Cisco product with the Smart License you purchased.
This process involves obtaining a _token_ from the virtual account that has the license you purchased. Typically, the products that you're licensing are aware of what kind of license they need and use only that license from the virtual account from which you obtained the token to register the product.

How to license your product depends on the product you're licensing and comes with the help documentation to do so. Once registered, you should be able to see the product details on CSSM under your Virtual Account.

### License Reservation

License Reservation or simply Reservation is a process of reserving the licenses in your Virtual account for use with the products that you wish to use in Air-Gap environment (no access to outside network or public internet). Typically, this process involves obtaining an authorization code from your Virtual Account in CSSM and then use that to license the product.
The reservation process requires connectivity to internet and only on successful reservation can you use the product in Air-Gap network.

There are two kinds of license reservation - the _Permanent License Reservation_ (PLR) and _Specific License Reservation_ (SLR).
PLR enables the use of all features on the product whereas SLR specifies the license types or entitlements that the product can use.

License reservation requires a special Smart Account authorization procedure and one must contact Cisco TAC (Technical Assistance Center) to get it done. It should be noted that having reservation capability in your Virtual account does not mean the product supports it. You should check the product documentation to verify the support for license reservation.

```plaintext
{{% alert title="Warning" color="warning" %}}
kASA licensing does not support License Reservation at present, and the plans to add it are not scoped yet.
{{% /alert %}}

### References

If you would like to learn more on Smart licensing capabilities, please reference the following documentation.

* [Cisco Internal: Engineering Licensing Office Guides](https://smartlicsolguide.cloudapps.cisco.com/website/index.html)
* [Cisco Internal: Smart Licensing Wiki](https://wiki.cisco.com/display/ELO/ELO+Home)

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package integ_tests

import (  
    "context"  
    v1 "css.cisco.com/kasa/license-broker/api/v1"  
    . "github.com/onsi/ginkgo"  
    . "github.com/onsi/gomega"  
    autoscalingv1 "k8s.io/api autoscaling/v1"  
    corev1 "k8s.io/api/core/v1"  
    metav1 "k8s.io/api/pim machinery/pkg/apis/meta/ v1"  
    "k8s.io/api/pim machinery/pkg/types"
    )

var _ = Describe("SmartLicense Webhook Test", func() {  
const defaultNamespace = "default"

var defaultCount uint32 = 1

var secret *corev1.Secret  
var hpa *autoscalingv1.HorizontalPodAutoscaler
BeforeEach(func() {
    secret = &corev1.Secret{
        Data: map[string][]byte{"token": []byte("MTIz")},
    }
    Expect(k8sClient.Create(context.TODO(), secret)).To(Succeed())
    hpa = &autoscalingv1.HorizontalPodAutoscaler{
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas: 3,
        },
    }
    Expect(k8sClient.Create(context.TODO(), hpa)).To(Succeed())
})

AfterEach(func() {
    Expect(k8sClient.Delete(context.TODO(), secret)).To(Succeed())
    Expect(k8sClient.Delete(context.TODO(), hpa)).To(Succeed())
})

Context("Mutating Webhook", func() {
    It("should fill in values on creation", func() {
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
            },
        }
        err := k8sClient.Create(testCtx, license)
        Expect(err).ShouldNot(HaveOccurred())
        err = k8sClient.Get(testCtx, types.NamespacedName{
            Namespace: defaultNamespace,
            Name: "foo",
        }, license)
        Expect(err).ShouldNot(HaveOccurred())
        Expect(license.Spec.Action).To(Equal(v1.Register))
        Expect(license.Spec.LicenseType).To(Equal(v1.SFWLicenceTag))
        Expect(license.Spec.MinLicenseCount).To(Equal(&defaultCount))
        Expect(license.Spec.MaxLicenseCount).To(Equal(&defaultCount))
        Expect(license.Spec.ScalingFactor).To(Equal(&defaultCount))
    })
})
Context("Validating Webhook", func() {

    It("should pass for valid object", func() {
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
            },
        }
        Expect(k8sClient.Create(context.TODO(), license)).ToNot(HaveOccurred())
    })

    It("has fields validations", func() {
        //given
        var zeroLicenses uint32 = 0
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
                MinLicenseCount: &zeroLicenses,
                MaxLicenseCount: &zeroLicenses,
            },
        }
        //when
        err := k8sClient.Create(testCtx, license)
        //then
        Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: [" + "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1]"))
    })

    It("should return error if max value is less then min value", func() {
        //given
        var minLicenses uint32 = 5
        var maxLicenses uint32 = 3
        license := &v1.SmartLicense{
            Spec: v1.SmartLicenseSpec{
                MinLicenseCount: &minLicenses,
                MaxLicenseCount: &maxLicenses,
            },
        }
        //when
        err := k8sClient.Create(testCtx, license)
        //then
        Expect(err).To(MatchError("admission webhook "vsmartlicense.kb.io" denied the request: [" + "spec.minLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.maxLicenseCount: Invalid value: 0x0: must be greater than or equal to 1, " + "spec.scalingFactor: Invalid value: 0x0: must be greater than or equal to 1]"))
    })
})
//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.maxLicenseCount: Invalid value: 0x3: maximum license count must be greater or equal then minimum license count"))
})

It("should return error when creating license with non-REGISTER action", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      Action: v1.Deregister,
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.action: Invalid value: 0x1: action must be REGISTER when creating a resource"))
})

It("should return error when secret does not exist", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret: Required value: token secret is not found"))
It("should return error when secret does not token key", func() {
  //given
  secret.Data = map[string][]byte{"wrongSecretKey": []byte("MTIz")}
  Expect(k8sClient.Update(context.TODO(), secret)).To(Succeed())
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.tokenSecret.data.token: Required value: cannot be empty"))
})

It("should return error when invalid scalingRef kind is specified", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
  }

  //when
  err := k8sClient.Create(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("spec.scalingRef.kind: Unsupported value: "Pod": supported values: Deployment, HorizontalPodAutoscaler"))
})

It("should return error when scalingRef does not exist", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
      ScalingRef: autoscalingv1.CrossVersionObjectReference{Kind: "HorizontalPodAutoscaler", Name: "non-existing-
//when
err := k8sClient.Create(context.TODO(), license)

//then
Expect(err).To(HaveOccurred())
Expect(err.Error()).Should(ContainSubstring("spec.scalingRef: Required value: referenced object is not found"))
}

It("should not allow changing licenseType after registration", func() {
  //given
  license := &v1.SmartLicense{
    Spec: v1.SmartLicenseSpec{
    },
    Status.RegistrationState = v1.Registered
  }

  Expect(k8sClient.Create(context.TODO(), license)).To(Succeed())
  license.Status.Update(context.TODO(), license).To(Succeed())

  //when
  license.Spec.LicenseType = "buzz"
  err := k8sClient.Update(context.TODO(), license)

  //then
  Expect(err).To(HaveOccurred())
  Expect(err.Error()).Should(ContainSubstring("Forbidden: not allowed to change licenseType when the platform is registered, deregister it first"))
})
})
})

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: broker-role-binding
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: broker-role

subjects:
- kind: ServiceAccount
  name: default
  namespace: system
package controllers_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
)

func TestControllers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controllers Suite")
}

var _ = BeforeSuite(func() {
    _ = v1.AddToScheme(scheme.Scheme)
})

package handlers_test

import (
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "k8s.io/client-go/kubernetes/scheme"
    "testing"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
)

func TestHandlers(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Controller handlers Suite")
}

var _ = BeforeSuite(func() {
    Expect(v1.AddToScheme(scheme.Scheme)).To(Succeed())
})

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package integ_tests

import ( "context"
func run(ctx context.Context, cfg *rest.Config, scheme *runtime.Scheme, options envtest.WebhookInstallOptions, done Done) error {
    ctrl.SetLogger(logr.FromContext(ctx))

    mgr, err := ctrl.NewManager(cfg, ctrl.Options{
        Scheme:             scheme,
        MetricsBindAddress: "localhost:8999",
        LeaderElection:     false,
        Port:               options.LocalServingPort,
        Host:               options.LocalServingHost,
        CertDir:            options.LocalServingCertDir,
    })
    if err != nil {
        return err
    }

    if err := (&v1.SmartLicense{}).SetupWebhookWithManager(mgr); err != nil {
        return err
    }

    close(done)
    if err := mgr.Start(ctx); err != nil {
        return err
    }
    return nil
}

package controllers_test

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    appsV1 "k8s.io/api/apps/v1"
    autoscalingV1 "k8s.io/api/autoscaling/v1"
const (
    epDeploymentName = "epDeployment"
    initialDeploymentReplicas int32 = 3
)

var _ = Describe("Deployment License Controller Test", func() {

deploymentNsName := types_NAMESPACEDNAME{Namespace: defaultNs, Name: epDeploymentName}
var (  
    reconciler *controllers_DeploymentLicenseReconciler
    fakeClient client.Client
    mockCtrl *gomock.Controller
    deployment *appsv1_Deployment
    smartLicense *v1_SmartLicense
    recorder *record.FakeRecorder
    replicasCalculatorMock *mocks.MockReplicasCalculator
)

BeforeEach(func() {
    mockCtrl = gomock.NewController(GinkgoT())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()
    recorder = record.NewFakeRecorder(1024)
    replicasCalculatorMock = mocks.NewMockReplicasCalculator(mockCtrl)
    reconciler = &controllers_DeploymentLicenseReconciler{
        Client: fakeClient,
        Log: logf.NullLogger{},
        Recorder: recorder,
        ReplicasCalculator: replicasCalculatorMock,
    }
    smartLicense = &v1_SmartLicense{
        ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
        Spec: v1_SmartLicenseSpec{
            Action: v1_Register,
            LicenseType: licenseType,
            MinLicenseCount: &minLicenseCount,
        }
    }
}

mockCtrl = gomock.NewController(GinkgoT())

MaxLicenseCount: &maxLicenseCount,
ScalingFactor: &scalingFactor,
Status: v1.SmartLicenseStatus{RegistrationState: v1.Registered},
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

replicas := initialDeploymentReplicas
deployment = &appsv1.Deployment{
  ObjectMeta: metav1.ObjectMeta{
    Name: epDeploymentName,
    Namespace: defaultNs,
    Annotations: map[string]string{
      controllers.InitialReplicasNumberAnnotation: strconv.Itoa(int(replicas)),
    },
  },
  Spec: appsv1.DeploymentSpec{
    Replicas: &replicas,
  },
}
Expect(fakeClient.Create(context.TODO(), deployment)).To(Succeed())

AfterEach(func() {
  Expect(fakeClient.DeleteAllOf(context.TODO(), &v1.SmartLicense{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &appsv1.Deployment{})).To(Succeed())
  Expect(fakeClient.DeleteAllOf(context.TODO(), &autoscalingv1.HorizontalPodAutoscaler{})).To(Succeed())
  mockCtrl.Finish()
})

It("should skip if Deployment does not exist", func() {
  Expect(fakeClient.Delete(context.TODO(), deployment)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())
})

It("should skip if Deployment SmartLicense does not exist", func() {
  Expect(fakeClient.Delete(context.TODO(), smartLicense)).To(Succeed())
  _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
  Expect(err).To(BeNil())
})

Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
It("should skip if SmartLicense is in deregistered state", func() {
    smartLicense.Status.RegistrationState = v1.Deregistered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
})

It("should skip if registered SmartLicense has enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(4), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
})

It("should reset Deployment Replicas if registered SmartLicense does not have enough licenses", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(2)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))

    Expect(recorder.Events).Should(HaveLen(2))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
    Expect(recorder.Events).Should(Receive(HavePrefix("Warning DeploymentScaledDown Decreased Deployment's
Replicas to 2")))
})

It("should an event if initial replica number annotation is incorrect", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
        gomock.Any()).Return(int32(2), nil)

    deployment.Annotations[controllers.InitialReplicasNumberAnnotation] = "hgfd"
Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
Expect(err).To(HaveOccurred())
Expect(recorder.Events).Should(HaveLen(1))
Expect(recorder.Events).Should(Receive(HavePrefix("Warning WrongInitialReplicasNumber sfcn.cisco.com/initial-
replicas-count label is not correct. Please, update it to correct number.")))
}

It("should reset Deployment Replicas to initial value after SmartLicense is applied", func() {
    *deployment.Spec.Replicas = 0
    Expect(fakeClient.Update(context.TODO(), deployment)).To(Succeed())

    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(25), nil)

    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    Expect(err).To(BeNil())

    Expect(fakeClient.Get(context.TODO(), deploymentNsName, deployment)).To(Succeed())
    Expect(*deployment.Spec.Replicas).Should(Equal(int32(3)))
    Expect(deployment.Labels).Should(HaveKeyWithValue(controllers.LicenseHolderLabel, "true"))
    Expect(recorder.Events).Should(HaveLen(1))
    Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
})

It("should send a warning if deployment controlled by HPA", func() {
    replicasCalculatorMock.EXPECT().CalculateMaxLicensedReplicas(gomock.Any(),
    gomock.Any()).Return(int32(4), nil)

    hpa := &autoscalingv1.HorizontalPodAutoscaler{
        ObjectMeta: metav1.ObjectMeta{Name: epHpaName, Namespace: defaultNs},
        Spec: autoscalingv1.HorizontalPodAutoscalerSpec{
            MaxReplicas:   initialHPAMaxReplicas,
        },
    }
    Expect(fakeClient.Create(context.TODO(), hpa)).To(Succeed())

    // err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: deploymentNsName})
    // Expect(err).To(BeNil())
    // Expect(recorder.Events).Should(HaveLen(2))
    // Expect(recorder.Events).Should(Receive(HavePrefix(fmt.Sprintf("Warning DeploymentControlledByHPA %s deployment is controlled by %s HPA. Please, update all smart license
resource to point to %s HPA", epDeploymentName, epHpaName, epHpaName)))
    // Expect(recorder.Events).Should(Receive(HavePrefix("Normal ScaledDeploymentToInitialReplicasNumber Scaled
Deployment to initial replicas number 3")))
})
package v1_test

import (
    v1 "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1"
    "cisco.com/kasa/operator/enforcementpoint/controller/kasa/v1/mocks"
    dispatcherMock "cisco.com/kasa/operator/enforcementpoint/dispatcher/mocks"
    "context"
    coreV1Client "css.cisco.com/kasa/pkg/client/core/v1"
    clientagent "css.cisco.com/licensing/client-agent"
    lca "css.cisco.com/licensing/client-agent"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/golang/mock/gomock"
    "github.com/onsi/ginkgo"
    "github.com/onsi/gomega"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/resource"
    metaV1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/runtime"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    "os"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/client/fake"
    logf "sigs.k8s.io/controller-runtime/pkg/log"
)

//go:generate mockgen -package=mocks -destination=./mocks/licensingclient.go css.cisco.com/licensing/client-agent LicensingClient
//go:generate mockgen -package=mocks -destination=./mocks/allotment.go css.cisco.com/licensing/client-agent AllotmentService

var _ = Describe("SmartLicense Controller Test", func() {

cost (podName = "sfcn-enforcer"
podNamespace = "sfcn-system"
nodeName = "aws-eks-node0"
)

tenant, podNamespacedName = &clientagent.Tenant{
    Name: podNamespace + "/" + podName,
    Attributes: map[string]string{
        "role": "license-requestor",
    }
})
newPod := func(name, namespace, nodeName string) *coreV1.Pod {
    return &coreV1.Pod{
        TypeMeta: metaV1.TypeMeta{
            Kind:    "Pod",
            APIVersion: "v1",
        },
        ObjectMeta: metaV1.ObjectMeta{
            Name:      name,
            Namespace: namespace,
            Labels:    tenant.Attributes,
        },
        Spec: coreV1.PodSpec{NodeName: nodeName, Containers: []coreV1.Container{
            {
                Name: "ep-container",
                Resources: coreV1.ResourceRequirements{
                    Limits: map[coreV1.ResourceName]resource.Quantity{
                        "cpu": resource.MustParse("2000m")
                    },
                }
            }
        }}
    }
}

newNode := func(name string) *coreV1.Node {
    return &coreV1.Node{
        TypeMeta: metaV1.TypeMeta{Kind: "Node", APIVersion: "v1"},
        ObjectMeta: metaV1.ObjectMeta{Name: name},
            "cpu": resource.MustParse("4")
        }}
    }
}

var (
    pod          *coreV1.Pod
    node         *coreV1.Node
    reconciler   *v1.SmartLicenseReconciler
    fakeClient   client.Client
    mockCtrl     *gomock.Controller
    licensingClient *mocks.MockLicensingClient
    allotmentService *mocks.MockAllotmentService
dispatcher       *dispatcherMock.MockGatewayClient
recorder         *record.FakeRecorder
)

resetRecorder := func() {
    recorder = record.NewFakeRecorder(1024)
    reconciler.Recorder = recorder
}

reconcileAndExpectFail := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred()) // failure is determined by requeue after duration
    Expect(result).To(Equal(ctrl.Result{RequeueAfter: v1.RetryDuration}))
}

reconcileAndExpectSuccess := func() {
    resetRecorder()
    result, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).ShouldNot(HaveOccurred())
    Expect(result).To(Equal(ctrl.Result{}))
}

recordedEvents := func() []string {
    close(recorder.Events)
    var events []string
    for event := range recorder.Events {
        events = append(events, event)
    }
    return events
}

lastRecordedEvent := func() string {
    events := recordedEvents()
    if len(events) == 0 {
        return ""
    }
    return events[0]
}

BeforeEach(func() {
    pod = newPod(podName, podNamespace, nodeName)
    node = newNode(nodeName)
    data := []client.Object{pod, node}
    mockCtrl = gomock.NewController(GinkgoT())
    scheme := runtime.NewScheme()
    Expect(coreV1.AddToScheme(scheme)).To(Succeed())
    fakeClient = fake.NewClientBuilder().WithScheme(scheme).WithObjects(data...).Build()
allotmentService = mocks.NewMockAllotmentService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
dispatcher = dispatcherMock.NewMockGatewayClient(mockCtrl)
recorder = record.NewFakeRecorder(1024)
reconciler = &v1.SmartLicenseReconciler{
    CoreClient: coreV1Client.New(fakeClient, context.Background),
    Licenser: licensingClient,
    Log: logf.NullLogger{},
    Recorder: recorder,
    Dispatcher: dispatcher,
}
licensingClient.EXPECT().Allotment().Return(allotmentService).AnyTimes()
}

It("should revoke ASAc license after failing multiple attempts of registration", func() {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(fmt.Errorf("test registration failure")).AnyTimes()
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    dispatcher.EXPECT().RevokeLicense().Times(1)
    numAttempts := 0
    for numAttempts < v1.MaxRetryAttempts {
        reconcileAndExpectFail()
        numAttempts += 1
        if numAttempts == 1 {
            // on the first attempt expect an event is recorded
            Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
        } else {
            Expect(lastRecordedEvent()).Should(BeEmpty())
        }
        reconcileAndExpectFail()
        Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because of license communication failure"))
    }
})

ItReconcileSuccessfullyWithExpectedNumberOfCores := func(numCores uint32) {
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil)
    allotmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
        PoolName: podNamespace,
        Tenant: tenant,
        NumCores: numCores, // this is the limit specified for the container
    })).Return(&clientagent.AllotmentRequestStatus{
        ContextId: "test-context",
        Tenant: tenant,
        NumCores: numCores,
    })
})
SmartAccountName: "test-domain",
VirtualAccountName: "test-account",
ExportControlled: true,
}

dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().GrantLicense(true)

reconcileAndExpectSuccess()
Expect(recordedEvents()).Should(ConsistOf(
  HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"),
  HavePrefix("Normal LicenseGranted successfully obtained a license from the server"),
  HavePrefix("Normal LicenseVerified ASA operating at full potential, license status verified"))
}

It("should verify the license status and request on successful registration", func() {
  ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
})

It("should request for the CPUs of the node if limits of container are not specified", func() {
    Name: "epc-container", // a container that does not specify a limit, should fallback to num CPUs of node
  })
  Expect(fakeClient.Update(context.TODO(), pod)).To(Succeed())
  ItReconcileSuccessfullyWithExpectedNumberOfCores(4)
})

It("should revoke ASAc license after successful registration but fails to get a lease", func() {
  allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
dispatcher.EXPECT().RevokeLicense().Times(1)
allocitmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, nil).AnyTimes()
allocitmentService.EXPECT().LeaseAllotment(gomock.Eq(&clientagent.AllotmentRequest{
  PoolName: podNamespace,
  Tenant: tenant,
  NumCores: 2, // this is the limit specified for the container
}).Return(nil, fmt.Errorf("test insufficient cores"))).AnyTimes()

numAttempts := 0
for numAttempts < v1.MaxRetryAttempts {
  reconcileAndExpectFail()
  numAttempts += 1
  if numAttempts == 1 {
    // on the first attempt expect an event is recorded
    Expect(lastRecordedEvent()).Should(HavePrefix("Warning AwaitingLicense ASA operating at full potential but not licensed"))
  } else {
    Expect(lastRecordedEvent()).Should(BeEmpty())
  }
}
reconcileAndExpectFail()
Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseCommunicationFailed ASA operating at reduced throughput because it failed to obtain a license"))

It("should revoke ASAc license when server requests to the release the allotment", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

dispatcher.EXPECT().RevokeLicense().Times(1)
allotmentService.EXPECT().ReleaseAllotment(gomock.Eq(&clientagent.AllotmentRelease{
    ContextId: "test-context",
    Tenant:    tenant,
})).Return(nil)

ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
resetRecorder()
reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
    ContextId: "test-context",
    Type:      proto.AllotmentEvent_RELEASE_ALLOTMENT,
    Message:   "testing release allotment request",
    Tenant:    tenant,
})).Return(nil)

Expect(lastRecordedEvent()).Should(HavePrefix("Warning LicenseRevoked ASA operating at reduced throughput because the server revoked its license"))

It("should report the allotment it holds when the server requests so", func() {
    _ = os.Setenv("POD_NAME", podName)
    _ = os.Setenv("POD_NAMESPACE", podNamespace)

    allotmentService.EXPECT().ReportAllotment(gomock.Eq(&clientagent.AllotmentReport{
        ContextId: "test-context",
        Tenant:    tenant,
        NumCores:  2,
    })).Return(nil)

    ItReconcileSuccessfullyWithExpectedNumberOfCores(2)
    resetRecorder()
    reconciler.OnAllotmentEvent(&clientagent.AllotmentEvent{
        ContextId: "test-context",
        Type:      proto.AllotmentEvent_REPORT_ALLOTMENT,
        Message:   "testing release allotment request",
        Tenant:    tenant,
    })}
Expect(lastRecordedEvent()).Should(BeEmpty())
}

It("should mark tenant as unregistered if license server is unavailable and retry again", func() {
    dispatcher.EXPECT().Show(v1.LicenseCmd).Return(v1.LicensedResponse, nil)
    allotmentService.EXPECT().Register(gomock.Eq(tenant), gomock.Eq(reconciler)).Return(nil)
    allotmentService.EXPECT().Status(gomock.Eq(tenant)).Return(nil, fmt.Errorf("some error occurs: %w", lca.ErrLicenseServerUnavailable))
    res, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: podNamespacedName})
    Expect(err).Should(BeNil())
    Expect(res).ShouldNot(BeNil())
    Expect(res.RequeueAfter).Should(Equal(v1.RetryDuration))
})

AfterEach(func() {
    mockCtrl.Finish()
})

package handlers

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    coreV1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/util/workqueue"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/event"
    "sigs.k8s.io/controller-runtime/pkg/handler"
)

//go:generate mockgen -package=mocks -destination=./mocks/mock_queue.go k8s.io/client-go/util/workqueue
RateLimitingInterface

var secretLog = ctrl.Log.WithName("handlers").WithName("Secrets")

func SecretHandler(c client.Client) handler.EventHandler {
    return handler.Funcs{
        UpdateFunc: func(evt event.UpdateEvent, q workqueue.RateLimitingInterface) {
            if secret, ok := evt.ObjectNew.(*coreV1.Secret); ok {
                licenseList := v1.SmartLicenseList{}
                err := c.List(context.TODO(), &licenseList)
                if err != nil {
                    secretLog.Error(err,
                        "failed to get SmartLicenses for %s tenant from k8s", secret.Namespace)
                } else {
                    c.Log().Info("SmartLicenses loaded")
                }
            }
        }
    }
}

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package controllers

import (  
    "context"  
    "css.cisco.com/kasa/license-broker/controllers/handlers"  
    "css.cisco.com/kasa/license-broker/controllers/listeners"  
    licensing "css.cisco.com/licensing/client-agent"  
    "errors"  
    "fmt"  
    "github.com/go-logr/logr"  
    apiErrors "k8s.io/apimachinery/pkg/api/errors"  
    "k8s.io/apimachinery/pkg/runtime"  
    "k8s.io/apimachinery/pkg/types"  
    "k8s.io/client-go/tools/record"  
    ctrl "sigs.k8s.io/controller-runtime"  
    "sigs.k8s.io/controller-runtime/pkg/builder"  
    "sigs.k8s.io/controller-runtime/pkg/client"  
    "sigs.k8s.io/controller-runtime/pkg/event"  
    "sigs.k8s.io/controller-runtime/pkg/handler"  
    corePredicate "sigs.k8s.io/controller-runtime/pkg/predicate"
const SFCNProductId = "SFW"

const (
    registrationReason   = "Registration"
    deregistrationReason = "Deregistration"
    FinalizerName        = "sfcn.cisco.com/license-degistration-finalizer"
)

// SmartLicenseReconciler reconciles a SmartLicense object
type SmartLicenseReconciler struct {
    Client            client.Client
    LicensingClient   licensing.LicensingClient
    Log               logr.Logger
    Recorder          record.EventRecorder
    Scheme            *runtime.Scheme
}

var oobChangeNotifier = make(chan event.GenericEvent)

func (r *SmartLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&v1.SmartLicense{}, builder.WithPredicates(&corePredicate.GenerationChangedPredicate{})).
        Watches(&source.Channel{Source: oobChangeNotifier}, &handler.EnqueueRequestForObject{}).
        Complete(r)
}

// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses,verbs=get;list;watch;create;update;patch;delete
// +kubebuilder:rbac:groups=sfcn.cisco.com,resources=smartlicenses/status,verbs=get;update;patch
// +kubebuilder:rbac:groups=core,resources=secrets,verbs=get;list;watch
// +kubebuilder:rbac:groups=core,resources=pods,verbs=get;list;watch;update;delete
// +kubebuilder:rbac:groups=apps,resources=deployments,verbs=get;list;watch;update
// +kubebuilder:rbac:groups=apps,resources=replicasets,verbs=get;list;watch
// +kubebuilder:rbac:groups=autoscaling,resources=horizontalpodautoscalers,verbs=get;list;watch;update

func (r *SmartLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := r.Log.WithValues("smartlicense", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()
var license v1.SmartLicense
if err := r.Client.Get(ctx, req.NamespacedName, &license); err != nil {
    if apiErrors.IsNotFound(err) {
        log.Info("SmartLicense does not exist, nothing to reconcile")
    }
    return ctrl.Result{}, client.IgnoreNotFound(err)
}

if license.ObjectMeta.DeletionTimestamp.IsZero() {
    if err := r.addFinalizerIfMissing(&license); err != nil {
        return ctrl.Result{}, err
    } else {
        // the license is being deleted, need to deregister it first
        return ctrl.Result{}, r.deregisterAndRemoveFinalizer(&license)
    }
}

switch license.Spec.Action {
  case v1.Register:
    err := r.registerPlatform(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, registrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to register the platform: %w", err)
    }
    err = r.scaleEntitlements(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, registrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to enable license scaling: %w", err)
    }
    if err = r.recordSuccessAndUpdateStatus(&license, registrationReason); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
    }
    return ctrl.Result{}, nil
  case v1.Deregister:
    err := r.deregisterPlatform(&license)
    if err != nil {
        r.recordFailureAndUpdateStatus(&license, deregistrationReason, err)
        return ctrl.Result{}, fmt.Errorf("failed to deregister the platform: %w", err)
    }
    if err = r.recordSuccessAndUpdateStatus(&license, deregistrationReason); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update SmartLicense status %w", err)
    }
}
return ctrl.Result{}, nil

default:
    // should not happen due to CRD validation, but not returning an error as subsequent reconciliations will not fix
    // the issue anyway
    'action' value")
    return ctrl.Result{}, nil

func (r *SmartLicenseReconciler) addFinalizerIfMissing(license *v1.SmartLicense) error {
    if !containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        license.SetFinalizers(append(license.ObjectMeta.Finalizers, FinalizerName))
        if err := r.Client.Update(context.Background(), license); err != nil {
            return err
        }
        r.licenseLogger(license).Info("added finalizer")
    }
    return nil
}

func (r *SmartLicenseReconciler) deregisterAndRemoveFinalizer(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)
    if containsString(license.ObjectMeta.Finalizers, FinalizerName) {
        if license.Status.RegistrationState == v1.Registered {
            if err := r.deregisterPlatform(license); err != nil {
                //TODO: return error and do not remove finalizer when corner cases are tested
                log.Error(err, "failed to deregisted the platform in CSSM, proceed with removing finalizer")
            } else {
                log.Info("removing finalizer without deregistration as platform is not registered")
            }
        } else {
            license.SetFinalizers(removeString(license.ObjectMeta.Finalizers, FinalizerName))
            if err := r.Client.Update(context.Background(), license); err != nil {
                return err
            }
            log.Info("removed finalizer")
        }
        return nil
    }

func (r *SmartLicenseReconciler) registerPlatform(license *v1.SmartLicense) error {
    licenseNsName := types.NamespacedName{Namespace: license.Namespace, Name: license.Name}
    log := r.licenseLogger(license)
    token, err := r.getToken(license)
    if err != nil {
return fmt.Errorf("failed to retrieve licensing token: %w", err)
}

log.Info("trying to register platform", "platformName", licenseNsName.String())
deregistrationListener := listeners.NewDeregistrationListener(licenseNsName, r.Client, ctrl.Log.WithName("listeners"), r.Recorder, oobChangeNotifier)
registration, err := r.LicensingClient.Registration().Register(&licensing.Platform{
  Uuid:         string(license.UID),
  Name:         licenseNsName.String(),
  SerialNumber: serialNumber(licenseNsName.String()),
  ProductId:    SFCNProductId,
  PoolName:     license.Namespace,
}, token, deregistrationListener)
if err != nil {
  license.Status.RegistrationState = v1.RegistrationFailed
  license.Status.LicenseState = v1.Unlicensed
  return fmt.Errorf("failed to complete registration call: %w", err)
}
log.Info("registered the platform in CSSM", "registrationInfo", registration)
license.Status.RegistrationState = v1.Registered
// we don’t want to change license state to Pending if a platform is already registered and a user just updates some field.
if !registration.IsRegistered {
  license.Status.LicenseState = v1.PendingLicenseState
}
license.Status.AccountDomain = registration.SmartAccountName
license.Status.AccountName = registration.VirtualAccountName
license.Status.ContextId = registration.ContextId
license.Status.ExportControlled = registration.ExportControlled
entitlementListener := &listeners.EntitlementListener{
  Log:       ctrl.Log.WithName("listeners"), r.Client,
  LicenseNsName: licenseNsName,
}
if err = r.LicensingClient.Entitlement().Notify(registration.ContextId, entitlementListener); err != nil {
  if errors.Is(err, licensing.ErrDuplicateListener) {
    log.Info("entitlement listener is already added", "contextId", registration.ContextId)
    return nil
  }
  return fmt.Errorf("failed to subscribe to entitlement notifications: %w", err)
}
log.Info("added entitlement listener", "contextId", registration.ContextId)
return nil

func (r *SmartLicenseReconciler) scaleEntitlements(license *v1.SmartLicense) error {
  if license.Status.RegistrationState != v1.Registered {
    return
return fmt.Errorf("platform must be registered before license reservation")
}
log := r.licenseLogger(license)

log.Info("trying to scale entitlements", "contextId", license.Status.ContextId)
err := r.LicensingClient.Entitlement().ScaleEntitlement(&licensing.EntitlementScalingRequest{
    ContextId:   license.Status.ContextId,
    EntitlementId: license.Spec.LicenseType,
    MinEntitlements:   *license.Spec.MinLicenseCount,
    MaxEntitlements:   *license.Spec.MaxLicenseCount,
    ScalingFactor:   *license.Spec.ScalingFactor,
})
if err != nil {
    return fmt.Errorf("failed to enable licensing scaling: %w", err)
}

log.Info("updated entitlement scaling limits", "contextId", license.Status.ContextId)
return nil
}

func (r *SmartLicenseReconciler) deregisterPlatform(license *v1.SmartLicense) error {
    log := r.licenseLogger(license)

    state := license.Status.RegistrationState
    if state == v1.Deregistered {
        log.Info("platform is already deregistered, skipping deregistration")
        return nil
    }

    err := r.LicensingClient.Registration().Deregister(license.Status.ContextId)
    if err != nil {
        license.Status.RegistrationState = v1.DeregistrationFailed
        return fmt.Errorf("failed to complete deregistration call: %w", err)
    }

    log.Info("deregistered the platform in CSSM", "contextId", license.Status.ContextId)
    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.EstimatedMaxReplicas = 0
    license.Status.CoresPerLicense = 0
    license.Status.LicenseNumber = 0
    return nil
}

func (r *SmartLicenseReconciler) getToken(license *v1.SmartLicense) (string, error) {
    secretNamespacedName := types.NamespacedName{
        Namespace: license.Spec.TokenSecret.Namespace,
        Name:      license.Spec.TokenSecret.Name,
    }
    return secretNamespacedName.String(), nil
}
var tokenSecret coreV1.Secret
if err := r.Client.Get(context.Background(), secretNamespacedName, &tokenSecret); err != nil {
    return "", fmt.Errorf("failed to get token secret: %w", err)
}
return string(tokenSecret.Data[v1.TokenKeyName]), nil
}

func (r *SmartLicenseReconciler) recordFailureAndUpdateStatus(license *v1.SmartLicense, reason string, err error) {
    r.Recorder.Event(license, coreV1.EventTypeWarning, reason,
                    fmt.Sprintf("Failed to update SmartLicense state. Error: %s", err.Error()))
    license.Status.ErrorReason = err.Error()
    if statusErr := r.Client.Status().Update(context.Background(), license); statusErr != nil {
        r.Log.Error(statusErr, "failed to update SmartLicense status")
    }
}

func (r *SmartLicenseReconciler) recordSuccessAndUpdateStatus(license *v1.SmartLicense, reason string) error {
    r.Recorder.Event(license, coreV1.EventTypeNormal, reason, "SmartLicense state updated.")
    license.Status.ErrorReason = ""
    if err := r.Client.Status().Update(context.Background(), license); err != nil {
        return err
    }
    return nil
}

func (r *SmartLicenseReconciler) licenseLogger(license *v1.SmartLicense) logr.Logger {
    return r.Log.WithValues("smartlicense", fmt.Sprintf("%s/%s", license.Namespace, license.Name))
}

package controllers_test

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers"
    "css.cisco.com/kasa/license-broker/controllers/mocks"
    licensing "css.cisco.com/licensing/client-agent"
    "fmt"
    "github.com/golang/mock/gomock"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    corev1 "k8s.io/api/core/v1"
    metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/client"
const (
    smartLicenseName = "license-sample"
    secretName      = "secret-sample"
    defaultNs       = "default"
    licenseType     = "L-ASA10S-STD"
    secretToken     = "MTIz"
)

var (minLicenseCount uint32 = 1
    maxLicenseCount uint32 = 5
    newMaxLicenseCount uint32 = 10
    scalingFactor    uint32 = 2)

var _, _ = Describe("SmartLicense Controller Test", func() {
    licenseNsName := types.NamespacedName{Namespace: defaultNs, Name: smartLicenseName}

    var reconciler *controllers.SmartLicenseReconciler
    var fakeClient client.Client
    var mockCtrl *gomock.Controller

    var licensingClient *mocks.MockLicensingClient
    var registrationService *mocks.MockRegistrationService
    var entitlementService *mocks.MockEntitlementService

    var (smartLicense *v1.SmartLicense
        secret    *corev1.Secret)

    BeforeEach(func() {
        mockCtrl = gomock.NewController(GinkgoT())
        fakeClient = fake.NewClientBuilder().WithScheme(scheme.Scheme).Build()

        registrationService = mocks.NewMockRegistrationService(mockCtrl)
entitlementService = mocks.NewMockEntitlementService(mockCtrl)
licensingClient = mocks.NewMockLicensingClient(mockCtrl)
reconciler = &controllers.SmartLicenseReconciler{
    Client:          fakeClient,
    LicensingClient: licensingClient,
    Log:             logf.NullLogger{},
    Recorder:        record.NewFakeRecorder(1024),
}
licensingClient.EXPECT().Registration().Return(registrationService).AnyTimes()
licensingClient.EXPECT().Entitlement().Return(entitlementService).AnyTimes()

secret = &corev1.Secret{
    ObjectMeta: metav1.ObjectMeta{Name: secretName, Namespace: defaultNs},
    Data:       map[string][]byte{"token": []byte(secretToken)},
}
Expect(fakeClient.Create(context.TODO(), secret)).To(Succeed())

smartLicense = &v1.SmartLicense{
    ObjectMeta: metav1.ObjectMeta{Name: smartLicenseName, Namespace: defaultNs},
    Spec: v1.SmartLicenseSpec{
        Action: v1.Register,
        TokenSecret: corev1.SecretReference{
            Name:      secretName,
            Namespace: defaultNs,
        },
        LicenseType:  licenseType,
        MinLicenseCount: &minLicenseCount,
        MaxLicenseCount: &maxLicenseCount,
        ScalingFactor: &scalingFactor,
    },
}
Expect(fakeClient.Create(context.TODO(), smartLicense)).To(Succeed())

AfterEach(func() {
    mockCtrl.Finish()
})

Context("platform registration", func() {
    It("should register platform in licensing system", func() {
        registrationService.EXPECT().Register(&licensing.Platform{
            Uuid:         string(smartLicense.UID),
            Name:         licenseNsName.String(),
            SerialNumber: "8B201B63BB8",
            ProductId:    controllers.SFCNProductId,
            PoolName:     defaultNs,
        }, secretToken, gomock.Any()).Return(&licensing.Registration{
ContextId: "testContextId",
SmartAccountName: "TestAccountName",
VirtualAccountName: "TestVirtualName",
ExportControlled: true,
IsRegistered: false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
ContextId:  "testContextId",
EntitlementId: licenseType,
MinEntitlements: minLicenseCount,
MaxEntitlements: maxLicenseCount,
ScalingFactor: scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
Expect(smartLicense.Status.AccountDomain).Should(Equal("TestAccountName"))
Expect(smartLicense.Status.AccountName).Should(Equal("TestVirtualName"))
Expect(smartLicense.Status.ExportControlled).Should(BeTrue())
Expect(smartLicense.Finalizers).Should(ContainElement(controllers.FinalizerName))
})

It("should ignore ErrDuplicateListener error", func() {
registrationService.EXPECT().Register(gomock.Any(), gomock.Any(),
gomock.Any()).Return(&licensing.Registration{
ContextId:  "testContextId",
IsRegistered: false,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(
fmt.Errorf("entitlement listener already exists: %w", licensing.ErrDuplicateListener))
entitlementService.EXPECT().ScaleEntitlement(gomock.Any()).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.RegistrationState).Should(Equal(v1.Registered))
Expect(smartLicense.Status.LicenseState).Should(Equal(v1.PendingLicenseState))
Expect(smartLicense.Status.ContextId).Should(Equal("testContextId"))
})
})
Context("platform deregistration", func() {
It("should deregister platform in licensing system", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.ContextId = "testContextId"
    smartLicense.Status.RegistrationState = v1.Registered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
}
}

It("should skip deregistration if platform is already deregistered", func() {
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    smartLicense.Status.RegistrationState = v1.Deregistered
    smartLicense.Status.ContextId = "testContextId"
    smartLicense.Status.RegistrationState = v1.Registered
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
}
}

It("should deregister platform on resource deletion", func() {
    smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
    now := metav1.Now()
    smartLicense.DeletionTimestamp = &now
    smartLicense.Status.RegistrationState = v1.Registered
    smartLicense.Status.ContextId = "testContextId"
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
}
}

It("should deregister platform on resource deletion", func() {
    smartLicense.Finalizers = append(smartLicense.Finalizers, controllers.FinalizerName)
    now := metav1.Now()
    smartLicense.DeletionTimestamp = &now
    smartLicense.Status.RegistrationState = v1.Registered
    smartLicense.Status.ContextId = "testContextId"
    Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())
    registrationService.EXPECT().Deregister("testContextId").Return(nil)
    _, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
    Expect(err).To(BeNil())
}
}

// cannot check finalizer removal due to a bug in fakeClient: https://github.com/kubernetes/client-go/issues/607
Context("smart license updating", func() {
It("license state should not be updated", func() {
Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
licenseStateBeforeUpdate := smartLicense.Status.LicenseState
smartLicense.Spec.MaxLicenseCount = &newMaxLicenseCount
Expect(fakeClient.Update(context.TODO(), smartLicense)).To(Succeed())

registrationService.EXPECT().Register(gomock.Any(), gomock.Any(), gomock.Any()).Return(&licensing.Registration{
ContextId:   "testContextId",
IsRegistered: true,
}, nil)
entitlementService.EXPECT().Notify("testContextId", gomock.Any()).Return(nil)
entitlementService.EXPECT().ScaleEntitlement(&licensing.EntitlementScalingRequest{
ContextId:   "testContextId",
EntitlementId: licenseType,
MinEntitlements: minLicenseCount,
MaxEntitlements: newMaxLicenseCount,
ScalingFactor: scalingFactor,
}).Return(nil)

_, err := reconciler.Reconcile(context.TODO(), ctrl.Request{NamespacedName: licenseNsName})
Expect(err).To(BeNil())

Expect(fakeClient.Get(context.TODO(), licenseNsName, smartLicense)).To(Succeed())
Expect(smartLicense.Status.LicenseState).Should(Equal(licenseStateBeforeUpdate))
})})
})}
package subscribers

import (licensing "css.cisco.com/licensing/client-agent"
"css.cisco.com/licensing/client-agent/proto"
"github.com/go-logr/logr"
coreV1 "k8s.io/api/core/v1"
metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"
"sigs.k8s.io/controller-runtime/pkg/apis/meta/v1"
"strings"
)

func NewSubscriptionListener(channel chan event.GenericEvent, log logr.Logger) *subscriptionListener {
return &subscriptionListener{
channel: channel,
type subscriptionListener struct {
    channel chan event.GenericEvent
    log     logr.Logger
}

func (l *subscriptionListener) OnRegistrationEvent(_ *licensing.RegistrationEvent) {
    // we are ignoring registration related events
}

func (l *subscriptionListener) OnEntitlementEvent(e *licensing.EntitlementEvent) {
    // we are ignoring entitlement events
}

func (l *subscriptionListener) OnAllotmentEvent(e *licensing.AllotmentEvent) {
    l.log.V(1).Info("received allotment event", "eventType", e.Type, "tenant", e.Tenant.Name)

    switch e.Type {
    case proto.AllotmentEvent_ALLOTMENT_GRANTED, proto.AllotmentEvent_ALLOTMENT_RELEASED, 
        proto.AllotmentEvent_ALLOTMENT_DENIED:
        l.log.V(1).Info("scheduling event for PodLicenseReconciler")
        l.sendEventToChannel(e.Tenant.Name)
    }
}

func (l *subscriptionListener) sendEventToChannel(tenantName string) {
    namespacedName := strings.Split(tenantName, "/")
        Name:      namespacedName[1],
        Namespace: namespacedName[0],
    }}
    l.channel <- event.GenericEvent{Object: pod}
}

package listeners

import (  
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/licensing/client-agent/proto"
    "fmt"
    "github.com/go-logr/logr"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
func NewDeregistrationListener(licenseNsName types.NamespacedName, client client.Client, log logr.Logger, recorder record.EventRecorder, notifierChannel chan event.GenericEvent) *deregistrationListener {
    return &deregistrationListener{
        log:             log,
        client:          client,
        licenseNsName:   licenseNsName,
        recorder:        recorder,
        notifierChannel: notifierChannel,
    }
}

const MaxRetries = 10

type deregistrationListener struct {
    log             logr.Logger
    client          client.Client
    licenseNsName   types.NamespacedName
    recorder        record.EventRecorder
    notifierChannel chan event.GenericEvent
    retries         int
}

// OnAutoDeregistration updates SmartLicense status to be in deregistered state.
// The method is called by License Server in response to out-of-band change that deregistered the platform in CSSM.
func (d *deregistrationListener) OnAutoDeregistration(platform *proto.Platform, msg string) {
    log := d.log.WithValues("smartlicense", d.licenseNsName)
    log.V(1).Info("received auto-deregistration event", "platform", platform.String(), "message", msg)
    if err := d.warnSmartLicenseDeregistered(msg); err != nil {
        if d.retries < MaxRetries {
            log.Error(err, "failed to process auto-deregistration event. retrying...")
            d.retries++
            time.Sleep(1 * time.Second)
            d.OnAutoDeregistration(platform, msg)
            return
        }
        log.Error(err, "failed to process auto-deregistration event")
        return
    }
    d.retries = 0
    log.V(1).Info("successfully processed auto-deregistration event")
}
func (d *deregistrationListener) warnSmartLicenseDeregistered(msg string) error {
    var license v1.SmartLicense
    if err := d.client.Get(context.Background(), d.licenseNsName, &license); err != nil {
        if errors.IsNotFound(err) {
            d.log.V(1).Info("skipping auto-deregistration event as SmartLicense CR does not exist anymore", "smartlicense", d.licenseNsName)
            return nil
        }
        return fmt.Errorf("failed to fetch SmartLicense CR: %w", err)
    }

    license.Status.RegistrationState = v1.Deregistered
    license.Status.LicenseState = v1.Unlicensed
    license.Status.LicenseNumber = 0
    license.Status.CoresPerLicense = 0
    license.Status.EstimatedMaxReplicas = 0

    if err := d.client.Status().Update(context.Background(), &license); err != nil {
        return fmt.Errorf("failed to update SmartLicense status: %w", err)
    }

    d.recorder.Event(&license, corev1.EventTypeWarning, "Deregistered", "Deregistered SmartLicense in response to out-of-band event from License Server.")
    d.notifierChannel <- event.GenericEvent{Object: &license}
    return nil
}

package controllers

import (
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "css.cisco.com/kasa/license-broker/controllers/handlers"
    "css.cisco.com/kasa/pkg/predicates"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    autoscalingv1 "k8s.io/api/autoscaling/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/apimachinery/pkg/types"
    "k8s.io/client-go/tools/record"
    ctrl "sigs.k8s.io/controller-runtime"
    "sigs.k8s.io/controller-runtime/pkg/builder"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "strconv"
open source used in kasa v1.5

```
//go:generate mockgen -package=mocks -destination=./mocks/replicascalculator.go . ReplicasCalculator

type ReplicasCalculator interface {
    CalculateMaxLicensedReplicas/licenses/[]v1.SmartLicense, deployment *appsv1.Deployment) (int32, error)
}

type DeploymentLicenseReconciler struct {
    client.Client
    Log                logr.Logger
    Recorder           record.EventRecorder
    ReplicasCalculator ReplicasCalculator
}

func (c *DeploymentLicenseReconciler) SetupWithManager(mgr ctrl.Manager) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&appsv1.Deployment{}, builder.WithPredicates(
            &predicates.LabelOrAnnotationExistPredicate{LabelKey: LicenseHolderLabel, AnnotationKey: InitialReplicasNumberAnnotation}).
        Watches(&source.Kind{Type: &v1.SmartLicense{}}, handlers.DeploymentHandler()).
        Complete(c)
}

// Reconcile reconciles Deployment specified in SmartLicense custom resource (CR) and resets its Replicas value
// when it exceeds the replicas allowed by licensing config.
func (c *DeploymentLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log := c.Log.WithValues("deployment", req.NamespacedName)
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()
    deployment := &appsv1.Deployment{
    if err != nil {
        if errors.IsNotFound(err) {
            log.Info("Deployment does not exist, nothing to reconcile")
        }
        return ctrl.Result{}, client.IgnoreNotFound(err)
    }
    licenseList := v1.SmartLicenseList{
        return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
    }
```
registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
deploymentLicenses := filterLicensesByKind(registeredLicenses, v1.DeploymentKind, deployment.Name)

labelsChanged := setLicenseLabel(&deployment.ObjectMeta, LicenseHolderLabel, len(deploymentLicenses) != 0)
if labelsChanged {
    if err = c.Client.Update(ctx, deployment); err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to update Deployment: %w", err)
    }
    log.Info("updated Deployment labels")
}

if len(deploymentLicenses) == 0 {
    log.Info("skipping Deployment reconciliation, no associated SmartLicense resources found")
    return ctrl.Result{}, nil
}

if pendingLicenseExists(deploymentLicenses) {
    log.Info("at least one smart license is in pending state")
    return ctrl.Result{}, nil
}

maxLicensedReplicas, err := c.ReplicasCalculator.CalculateMaxLicensedReplicas(deploymentLicenses, deployment)
if err != nil {
    return ctrl.Result{}, err
}

hpa, err := c.findHPAControlledDeployment(ctx, deployment)
if err != nil {
    log.Error(err, "can not find HPA controlled which is controlling deployment")
    return ctrl.Result{}, nil
}

if hpa != nil {
    log.Info("deployment is controlled by hpa", "hpaName", hpa.Name)
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentControlledByHPA",
    fmt.Sprintf("%s deployment is controlled by %s HPA. Please, update all smart license resource to point to %s
    HPA", deployment.Name, hpa.Name, hpa.Name))
}

if initialReplicasCount, ok := deployment.Annotations[InitialReplicasNumberAnnotation]; ok {
    initialReplicasCountInt, err := strconv.Atoi(initialReplicasCount)
    if err != nil {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "WrongInitialReplicasNumber",
        fmt.Sprintf("%s label is not correct. Please, update it to correct number.", InitialReplicasNumberAnnotation))
        return ctrl.Result{}, err
    }
}
log.Info("scaling deployment back to initial replicas count", "replicasNumber", initialReplicasCountInt)
*deployment.Spec.Replicas = int32(initialReplicasCountInt)
// delete initial replicas number from Deployment annotations to don't back to initial number on each reconciliation
delete(deployment.Annotations, InitialReplicasNumberAnnotation)
if err = c.Client.Update(context.Background(), deployment); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}

c.Recorder.Event(deployment, corev1.EventTypeNormal, "ScaledDeploymentToInitialReplicasNumber",
fmt.Sprintf("Scaled Deployment to initial replicas number %d", initialReplicasCountInt))

if *deployment.Spec.Replicas > maxLicensedReplicas {
    log.Info("scaling down deployment as system does not have enough deploymentLicenses", "currentReplicas",
*deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
*deployment.Spec.Replicas = maxLicensedReplicas
}
if err = c.Client.Update(context.Background(), deployment); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to update Deployment resource: %w", err)
}
c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
fmt.Sprintf("Decreased Deployment's Replicas to %d as it is the maximum replicas that could be granted a license. Please, check SmartLicense resource to increase the limit.", maxLicensedReplicas))
log.Info("successfully scaled down deployment to max license limit", "updatedReplicas",
*deployment.Spec.Replicas)
return ctrl.Result{}, nil
}

log.Info("skipping scaling, system has enough licenses to have all replicas running", "currentReplicas",
*deployment.Spec.Replicas, "maxLicensedReplicas", maxLicensedReplicas)
return ctrl.Result{}, nil
}

func (c *DeploymentLicenseReconciler) findHPAControlledDeployment(ctx context.Context, deployment
*appsv1.Deployment) (*autoscalingv1.HorizontalPodAutoscaler, error) {

hpaList := &autoscalingv1.HorizontalPodAutoscalerList{ }
if err != nil {
    return nil, err
}

for _, hpa := range hpaList.Items {
        return &hpa, err
    }
}
type PodLicenseReconciler struct {
    client.Client
    LicensingClient licensing.LicensingClient
    Log             logr.Logger
    Recorder        record.EventRecorder
}

func (c *PodLicenseReconciler) SetupWithManager(mgr ctrl.Manager, eventChannel chan event.GenericEvent) error {
    return ctrl.NewControllerManagedBy(mgr).
        For(&coreV1.Pod{}, builder.WithPredicates(&predicates.LabelExistsPredicate{Key: LicenseHolderLabel})).
        Watches(&source.Channel{Source: eventChannel}, &handler.EnqueueRequestForObject{}).
        Complete(c)
func (c *PodLicenseReconciler) Reconcile(ctx context.Context, req ctrl.Request) (ctrl.Result, error) {
    log.V(1).Info("reconciliation started")
    start := time.Now()
    defer func() {
        log.V(1).Info("reconciliation took", "ms", time.Since(start).Milliseconds())
    }()

    pod := coreV1.Pod{}
    podNsName := types.NamespacedName{Name: req.Name, Namespace: req.Namespace}
    err := c.Client.Get(ctx, podNsName, &pod)
    if err != nil {
        if apiErrors.IsNotFound(err) {
            log.Info("Pod does not exist, releasing allotments it might still hold")
            return ctrl.Result{}, c.releaseAllotmentsIfAny(&podNsName)
        }
        return ctrl.Result{}, fmt.Errorf("failed to fetch Pod: %w", err)
    }

    status, err := c.LicensingClient.Allotment().Status(toLicenseTenant(pod))
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    shouldHaveLicensingLabel := status != nil && status.NumCores != 0
    changed := setLicenseLabel(&pod.ObjectMeta, LicenseHolderLabel, shouldHaveLicensingLabel)
    if changed {
        if err = c.Client.Update(ctx, &pod); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to update Pod: %w", err)
        }
        log.Info("updated Pod labels")
    }

    deployment, err := c.findPodDeployment(&pod)
    if err != nil {
        return ctrl.Result{}, fmt.Errorf("failed to determine Pod's Deployment: %w", err)
    }

    if deployment == nil {
        log.Info("deleting orphan Pod as it requested license but does not belong to any Deployment")
        if err := c.Client.Delete(context.Background(), &pod); err != nil {
            return ctrl.Result{}, fmt.Errorf("failed to delete orphan pod: %w", err)
        }
    }
}

// Reconcile reconciles Pods that requested licenses, keeps them labeled with LicenseHolderLabel until they hold
// a license, and makes sure that only Pods belonging to Deployments with configured SmartLicense resource exist.
// On Pod removal, reconciler cleans up resources by releasing licenses that Pod held.

c.Recorder.Event(&pod, corev1.EventTypeWarning, "PodDeleted", fmt.Sprintf("Deleted Pod as it requested a license but does not belong to any Deployment. Please, check SmartLicense resources to update licensing configuration."))
log.Info("deleted orphan Pod")
return ctrl.Result{}, nil

licenseList := v1.SmartLicenseList{}
    return ctrl.Result{}, fmt.Errorf("failed to fetch SmartLicense list: %w", err)
}

registeredLicenses := filterLicensesByState(licenseList.Items, v1.Registered)
serviceRole := getDeploymentServiceRole(deployment)
if err := c.containsRegisteredLicencesForServiceRole(registeredLicenses, req.Namespace, serviceRole); err != nil {
    return ctrl.Result{}, fmt.Errorf("failed to evaluate if service role has registered licenses: %w", err)
}
if !serviceRoleIsRegistered {
    if err := c.restrictOneTrialReplicaPerServiceRole(deployment, req.NamespacedName); err != nil {
        return ctrl.Result{}, err
    }
}

if err := c.removeTrialLabelIfExists(deployment, req.NamespacedName); err != nil {
    return ctrl.Result{}, err
}
if err := c.throttleDeploymentIfNoLicense(deployment, registeredLicenses, req.NamespacedName); err != nil {
    return ctrl.Result{}, err
}

return ctrl.Result{}, nil

// releaseAllotmentsIfAny releases licensing allotments that Pod held in the licence-server
func (c *PodLicenseReconciler) releaseAllotmentsIfAny(nsName *types.NamespacedName) error {
    log := c.Log.WithValues("pod", nsName.String())

    tenant := &licensing.Tenant{Name: nsName.String()}
    status, err := c.LicensingClient.Allotment().Status(tenant)
    if err != nil {
        if errors.Is(err, licensing.ErrNotRegistered) {
            log.Info("Pod tenant is not registered in license server, nothing to release")
            return nil
        }
        return fmt.Errorf("failed to fetch allotment status of the pod: %w", err)
    }

    return nil
}
if status != nil && status.NumCores != 0 {
    log.Info("releasing allotments that Pod still holds", "numCores", status.NumCores)
    if err := c.LicensingClient.Allotment().ReleaseAllotment(&licensing.AllotmentRelease{
        ContextId: status.ContextId,
        Tenant:    tenant,
    }); err != nil {
        return fmt.Errorf("failed to release Pod allotments: %w", err)
    }
    log.Info("successfully released Pod allotments")
    return nil
}

log.Info("Pod does not hold any allotments, nothing to release")
return nil
}

func (c *PodLicenseReconciler) podLogger(pod *coreV1.Pod) logr.Logger {
}

func toLicenseTenant(pod coreV1.Pod) *licensing.Tenant {
    podNsName := types.NamespacedName{Name: pod.Name, Namespace: pod.Namespace}
    return &licensing.Tenant{Name: podNsName.String(), Attributes: pod.Labels}
}

// restrictOneTrialReplicaPerServiceRole makes sure that only one replica that requested license is running for each
// service role
// in unlicensed namespace. If more than 1 Replica/Deployment requiring a license is present, its Replica count is
// scaled down.
func (c *PodLicenseReconciler) restrictOneTrialReplicaPerServiceRole(deployment *appsv1.Deployment,
    reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    log.Info("no SmartLicense resources configured, allow 1 Deployment with 1 Replica for each service in the
    namespace")

    trialDeploymentList := appsv1.DeploymentList{
        labelSelector: := labels.NewSelector()
        trialLicenseHolderRequirement, err := labels.NewRequirement(TrialLicenseHolderLabel, selection.Equals,
            []string{"true"})
        if err == nil {
            labelSelector = labelSelector.Add(*trialLicenseHolderRequirement)
        }
        serviceRole := getDeploymentServiceRole(deployment)
        serviceLabelRequirement, err := labels.NewRequirement(ServiceRoleLabel, selection.Equals,
            []string{serviceRole})
        if err == nil {

labelSelector = labelSelector.Add(*serviceLabelRequirement)
}
if err := c.Client.List(context.Background(), &trialDeploymentList, &client.ListOptions{
    Namespace: deployment.Namespace,
    LabelSelector: labelSelector,
}); err != nil {
    return fmt.Errorf("failed to fetch Deployments with trial license label")
}
log.Info("Length of trial deployment list"); length, len(trialDeploymentList.Items))
var allowedReplicas int32 = 0
trialDeploymentIsAbsent := len(trialDeploymentList.Items) == 0
isDeploymentInTrial := len(trialDeploymentList.Items) == 1 && trialDeploymentList.Items[0].Name == deployment.Name
if trialDeploymentIsAbsent || isDeploymentInTrial {
    log.Info("Deployment has to be marked as trial license holder")
    allowedReplicas = 1
}

trialLabelUpdated := setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, allowedReplicas != 0)
if scaleDownRequired || trialLabelUpdated {
    initialReplicasNumber := strconv.Atoi(int32(*deployment.Spec.Replicas))
    log.Info("setting initial replicas count", "initialReplicasNumber", initialReplicasNumber)
    deployment.Annotations[InitialReplicasNumberAnnotation] = initialReplicasNumber
    deployment.Spec.Replicas = &allowedReplicas
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    if scaleDownRequired {
        c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown", "as only a single trial Pod requiring license is allowed to be running in unlicensed cluster. Please, configure cluster licensing by adding SmartLicense resource", allowedReplicas)
        log.Info("scaled Deployment", "replica count", allowedReplicas)
    }
    return nil
}

func (c *PodLicenseReconciler) throttleDeploymentIfNoLicense(deployment *appsv1.Deployment, licenseList []v1.SmartLicense, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    licensedDeploymentNames, err := c.getLicensedDeploymentNames(licenseList)
    if err != nil {
        return fmt.Errorf("failed to determine licensed deployment names: %w", err)
    }
    // throttleDeploymentIfNoLicense detects if deployment has a corresponding SmartLicense resource.
    // If deployment that does not have a corresponding SmartLicense configured, it is scaled down to 0 replicas.

if !containsString(licensedDeploymentNames, deployment.Name) {
    *deployment.Spec.Replicas = 0
    if err := c.Client.Update(context.Background(), deployment); err != nil {
        return fmt.Errorf("failed to update Deployment resource: %w", err)
    }
    c.Recorder.Event(deployment, corev1.EventTypeWarning, "DeploymentScaledDown",
    fmt.Sprintf("Decreased Deployment's Replicas to 0 "+ 
    "as it requested license but does not belong to any licensed EP deployment. "+ 
    "Please, check SmartLicense resources to update licensing configuration."))
    log.Info("scaled down Pod's Deployment to 0")
    return nil
}

log.Info("verified that Pod belongs to the licensed Deployment")
return nil
}

// removeTrialLabelIfExists removes trial license label if it exists and updates the Deployment.
func (c *PodLicenseReconciler) removeTrialLabelIfExists(deployment *appsv1.Deployment, reconciledName types.NamespacedName) error {
    log := c.Log.WithValues("pod", reconciledName.String())
    if setLicenseLabel(&deployment.ObjectMeta, TrialLicenseHolderLabel, false) {
        if err := c.Client.Update(context.Background(), deployment); err != nil {
            return fmt.Errorf("failed to update Deployment: %w", err)
        }
        log.Info("removed Deployment trial license label")
    }
    return nil
}

// getLicensedDeploymentNames collects names of all Deployments that have a corresponding SmartLicense resource.
func (c *PodLicenseReconciler) getLicensedDeploymentNames(licenseList []v1.SmartLicense) ([]string, error) {
    var deploymentNames []string
    for _, license := range licenseList {
        switch license.Spec.ScalingRef.Kind {
        case v1.DeploymentKind:
            deploymentNames = append(deploymentNames, license.Spec.ScalingRef.Name)
        case v1.HPAKind:
            hpa := &autoscalingv1.HorizontalPodAutoscaler{}
            hpaNsName := types.NamespacedName{Name: license.Spec.ScalingRef.Name, Namespace: license.Namespace}
            if err := c.Client.Get(context.Background(), hpaNsName, hpa); err != nil {
                return nil, fmt.Errorf("failed to fetch HPA %s defined in SmartLicense: %w", hpaNsName.String(), err)
            }
            deploymentNames = append(deploymentNames, hpa.Spec.ScaleTargetRef.Name)
        }
    }
    return deploymentNames, nil
}
default:
}
return deploymentNames, nil
}

// findPodDeployment tries to find Pod's Deployment if Pod is managed by Deployment.
// If Pod is not managed by Deployment controller, 'nil' is returned.
func (c *PodLicenseReconciler) findPodDeployment(pod *corev1.Pod) (*appsv1.Deployment, error) {
log := c.podLogger(pod)
if len(pod.OwnerReferences) != 1 || !*pod.OwnerReferences[0].Controller || pod.OwnerReferences[0].Kind != "ReplicaSet" {
log.Info("pod is not owned by ReplicaSet")
return nil, nil
}
replicaSetNsName := types.NamespacedName{Name: pod.OwnerReferences[0].Name, Namespace: pod.Namespace}
replicaSet := &appsv1.ReplicaSet{}
if err := c.Client.Get(context.Background(), replicaSetNsName, replicaSet); err != nil {
return nil, fmt.Errorf("failed to fetch ReplicaSet: %w", err)
}
if len(replicaSet.OwnerReferences) != 1 ||!*replicaSet.OwnerReferences[0].Controller || replicaSet.OwnerReferences[0].Kind != "Deployment" {
log.Info("pod's ReplicaSet is not owned by Deployment")
return nil, nil
}
deploymentNsName := types.NamespacedName{Name: replicaSet.OwnerReferences[0].Name, Namespace: pod.Namespace}
deployment := &appsv1.Deployment{}
if err := c.Client.Get(context.Background(), deploymentNsName, deployment); err != nil {
return nil, fmt.Errorf("failed to fetch Deployment: %w", err)
}
return deployment, nil
}

// containsRegisteredLicencesForServiceRole checks if there is a licensed deployment with serviceRole in
registeredLicenses. It grabs all deployment names registered by Deployment or HPA ref and checks if any of those have specified
service role label.
func (c *PodLicenseReconciler) containsRegisteredLicencesForServiceRole(registeredLicenses []v1.SmartLicense, namespace string, serviceRole string) (bool, error) {
licensedDeploymentNames, err := c.getLicensedDeploymentNames(registeredLicenses)
if err != nil {
return false, fmt.Errorf("failed to determine licensed deployment names: %w", err)
for _, deploymentName := range licensedDeploymentNames {
    deployment := &appsv1.Deployment{}
    deploymentNsName := types.NamespacedName{Name: deploymentName, Namespace: namespace}
    err := c.Client.Get(context.Background(), deploymentNsName, deployment)
    if err != nil {
        return false, fmt.Errorf("failed to fetch deployment %s: %w", deploymentNsName, err)
    }
    if getDeploymentServiceRole(deployment) == serviceRole {
        return true, nil
    }
}
return false, nil

func getDeploymentServiceRole(deployment *appsv1.Deployment) string {
    serviceRole, ok := deployment.Labels[ServiceRoleLabel]
    if !ok || serviceRole == "" {
        // if service role is not explicitly set assume default value
        serviceRole = DefaultServiceRole
    }
    return serviceRole
}

// Code generated by MockGen. DO NOT EDIT.
// Source: css.cisco.com/licensing/client-agent (interfaces: RegistrationService)

// Package mocks is a generated GoMock package.
package mocks

import (
    proto "css.cisco.com/licensing/client-agent/proto"
    service "css.cisco.com/licensing/client-agent/service"
    gomock "github.com/golang/mock/gomock"
    reflect "reflect"
)

// MockRegistrationService is a mock of RegistrationService interface
type MockRegistrationService struct {
    ctrl   *gomock.Controller
    recorder *MockRegistrationServiceMockRecorder
}

// MockRegistrationServiceMockRecorder is the mock recorder for MockRegistrationService
type MockRegistrationServiceMockRecorder struct {
    mock *MockRegistrationService
}

// NewMockRegistrationService creates a new mock instance
func NewMockRegistrationService(ctrl *gomock.Controller) *MockRegistrationService {
    mock := &MockRegistrationService{ctrl: ctrl}
    mock.recorder = &MockRegistrationServiceMockRecorder{mock}
    return mock
}

// EXPECT returns an object that allows the caller to indicate expected use
func (m *MockRegistrationService) EXPECT() *MockRegistrationServiceMockRecorder {
    return m.recorder
}

// Deregister mocks base method
func (m *MockRegistrationService) Deregister(arg0 string) error {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Deregister", arg0)
    ret0, _ := ret[0].(error)
    return ret0
}

// Deregister indicates an expected call of Deregister
func (mr *MockRegistrationServiceMockRecorder) Deregister(arg0 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Deregister",
        reflect.TypeOf((*MockRegistrationService)(nil).Deregister), arg0)
}

// Register mocks base method
func (m *MockRegistrationService) Register(arg0 *proto.Platform, arg1 string, arg2 service.DeregistrationListener) (*service.Registration, error) {
    m.ctrl.T.Helper()
    ret := m.ctrl.Call(m, "Register", arg0, arg1, arg2)
    ret0, _ := ret[0].(*service.Registration)
    ret1, _ := ret[1].(error)
    return ret0, ret1
}

// Register indicates an expected call of Register
func (mr *MockRegistrationServiceMockRecorder) Register(arg0, arg1, arg2 interface{}) *gomock.Call {
    mr.mock.ctrl.T.Helper()
    return mr.mock.ctrl.RecordCallWithMethodType(mr.mock, "Register",
        reflect.TypeOf((*MockRegistrationService)(nil).Register), arg0, arg1, arg2)
}

val crdOpts = "crd:trivialVersions=true"
val controllerGen = "controller-gen"
val getRegistrylessTaggedImage: (String) -> String by extra
val getTaggedImage: (String) -> String by extra
val getPublicTaggedImage: (String) -> String by extra
val createPublicTaggedImage: (String, String) -> String by extra
val execCommand: (String) -> String by extra
val execHelmCommand: (String) -> String by extra
val execCommands: (List<String>) -> Unit by extra
val createRegistrySecret: (String) -> String by extra
val promoteImage: (String, String, String, String, String) -> Unit by extra

val imageNameForPush = getTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPush = getTaggedImage(project.findProperty("licenseServerImageName") as String)
val imageNameForPull = getPublicTaggedImage(project.findProperty("imageName") as String)
val serverImageNameForPull = getPublicTaggedImage(project.findProperty("licenseServerImageName") as String)
val systemNamespace: String = project.findProperty("systemNamespace")!! as String
var clusterName = project.findProperty("clusterName")

fun createTaggedImage(imageName: String): String {
    val imageValues = imageName.split(":")
    return createPublicTaggedImage(imageValues[0], imageValues[1])
}

ext {
    set("publishImages", listOf(
        project.findProperty("imageName") as String,
        project.findProperty("licenseServerImageName") as String
    ))
}

tasks {

    named("build") {
        dependsOn("generate")
        doLast {
            execCommand("go build -o bin/manager main.go")
        }
    }

    named("dockerBuild") {
        doLast {
            exec {
                environment("DOCKER_BUILDKIT", 1)
                commandLine("docker build -f ./Dockerfile -t $imageNameForPush ../".split(" "))
            }
            val artifactoryUser = project.findProperty("artifactoryUser")!! as String
            val artifactoryApiKey = project.findProperty("artifactoryApiKey")!! as String
            val saArtifactoryUrl = project.findProperty("saArtifactoryUrl")!! as String
            val saServerArtifactVersion = project.findProperty("saServerArtifactVersion")!! as String
            val downloadUrl = "$saArtifactoryUrl/com/cisco/css/sl/sa-server/$saServerArtifactVersion/sa-server" + 
                            "-$saServerArtifactVersion-all.jar"
            if (!file("${projectDir}/bin/sa-server-$saServerArtifactVersion-all.jar").exists()) {
                exec {
setWorkingDir("bin")

commandLine = listOf(
    "bash", "-c",
    "curl -f -u artifactoryUser:artifactoryApiKey -O $downloadUrl"
)

exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))

    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}

exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}

exec {
    environment("DOCKER_BUILDKIT", 1)
    commandLine("docker build -f ./server.Dockerfile -t $serverImageNameForPush ../".split(" "))
}

named("promoteImage") {
    val licenseServerImageName: String? by project
    onlyIf {
        licenseServerImageName != null
    }
    doLast {
        val sourceTag: String? by project
        val sourceRepo: String? by project
        val imageTag: String? by project
        if (sourceTag == null || sourceRepo == null || imageTag == null) {
            val msg = "One or more mandatory sourceTag/sourceRepo/imageTag parameters are missing. Please, specify them with: -PsouceTag=<srcImageTag> -PsoureRepo=<sourceRepoName> -PimageTag=<targetImageTag>"
            logger.error(msg)
            throw GradleException(msg)
        }

        val targetRepo = project.findProperty("artifactoryDockerRepoName")!! as String
        val imName = getRegistrylessTaggedImage(licenseServerImageName!!).split(':')[0]
        promoteImage(imName, sourceRepo!!, sourceTag!!, targetRepo, imageTag!!)
    }
}

named("check") {
    doLast {
        execCommands(listOf(
            "go fmt ./...",
            "go vet ./...",
        ))
    }
}

named("test") {
    doLast {
        execCommands(listOf(
            "go fmt ./...",
            "go vet ./...",
        ))
    }
}
execCommands(listOf(
    "go test -coverpkg=./... -coverprofile cover.out ./...",
    "go tool cover -func=cover.out -o ${project.name}-cover.txt"
))

val licenseServerImageName: String? by project
onlyIf {
    licenseServerImageName != null
}
doLast {
    println(execCommand("docker push $serverImageNameForPush"))
}

manifests() {
    dependsOn("controller-gen")
description = "Generates manifests for k8s deployment using Helm"
doLast {
    execHelmCommand("helm dependency update")
    val stdOut = execHelmCommand("helm template ${project.findProperty("helmReleaseName")} \--namespace ${systemNamespace} \--set nameOverride=licenseapi")
    buildDir.deleteRecursively()
    buildDir.mkdir()
    File("$buildDir/license-broker.yaml").writeText(stdOut)
}

generateValuesFile() {
    expand(
        "platform" to project.findProperty("platform")!!,
        "registry" to project.findProperty("dockerRegistry")!!,
        "artifactoryRepo" to project.findProperty("imageDirectory")!!,
        "controllerImage" to getRegistrylessTaggedImage(project.findProperty("imageName")!! as String),
        "licenseServerImage" to getRegistrylessTaggedImage(project.findProperty("licenseServerImageName")!! as String),
        "defaultImagePullPolicy" to project.findProperty("imagePullPolicy")!!,
        "logLevel" to project.findProperty("logLevel")!!,
        "logFormat" to project.findProperty("logFormat")!!,
        "licenseServerTransportUrl" to project.findProperty("licenseServerTransportUrl")!!
    )
}

generateControllerGenFiles() {

}
dependsOn("controller-gen")
doLast {
    execCommand("$controllerGen ScrdOpts rbac:roleName=broker-role webhook paths=./...
output:crd:artifacts:config=config/crd")
}

register("generate") {
    dependsOn("controller-gen")
    description = "Executes code generators"
    doLast {
        execCommand("$controllerGen object:headerFile=./hack/boilerplate.go.txt paths=./...")
    }
}

register("uninstall") {
    description = "Removes k8s objects from the active cluster"
    dependsOn("manifests")
    doLast {
        exec {
            isIgnoreExitValue = true
            commandLine("kubectl delete -f $buildDir".split(" "))
        }
    }
}

named("deploy") {
    dependsOn(":installCertManager")
    dependsOn("manifests")
    doLast {
        exec {
            commandLine("kubectl apply -f $buildDir".split(" "))
        }
        createRegistrySecret(systemNamespace)
    }
}

named("loadImagesToKind") {
    doLast {
        val clusterName: String by project
        execCommand("docker tag $serverImageNameForPush $serverImageNameForPull")
        execCommand("kind load docker-image $serverImageNameForPull --name $clusterName")
        execCommand("docker tag $imageNameForPush $imageNameForPull")
        execCommand("kind load docker-image $imageNameForPull --name $clusterName")
    }
}
Please review the EULA agreement and set the flag `--set global.acceptEULA=[yes, or agree]` for acknowledgement.

Cisco End User License Agreement

package integ_tests

import (  
    "context"
    "css.cisco.com/kasa/license-broker/api/v1"
    . "github.com/onsi/ginkgo"
    . "github.com/onsi/gomega"
    "k8s.io/apimachinery/pkg/api/errors"
    "k8s.io/client-go/kubernetes/scheme"
    "k8s.io/client-go/rest"
    "path/filepath"
    "sigs.k8s.io/controller-runtime/pkg/client"
    "sigs.k8s.io/controller-runtime/pkg/envtest"
    "sigs.k8s.io/controller-runtime/pkg/envtest/printer"
    "sigs.k8s.io/controller-runtime/pkg/log/zap"
    "strings"
    "testing"
    "time"

    logf "sigs.k8s.io/controller-runtime/pkg/log"
)  

var cfg *rest.Config
var k8sClient client.Client
var testEnv *envtest.Environment
var testCtx, cancelCtx = context.WithCancel(context.Background())

func TestHook(t *testing.T) {  
    RegisterFailHandler(Fail)
    SetDefaultEventuallyTimeout(time.Minute)
    RunSpecsWithDefaultAndCustomReporters(t, "Webhook Integration Suite", []Reporter{printer.NewlineReporter{}})
}

var _ = BeforeSuite(func(done Done) {  
    logf.SetLogger(zap.New(zap.UseDevMode(true), zap.WriteTo(GinkgoWriter)))
    By("bootstrapping test environment")
    apiServerFlags := envtest.DefaultKubeAPIServerFlags[0 : len(envtest.DefaultKubeAPIServerFlags)-1]
    apiServerFlags = append(apiServerFlags, "--enable-admission-plugins=MutatingAdmissionWebhook,ValidatingAdmissionWebhook")
    testEnv = &envtest.Environment{
        WebhookInstallOptions: envtest.WebhookInstallOptions{  

    }}
package v1

Paths: []string{filepath.Join("..", "config", "webhook")},
,
CRDDirectoryPaths: []string{filepath.Join("..", "config", "crd")},
KubeAPIServerFlags: apiServerFlags,
ControlPlaneStartTimeout: 100 * time.Second,
ControlPlaneStopTimeout: 100 * time.Second,

var err error
cfg, err = testEnv.Start()
Expect(err).ToNot(HaveOccurred())
Expect(cfg).ToNot(BeNil())

er = v1.AddToScheme(scheme.Scheme)
Expect(err).NotTo(HaveOccurred())

k8sClient, err = client.New(cfg, client.Options{Scheme: scheme.Scheme})
Expect(err).ToNot(HaveOccurred())
Expect(k8sClient).ToNot(BeNil())

By("running webhook server")
go run(testCtx, cfg, scheme.Scheme, testEnv.WebhookInstallOptions, done)
}, envtest.StartTimeout)

var _ = AfterSuite(func(done Done) {
By("tearing down the test environment")
cancelCtx()
Expect(testEnv.Stop()).ToNot(HaveOccurred())

close(done)
}, envtest.StopTimeout)

func errCauses(err error) []string {
var causes []string
if statusError, ok := err.(*errors.StatusError); ok {
for _, cause := range statusError.Status().Details.Causes {
    causes = append(causes, strings.Split(cause.Message, ": ")[2])
}
}
return causes
}

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**************************************************************/

package v1
import (  
  autoscalingv1 "k8s.io/api/autoscaling/v1"  
  v1 "k8s.io/api/core/v1"  
  metav1 "k8s.io/apimachinery/pkg/apis/meta/v1"  
  
)

const TokenKeyName = "token"

type RegistrationAction string

const (  
  Register RegistrationAction = "REGISTER"  
  Deregister RegistrationAction = "DEREGISTER"  
  
)

// SmartLicenseSpec defines the desired state of SmartLicense  
type SmartLicenseSpec struct {  
  // Action is the desired state of the Smart Agent license registration.  
  // +kubebuilder:validation:Enum=REGISTER;DEREGISTER  
  // +optional  
  Action RegistrationAction `json:"action"`

  // TokenSecret is a reference to a Secret that holds `token` for Cisco Software Central authentication.  
  // The default value is a SFW license tag being able to handle 1vCPU.  
  // +optional  
  TokenSecret v1.SecretReference `json:"tokenSecret"

  // LicenseType defines the type of license to request/release, usually the SKU of the license.  
  // The default value is a SFW license tag being able to handle 1vCPU.  
  // +optional  
  LicenseType string `json:"licenseType"

  // MinLicenseCount is a minimum number of licenses SFCN reserves for the product.  
  // The default value is 1.  
  // +optional  
  MinLicenseCount *uint32 `json:"minLicenseCount,omitempty"

  // MaxLicenseCount is an optional value, the maximum number of licenses SFCN can reserve for the product.  
  // The default value is equal to MinLicenseCount.  
  // +optional  
  MaxLicenseCount *uint32 `json:"maxLicenseCount,omitempty"

  // ScalingFactor is a factor to increment or decrement the number of licenses SFCN reserves for the product when scaling up or down.  
  // The default value is 1.  
  // +optional  
  ScalingFactor *uint32 `json:"scalingFactor,omitempty"
// ScalingRef is a reference to the scaled resource managing Enforcement Point pods. Deployment and HPA resources are supported.
ScalingRef autoscalingv1.CrossVersionObjectReference `json:"scalingRef,omitempty"
}

type LicenseState string

const (  
PendingLicenseState LicenseState = "PENDING"
Unlicensed           LicenseState = "UNLICENSED"
InCompliance         LicenseState = "IN_COMPLIANCE"
OutOfCompliance     LicenseState = "OUT_OF_COMPLIANCE"
Overage              LicenseState = "OVERAGE"
)

const (  
DeploymentKind = "Deployment"
HPAKind       = "HorizontalPodAutoscaler"
)

type RegistrationState string

const (  
PendingRegistrationState RegistrationState = "PENDING"
Registered          RegistrationState = "REGISTERED"
RegistrationFailed RegistrationState = "REGISTRATION_FAILED"
Deregistered       RegistrationState = "DEREGISTERED"
DeregistrationFailed RegistrationState = "DEREGISTRATION_FAILED"
)

// SmartLicenseStatus defines the observed state of SmartLicense

type SmartLicenseStatus struct {

// AccountDomain is the account domain in Cisco Software Central.
AccountDomain string `json:"accountDomain,omitempty"

// AccountName is the name of the virtual account in Cisco Software Central.
AccountName string `json:"accountName,omitempty"

// RegistrationState is the registration status of the SFCN product in Cisco Software Central.
//+kubebuilder:validation:Enum=PENDING;REGISTERED;REGISTRATION_FAILED;DEREGISTERED;DEREGISTRATION_FAILED
RegistrationState RegistrationState `json:"registrationState,omitempty"

// LicenseState is the state of the reserved licenses.
//+kubebuilder:validation:Enum=PENDING;UNLICENSED;IN_COMPLIANCE;OUT_OF_COMPLIANCE;OVERAGE
LicenseState LicenseState `json:"licenseState,omitempty"
// ErrorReason specifies the error due to which the SFCN product was not registered in Cisco Software Central.
ErrorReason string `json:"errorReason, omitempty"

// LicenseNumber is the amount of licenses SFCN has registered for the product at particular time.
LicenseNumber uint32 `json:"licenseNumber, omitempty"

// CoresPerLicense is number of cores per one requested LicenseType.
CoresPerLicense uint32 `json:"coresPerLicense, omitempty"

// EstimatedMaxReplicas is maximum count of ep pod replicas. It is calculated based on MaxLicenseCount and CoresPerLicense.
EstimatedMaxReplicas int32 `json:"estimatedMaxReplicas, omitempty"

// ExportControlled is a flag indicating whether the export-controlled functionality was enabled while generating the token on Cisco Software Central. If true, this indicates a Strong Encryption (3DES/AES) license.
ExportControlled bool `json:"exportControlled, omitempty"

// ContextId is an internal identifier uniquely defining platform registration.
ContextId string `json:"contextId, omitempty"

// +kubebuilder:object:root=true
// +kubebuilder:subresource:status
// +kubebuilder:printcolumn:name="Age", type=date, JSONPath=".metadata.creationTimestamp"
// +kubebuilder:printcolumn:name="Registration State", type=string, JSONPath=".status.registrationState"
// +kubebuilder:printcolumn:name="License State", type=string, JSONPath=".status.licenseState"
// +kubebuilder:printcolumn:name="License Number", type=integer, JSONPath=".status.licenseNumber"
// +kubebuilder:printcolumn:name="Domain", type=string, priority=1, JSONPath=".status.accountDomain"
// +kubebuilder:printcolumn:name="Account", type=string, priority=1, JSONPath=".status.accountName"

// SmartLicense is the Schema for the smartlicenses API
type SmartLicense struct {
    metav1.TypeMeta `json:"", inline"
    metav1.ObjectMeta `json:"metadata, omitempty"

    Spec SmartLicenseSpec `json:"spec, omitempty"
    Status SmartLicenseStatus `json:"status, omitempty"

    // +kubebuilder:object:root=true
    // SmartLicenseList contains a list of SmartLicense
type SmartLicenseList struct {
        metav1.TypeMeta `json:"", inline"
        metav1.ListMeta `json:"metadata, omitempty"
        Items []SmartLicense `json:"items"
    }
func init() {
    SchemeBuilder.Register(&SmartLicense{}, &SmartLicenseList{})
}

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***************************************************************/

// Package v1 contains API Schema definitions for the sfcn.cisco.com v1 API group
// +kubebuilder:object:generate=true
// +groupName=sfcn.cisco.com
package v1

import (
    "k8s.io/apimachinerypkg/runtime/schema"
    "sigs.k8s.io/controller-runtime/pkg/scheme"
)

var (
    // GroupVersion is group version used to register these objects
)

// SchemeBuilder is used to add go types to the GroupVersionKind scheme
SchemeBuilder = &scheme.Builder{GroupVersion: GroupVersion}

// AddToScheme adds the types in this group-version to the given scheme.
AddToScheme = SchemeBuilder.AddToScheme
)

domain: sfcn.cisco.com
repo: css.cisco.com/kasa/license-broker
resources:
- group: sfcn.cisco.com
  kind: SmartLicense
  version: v1
  version: "2"
package controllers

import (
    "crypto/md5"
    "fmt"
)

v1 "css.cisco.com/kasa/license-broker/api/v1"
metav1 "k8s.io/apimachinerypkg/apis/meta/v1"
)

const (
LicenseHolderLabel = "sfcn.cisco.com/license-holder"
TrialLicenseHolderLabel = "sfcn.cisco.com/trial-license-holder"
ServiceRoleLabel = "sfcn.cisco.com/service-role"
// DefaultServiceRole is assumed when ServiceRoleLabel is not explicitly set
DefaultServiceRole = "default"
InitialReplicasNumberAnnotation = "sfcn.cisco.com/initial-replicas-count"

// serialNumber generates platform's Serial Number for SmartLicense resource.
// According to CSSM, it should consist of 11 upper-case alphanumerical characters.
func serialNumber(licenseNsName string) string {
    return fmt.Sprintf("%X", md5.Sum([]byte(licenseNsName))[0:11])
}

func containsString(slice []string, s string) bool {
    for _, item := range slice {
        if item == s {
            return true
        }
    }
    return false
}

func removeString(slice []string, s string) (result []string) {
    for _, item := range slice {
        if item == s {
            continue
        }
        result = append(result, item)
    }
    return
}

// filterLicensesByState filters SmartLicenses by registration state.
func filterLicensesByState(licenseList []v1.SmartLicense, state v1.RegistrationState) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Status.RegistrationState == state {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}

// filterLicensesByKind filters SmartLicenses by given kind and name properties of ScalingRef field and returns the result.
func filterLicensesByKind(licenseList []v1.SmartLicense, kind string, name string) []v1.SmartLicense {
    var filteredLicenses []v1.SmartLicense
    for _, license := range licenseList {
        if license.Status.RegistrationState == state {
            filteredLicenses = append(filteredLicenses, license)
        }
    }
    return filteredLicenses
}
for _, license := range licenseList {
    if license.Spec.ScalingRef.Kind == kind && license.Spec.ScalingRef.Name == name {
        filteredLicenses = append(filteredLicenses, license)
    }
}

return filteredLicenses

// pendingLicenseExists returns true if any license in the list is in Pending state.
func pendingLicenseExists(licenses []v1.SmartLicense) bool {
    for _, license := range licenses {
        if license.Status.LicenseState == v1.PendingLicenseState {
            return true
        }
    }
    return false
}

// setLicenseLabel makes sure that the licensing label is present when `shouldBePresent` is `true`
// and that the label is absent when `shouldBePresent` is `false`.
func setLicenseLabel(meta *metav1.ObjectMeta, label string, shouldBePresent bool) bool {
    if _, ok := meta.Labels[label]; !ok && shouldBePresent {
        if meta.Labels == nil {
            meta.Labels = make(map[string]string)
        }
        meta.Labels[label] = "true"
        return true
    }
    if _, ok := meta.Labels[label]; ok && !shouldBePresent {
        delete(meta.Labels, label)
        return true
    }
    return false
}

package services

import {
    "context"
    v1 "css.cisco.com/kasa/license-broker/api/v1"
    "fmt"
    "github.com/go-logr/logr"
    appsv1 "k8s.io/api/apps/v1"
    corev1 "k8s.io/api/core/v1"
    "k8s.io/api/machinery/pkg/api/resource"
    metav1 "k8s.io/api/machinery/pkg/apis/meta/v1"
    "k8s.io/api/machinery/pkg/types"
    return &ReplicasCalculator{client, logger}
}

type ReplicasCalculator struct {
    client.Client
    Log logr.Logger
}

// CalculateMaxLicensedReplicas calculates how many cores are needed for one pod managed by deployment and calculates maximum amount of replicas based on licensing.
// If no registered SmartLicenses are found, defaults to 1 replica.
func (r *ReplicasCalculator) CalculateMaxLicensedReplicas(licenses []v1.SmartLicense, deployment *appsv1.Deployment) (int32, error) {
    ctx := context.Background()
    var maxLimit int32
    coresQuantity := r.getCoresQuantity(deployment)
    if coresQuantity == 0 && deployment.Status.ReadyReplicas == 0 {
        r.Log.Info("can not calculate estimated maximum replicas count based on node CPU limit without running pods", "deployment", deployment.Name)
        // it can be a scenario when we have spec.Replicas = 5, but Status.ReadyReplicas = 0. So, we just return desired replicas by a user.
        return *deployment.Spec.Replicas, nil
    }
    var err error
    if coresQuantity == 0 && deployment.Status.ReadyReplicas != 0 {
        coresQuantity, err = r.getNodeCPULimit(deployment.Spec.Selector)
        if err != nil {
            return 0, fmt.Errorf("failed to calculate node's CPU limit: %w", err)
        }
    }
    r.Log.Info("calculated count of cores for deployment", "deployment", deployment.Name, "countOfCores", coresQuantity)
    for _, license := range licenses {
        if license.Status.LicenseState == v1.InCompliance {
            maxLicensedCores := int(*license.Spec.MaxLicenseCount) * int(license.Status.CoresPerLicense)
            maxLicensedReplicas := int32(maxLicensedCores / int(coresQuantity))
            r.Log.Info("calculated max licensed replicas", "maxLicensedReplicas", maxLicensedReplicas)
            maxLimit += maxLicensedReplicas
            license.Status.EstimatedMaxReplicas = maxLicensedReplicas
        }
    }
    return maxLimit, nil
}
if err := r.Client.Status().Update(ctx, &license); err != nil {
    return 0, fmt.Errorf("failed to update SmartLicense status: %w", err)
}

// keep at least 1 replica running even if there is no licenses
return int32(math.Max(float64(maxLimit), 1)), nil

func (r *ReplicasCalculator) getCoresQuantity(deployment *apps_v1.Deployment) uint32 {
    coresQuantity := resource.MustParse("0")
        containerLimit := *container.Resources.Limits.Cpu()
        if containerLimit.Value() == 0 {
            r.Log.Info("one or more containers in deployment has no CPU limit specified", "deployment", deployment.Name)
            return 0
        }
        coresQuantity.Add(containerLimit)
    }
    return uint32(coresQuantity.Value())
}

func (r *ReplicasCalculator) getNodeCPULimit(deploymentSelector *metav1.LabelSelector) (uint32, error) {
    ctx := context.Background()
    podSelector, err := metav1.LabelSelectorAsSelector(deploymentSelector)
    if err != nil {
        return 0, fmt.Errorf("failed to construct Pod selector based on Deployment: %w", err)
    }
    pods := core_v1.PodList{}
    if err := r.Client.List(ctx, &pods, &client.ListOptions{LabelSelector: podSelector}); err != nil {
        return 0, fmt.Errorf("failed to fetch Deployment's Pods: %w", err)
    }

    // TODO: do not rely on the fact that all nodes have the same CPU limit
    pod := pods.Items[0]
    nodeNsName := types.NamespacedName{Name: pod.Spec.NodeName}
    if err := r.Client.Get(ctx, nodeNsName, &node); err != nil {
        return 0, fmt.Errorf("failed to fetch Node where %s pod is running: %w", pod.Name, err)
    }

    r.Log.Info("calculate CPU limit of node", "nodeName", pod.Spec.NodeName, "nodeCPULimit", nodeCPULimit)
return nodeCPUlimit, nil

1.489 j2objc-annotations 1.3

1.490 collections v0.0.0-20130729185459-604e922904d3

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1.491 google-api-go-client 0.19.0

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Alain Vongsouvanhalainv <alainv@google.com>
Andrew Gerrand <adg@golang.org>
Brad Fitzpatrick <bradfitz@golang.org>
Eric Koleda <ekoleda+devrel@googlers.com>
Francesc Campoy <campoy@golang.org>
Garrick Evans <garrick@google.com>
Glenn Lewis <gmlewis@google.com>
Ivan Krasin <krasin@golang.org>
Jason Hall <jasonhall@google.com>
Johan Euphrosine <jroddy@noc.com>
Kostik Shtoyk <kostik@google.com>
Kunpei Sakai <namusyaka@gmail.com>
Matthew Dolan <dolan@lightstep.com>
Matthew Whisenhunt <matt.whisenhunt@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Nick Craig-Wood <nickcw@gmail.com>
Robbie Trencheny <me@robbiet.us>
Ross Light <light@google.com>
Sarah Adams <shadams@google.com>
Scott Van Woudenber <scottvw@google.com>
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package api

import (  
  "bytes"  
  "io/ioutil"  
  "os"  
  "path/filepath"  
  "regexp"  
  "testing"  
)

const prefix = "// Copyright"

// Files in this package use a BSD-style license.
var sentinel = regexp.MustCompile(`(//|#) Copyright \d\d\d\d (Google LLC|The Go Authors)\(\\)\*( All rights reserved\)\)*  
(//|#) Use of this source code is governed by a BSD-style  
(//|#) license that can be found in the LICENSE file.  
`)

// A few files have to be skipped.
var skip = map[string]bool{  
  "tools.go": true, // This file requires another comment above the license.  
  "internal/third_party/uritemplates/uritemplates.go": true, // This file is licensed to an individual.  
  "internal/third_party/uritemplates/uritemplates_test.go": true, // This file is licensed to an individual.  
}

// This test validates that all go files in the repo start with an appropriate license.
func TestLicense(t *testing.T) {  
  err := filepath.Walk(".", func(path string, fi os.FileInfo, err error) error {    
    if skip[path] {      
      return nil    
    }

    if err != nil {      
      return err    
    }
  })  
}

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if filepath.Ext(path) != ".go" && filepath.Ext(path) != ".sh" {
    return nil
}

src, err := ioutil.ReadFile(path)
if err != nil {
    return nil
}

// Verify that the license is matched.
if !sentinel.Match(src) {
    t.Errorf("%v: license header not present", path)
    return nil
}

// Also check it is at the top of .go files (but not .sh files, because they must have a shebang first).
if filepath.Ext(path) == ".go" && !bytes.HasPrefix(src, []byte(prefix)) {
    t.Errorf("%v: license header not at the top", path)
}
return nil
}

if err != nil {
    t.Fatal(err)
}

---

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Jan Merc1 <0xjnml@gmail.com>
Jonathan Swinney <jswinney@amazon.com>
Kai Backman <kaib@golang.org>
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Rodolfo Carvalho <rhcarvalho@gmail.com>
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1.495 cyrus-sasl 2.1.27+dfsg-1+deb10u1

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Julian Seward, jseward@acm.org
bzip2/libbzip2 version 1.0.8 of 13 July 2019

1.498 netty-handler 4.1.61.Final
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* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/PseudoRandomFunction.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/address/DynamicAddressConnectHandler.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/util/X509KeyManagerWrapper.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/OpenSslPrivateKeyMethod.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/util/KeyManagerFactoryWrapper.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/util/KeyManagerFactoryWrapper.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/util/KeyManagerFactoryWrapper.java
jar/io/netty/handler/ssl/SslMasterKeyHandler.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/address/package-info.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/util/TrustManagerFactoryWrapper.java

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* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslPrivateKey.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslKeyMaterial.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslTlsv13X509ExtendedTrustManager.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslCachingX509KeyManagerFactory.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslCachingKeyMaterialProvider.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslKeyMaterialProvider.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/DefaultOpenSslKeyMaterial.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/ExtendedOpenSslSession.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslX509TrustManagerWrapper.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
jar/io/netty/handler/ssl/OpenSslX509KeyManagerFactory.java
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  jar/io/netty/handler/ssl/ConscryptAlpnSslEngine.java
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  jar/io/netty/handler/ssl/OptionalSslHandler.java
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  jar/io/netty/handler/ssl/SslCompletionEvent.java
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  jar/io/netty/handler/ssl/Conscrypt.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/o CSP/package-info.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/JdkAlpnSslEngine.java
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  jar/io/netty/handler/ssl/SniCompletionEvent.java
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  jar/io/netty/handler/ssl/OcspClientHandler.java
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* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/FlushConsolidationHandler.java
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* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ipcp/EthernetPacket.java
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* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-jar/io/netty/handler/ssl/util/BouncyCastleSelfSignedCertGenerator.java
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jar/io/netty/handler/ipfilter/IpFilterRuleType.java
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  jar/io/netty/handler/ssl/OpenSslEngineMap.java
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* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/ApplicationProtocolUtil.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/JdkBaseApplicationProtocolNegotiator.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/JettyAlpnSslEngine.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/SupportedCipherSuiteFilter.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/JdkAlpnApplicationProtocolNegotiator.java

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  jar/io/netty/handler/ssl/ApplicationProtocolNegotiationHandler.java
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  jar/io/netty/handler/ssl/SSlContextBuilder.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/ApplicationProtocolAccessor.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/ApplicationProtocolNames.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/OpenSslSessionTicketKey.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/sftp/LazyJavaX509Certificate.java
* /opt/cola/permits/1153055926_1618392534.86/0/netty-handler-4-1-61-final-sources-
  jar/io/netty/handler/ssl/ClientAuth.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ForwardingSortedSet.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/graph/GraphConnections.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources.jar/com/google/common/collect/HashMultimapGwtSerializationDependencies.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources.jar/com/google/common/graph/GraphConstants.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources.jar/com/google/common/collect/LinkedHashMultimapGwtSerializationDependencies.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources.jar/com/google/common/graph/StandardValueGraph.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources.jar/com/google/common/graph/ForwardingGraph.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources.jar/com/google/common/graph/StandardMutableNetwork.java
jar/com/google/common/graph/MutableValueGraph.java
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jar/com/google/common/graph/AbstractValueGraph.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/cache/RemovalListener.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/AtomicLongMap.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/reflection/Invokable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/reflection/Parameter.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/io/FileWriteMode.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/math/PairedStatsAccumulator.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/io/ByteSource.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/reflection/MutableTypeToInstanceMap.java
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 */

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 *
 * As of 2010/06/11, this method is identical to the (package private) hash method in OpenJDK 7's
 * java.util.HashMap class.
 */

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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/JdkPattern.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/CommonMatcher.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/CommonPattern.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/ForwardingListMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/RowSortedTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/UnmodifiableListIterator.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/UnmodifiableListMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/AbstractSequentialIterator.java

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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/RowSortedTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/UnmodifiableListIterator.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/UnmodifiableListMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/AbstractSequentialIterator.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/ForwardingImmutableCollection.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/SortedMapDifference.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/ForwardingSortedSetMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/RegularImmutableTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/MapMakerInternalMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/cache/LocalCache.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/AbstractService.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/SignedBytes.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/DenseImmutableTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/ForwardingFluentFuture.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/cache/CacheBuilder.java

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* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/UnsignedBytes.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/Platform.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/ForwardingListenableFuture.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/SettableFuture.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/io/LineProcessor.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/net/InternetDomainName.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/escape/ArrayBasedEscaperMap.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/Cut.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/escape/ArrayBasedUnicodeEscaper.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/common/cache/ReferenceEntry.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/AbstractIdleService.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/SparseImmutableTable.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/AbstractExecutionThreadService.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/io/ByteArrayDataOutput.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/reflect/TypeResolver.java
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* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/html/HtmlEscapers.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/escape/ArrayBasedCharEscaper.java
* /opt/cola/permissions/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/common/collect/MapMaker.java
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 */

/**
* Holder for web specializations of methods of [@code Floats]. Intended to be empty for regular
* version.
*/

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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/graph/AbstractBaseGraph.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/ObjectCountHashMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/graph/Traverser.java

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*/
/**
 * Returns an array containing all of the elements in the specified collection. This method
 * returns the elements in the order they are returned by the collection's iterator. The returned
 * array is "safe" in that no references to it are maintained by the collection. The caller is
 * thus free to modify the returned array.
 * 
 * <p>This method assumes that the collection size doesn't change while the method is running.
 * 
 * <p>TODO(kevinb): support concurrently modified collections?
 * 
 * @param c the collection for which to return an array of elements
 */

Found in path(s):
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/ObjectArrays.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/ImmutableClassToInstanceMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ComparisonChain.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ImmutableSortedMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ImmutableAsList.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/SingletonImmutableTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/EmptyImmutableSetMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/AbstractIndexedListIterator.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/RegularImmutableSortedSet.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ImmutableTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/RegularImmutableList.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ForwardingTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ComputationException.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collection/ImmutableSetMultimap.java

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  jar/com/google/common/util/concurrent/TrustedListenableFutureTask.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/eventbus/Subscriber.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/math/Quantiles.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/base/MoreObjects.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/util/concurrent/ListenerCallQueue.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/eventbus/Dispatcher.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/eventbus/SubscriberRegistry.java

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  jar/com/google/common/graph/package-info.java
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/**
 * Holder for web specializations of methods of {@code Ints}. Intended to be empty for regular
 * version.
 */

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*/

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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/reflect/TypeVisitor.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/collect/AbstractTable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/eventbus/SubscriberExceptionHandler.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/WrappingScheduledExecutorService.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/eventbus/SubscriberExceptionContext.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/thirdparty/publicsuffix/PublicSuffixType.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/cache/LongAdder.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/AtomicDoubleArray.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/hash/Striped64.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/hash/LongAdder.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/hash/Java8Compatibility.java
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 */

/*
 * Outer class that exists solely to let us write [ @code Partially.GwtIncompatible] instead of plain
 * [ @code GwtIncompatible]. This is more accurate for [ @link Futures#catching], which is available
 * under GWT but with a slightly different signature.
 *
 * <p>We can't use [ @code PartiallyGwtIncompatible] because then the GWT compiler wouldn't recognize
 * it as a [ @code GwtIncompatible] annotation. And for [ @code Futures.catching], we need the GWT
 * compiler to autostrip the normal server method in order to expose the special, inherited GWT
 * version.
 */

Found in path(s):
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/Partially.java
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  jar/com/google/common/collection/CompactHashMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/TransformedIterator.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/ForwardingNavigableSet.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/CompactHashSet.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/CompactLinkedHashMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/ForwardingDeque.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/EvictingQueue.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/FilteredMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/FilteredKeyListMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/ForwardingBlockingDeque.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/TreeRangeMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/ImmutableEnumMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/FilteredSetMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/TreeTraverser.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/ForwardingImmutableMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/DescendingImmutableSortedSet.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/RangeMap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/UnmodifiableSortedMultiset.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/FilteredEntryMultimap.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/TransformedListIterator.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collection/SortedMultisetBridge.java
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 */

/**
 * Holder for extra methods of {code Objects} only in web. Intended to be empty for regular
 * version.
 */

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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/GeneralRange.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/Count.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/RangeSet.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/ForwardingSortedMultiset.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/SortedIterables.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/AbstractRangeSet.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/ImmutableSortedMultisetFauxverideShim.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/RegularImmutableSortedMultiset.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
jar/com/google/common/collections/SortedIterable.java

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*/
/**
* Holder for web specializations of methods of [@code Shorts]. Intended to be empty for regular
* version.
*/

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jar/com/google/common/util/concurrent/ExecutionSequencer.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/Stopwatch.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/Floats.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/thirdparty/publicsuffix/TrieParser.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/ListenableFutureTask.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/Joiner.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/Doubles.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/Chars.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/io/FileBackedOutputStream.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/Bytes.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/SequentialExecutor.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/Longs.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/CharMatcher.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/base/internal/Finalizer.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/Ints.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/escape/UnicodeEscaper.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/io/MultiReader.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/hash/FarmHashFingerprint64.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/io/ReaderInputStream.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/AsyncCallable.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/hash/FarmHashFingerprint64.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/AggregateFutureState.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/InterruptibleTask.java
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jar/com/google/common/collect/SortedMultiset.java
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jar/com/google/common/collect/SortedMultisets.java
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*/
/**
* Not supported. <b>You are attempting to create a map that may contain a non-{@code Comparable} key.</b> Proper calls will resolve to the version in {@code ImmutableSortedMap}, not this dummy version.
* @throws UnsupportedOperationException always
* @deprecated <b>Pass a key of type {@code Comparable} to use {@link ImmutableSortedMap#of(Comparable, Object)}.</b>
*/

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* */
/**
* Holder for web specializations of methods of { @code Doubles}. Intended to be empty for regular
* version.
* */

Found in path(s):
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/primitives/DoublesMethodsForWeb.java
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  jar/com/google/common/graph/IncidentEdgeSet.java
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/collect/CompactHashing.java
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/*
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 *http://code.google.com/p/smhasher/source/browse/trunk/MurmurHash3.cpp, which contained the
 *following header:
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 */

Found in path(s):
* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-
  jar/com/google/common/base/SmallCharMatcher.java
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* /opt/cola/permits/1136647774_1613845914.79/0/guava-30-0-android-sources-jar/com/google/common/util/concurrent/MoreExecutors.java

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1.510 commons-logging 1.2

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Built-By: norman
Bnd-LastModified: 1617096680823
Bundle-ManifestVersion: 2
Implementation-Vendor-Id: io.netty
Bundle-DocURL: https://netty.io/
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1.522 keypoint-pngencoder 1.0.15

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1.523 zeromq 4.3.3-r0

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wepoll - epoll for Windows
https://github.com/piscisaureus/wepoll

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Monkey HTTP Server

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1.525 protobuf-java 3.12.0

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* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/FieldSet.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/MapField.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/AbstractMessageLite.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/CodedInputStreamReader.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/google/protobuf/field_mask.proto
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/BooleanArrayList.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/UninitializedMessageException.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/UnknownFieldSet.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/Descriptors.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/BufferAllocator.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/NewInstanceSchemas.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/ProtocolStringList.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/GeneratedMessageV3.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/LazyStringList.java
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* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/AllocatedBuffer.java
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* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources-jar/com/google/protobuf/MessageOrBuilder.java
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* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/PrimitiveNonBoxingCollection.java
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* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/ByteString.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/WireFormat.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/ProtocolMessageEnum.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/Writer.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/TextFormatParseLocation.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/MessageSetSchema.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/DynamicMessage.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/NewInstanceSchema.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/TextFormatParseInfoTree.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/SingleFieldBuilderV3.java
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* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/BlockingService.java
* /opt/ws_local/PERMITS_SQL/1058025336_1592406724.78/0/protobuf-java-3-12-0-sources.jar/com/google/protobuf/InvalidProtocolBufferException.java
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1.526 jackson-annotations 2.12.0

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  * /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileParser.java
jar/io/netty/resolver/InetSocketAddressResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-
jar/io/netty/resolver/CompositeNameResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-
jar/io/netty/resolver/AddressResolver.java
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Found in path(s):
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-
jar/io/netty/resolver/RoundRobinInetAddressResolver.java

1.532 x-crypto v0.0.0-20201002170205-7f63de1d35b0
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1.533 utils v0.0.0-20201110183641-67b214c5f920

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++++++++++++++++

Dean Elsner wrote the original gas for vax. [more details?]

Jay Fenlason maintained gas for a while, adding support for gdb-specific debug information and the 68k series machines, most of the preprocessing pass, and extensive changes in messages.c, input-file.c, write.c.

K. Richard Pixley maintained gas for a while, adding various enhancements and many bug fixes, including merging support for several processors, breaking gas up to handle multiple object file format backends (including heavy rewrite, testing, an integration of the coff and b.out backends), adding configuration including heavy testing and verification of cross assemblers and file splits and renaming, converted gas to strictly ansi C including full prototypes, added support for m680[34]0 & cpu32, considerable work on i960 including a coff port (including considerable amounts of reverse engineering), a sparc opcode file rewrite, decstation, rs6000, and hp300hpux host ports, updated "know" assertions and made them work, much other reorganization, cleanup, and lint.

Ken Raeburn wrote the high-level BFD interface code to replace most of the code in format-specific I/O modules.

The original Vax-VMS support was contributed by David L. Kashtan. Eric Youngdale and Pat Rankin have done much work with it since.

The Intel 80386 machine description was written by Eliot Dresselhaus.

Minh Tran-Le at IntelliCorp contributed some AIX 386 support.

The Motorola 88k machine description was contributed by Devon Bowen of Buffalo University and Torbjorn Granlund of the Swedish Institute of Computer Science.

Keith Knowles at the Open Software Foundation wrote the original MIPS back end (tc-mips.c, tc-mips.h), and contributed Rose format support.
Ralph Campbell worked with the MIPS code to support a.out format.

Support for the Zilog Z8k and Hitachi H8/300, H8/500 and SH processors (tc-z8k, tc-h8300, tc-h8500, tc-sh), and IEEE 695 object file format (obj-ieee), was written by Steve Chamberlain of Cygnus Solutions. Steve also modified the COFF back end (obj-coffbfd) to use BFD for some low-level operations, for use with the Hitachi, 29k and Zilog targets.

John Gilmore built the AMD 29000 support, added .include support, and simplified the configuration of which versions accept which pseudo-ops. He updated the 68k machine description so that Motorola's opcodes always produced fixed-size instructions (e.g. jsr), while synthetic instructions remained shrinkable (jbsr). John fixed many bugs, including true tested cross-compilation support, and one bug in relaxation that took a week and required the proverbial one-bit fix.

Ian Lance Taylor of Cygnus Solutions merged the Motorola and MIT syntaxes for the 68k, completed support for some COFF targets (68k, i386 SVR3, and SCO Unix), wrote the ECOFF support based on Michael Meissner's mips-tfile program, wrote the PowerPC and RS/6000 support, and made a few other minor patches. He handled the binutils releases for versions 2.7 through 2.9.

David Edelsohn contributed fixes for the PowerPC and AIX support.

Steve Chamberlain made gas able to generate listings.

Support for the HP9000/300 was contributed by Glenn Engel of HP.

Support for ELF format files has been worked on by Mark Eichin of Cygnus Solutions (original, incomplete implementation), Pete Hoogenboom at the University of Utah (HPPA mainly), Michael Meissner of the Open Software Foundation (i386 mainly), and Ken Raeburn of Cygnus Solutions (sparc, initial 64-bit support).

Several engineers at Cygnus Solutions have also provided many small bug fixes and configuration enhancements.

The initial Alpha support was contributed by Carnegie-Mellon University. Additional work was done by Ken Raeburn of Cygnus Solutions. Richard Henderson then rewrote much of the Alpha support.

Ian Dall updated the support code for the National Semiconductor 32000 series, and added support for Mach 3 and NetBSD running on the PC532.

Klaus Kaempf ported the assembler and the binutils to openVMS/Alpha.
Steve Haworth contributed the support for the Texas Instruction c30 (tms320c30).

H.J. Lu has contributed many patches and much testing.

Alan Modra reworked much of the i386 backend, improving the error checking, updating the code, and improving the 16 bit support, using patches from the work of Martynas Kunigelis and H.J. Lu.

Many others have contributed large or small bugfixes and enhancements. If you've contributed significant work and are not mentioned on this list, and want to be, let us know. Some of the history has been lost; we aren't intentionally leaving anyone out.

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   d) If a facility in the modified Library refers to a function or a
      table of data to be supplied by an application program that uses
      the facility, other than as an argument passed when the facility
      is invoked, then you must make a good faith effort to ensure that,
      in the event an application does not supply such function or
      table, the facility still operates, and performs whatever part of
      its purpose remains meaningful.

   (For example, a function in a library to compute square roots has
   a purpose that is entirely well-defined independent of the
   application. Therefore, Subsection 2d requires that any
application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.
If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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copyright notice for the Library among them, as well as a reference
directing the user to the copy of this License. Also, you must do one
of these things:

a) Accompany the work with the complete corresponding
machine-readable source code for the Library including whatever
changes were used in the work (which must be distributed under
Sections 1 and 2 above); and, if the work is an executable linked
with the Library, with the complete machine-readable "work that
uses the Library", as object code and/or source code, so that the
user can modify the Library and then relink to produce a modified
executable containing the modified Library. (It is understood
that the user who changes the contents of definitions files in the
Library will not necessarily be able to recompile the application
to use the modified definitions.)

b) Accompany the work with a written offer, valid for at
least three years, to give the same user the materials
specified in Subsection 6a, above, for a charge no more
than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy
from a designated place, offer equivalent access to copy the above
specified materials from the same place.

d) Verify that the user has already received a copy of these
materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the
Library" must include any data and utility programs needed for
reproducing the executable from it. However, as a special exception,
the source code distributed need not include anything that is normally
distributed (in either source or binary form) with the major
components (compiler, kernel, and so on) of the operating system on
which the executable runs, unless that component itself accompanies
the executable.

It may happen that this requirement contradicts the license
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use both them and the Library together in an executable that you
distribute.

7. You may place library facilities that are a work based on
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Appendix: How to Apply These Terms to Your New Libraries

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<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

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In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

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The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

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0. This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called "this License"). Each licensee is addressed as "you".
A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

   a) The modified work must itself be a software library.

   b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.
Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may
distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
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For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

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b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

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1.536 slf4j 1.7.28

1.537 google-go-cmp v0.5.2
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1.539 units v0.0.0-20210208195552-ff826a37aa15

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1.546 esapi 2.1.0

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1.547 x-oauth2 v0.0.0-20210323180902-22b0adad7558

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X-Mailer: Lotus Notes Release 5.0.2a (Intl) 23 November 1999
Subject: Re: Juan C. Gomez license in OpenLDAP Source

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Local-Date: Thu, 05 Jun 2003 16:53:32 -0400
Date: Thu, 5 Jun 2003 16:53:32 -0400 (EDT)
From: Mark Adamson <adamson@andrew.cmu.edu>
To: Stephen Frost <sfrost@debian.org>
Subject: Re: Mark Adamson license in OpenLDAP source
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* To: Stephen Frost <sfrost@snowman.net>

Open Source Used In kASA v1.5 7850
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Regards, Kurt

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1.551 renekroon-ttlcache v2.1.0

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metrics from the pseudo-filesystem proc.

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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources.jar/io/netty/handler/codec/dns/DnsSection.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources.jar/io/netty/handler/codec/dns/ShuffledDnsServerAddressStream.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources.jar/io/netty/resolver/dns/RotationalDnsServerAddresses.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources.jar/io/netty/handler/codec/http/Http2OrHttpHandler.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources.jar/io/netty/handler/codec/http/Http2Server.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources.jar/io/netty/handler/codec/http2/tiles/Http2Server.java
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- /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http/CookieUtil.java
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- /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/SSLContextBuilder.java
- /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/headers/HeadersUtils.java
- /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/headers/ProtocolDetectionResult.java
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* /opt/cola/permits/115044603_1618916486.95/0/netty-all-4-1-63-final-sources-
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
arbo/netty/example/mqtt/heartBeat/MqttHeartBeatClient.java
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arbo/netty/handler/codec/http/websocketx/WebSocketServerHandshaker00.java
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arbo/netty/channel/ChannelHandlerMask.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
arbo/netty/util/internal/svm/CleanerJava6Substitution.java
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arbo/netty/handler/codec/http2/DefaultHttp2SettingsAckFrame.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
arbo/netty/handler/ssl/util/TrustManagerFactoryWrapper.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
arbo/netty/handler/codec/http2/AbstractHttp2StreamChannel.java

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arbo/netty/util/internal/CleanerJava9.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/channel/rxtx/DefaultRxtxChannelConfig.java
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// https://tools.ietf.org/html/rfc7540#section-8.1.2.2 makes a special exception for TE

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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http/websocketx/extensions/compression/PerMessageDeflateEncoder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/compression/Lz4Constants.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/resolver/dns/DnsResolveContext.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthResponseDecoder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/example/spdy/server/SpdyServer.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionDecoder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/example/memcache/binary/MemcacheClient.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/OpenSslSelfSignedCertGenerator.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/CipherSuiteConverter.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/OpenSslEngineMap.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/OpenSslSessionContext.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/CipherSuiteConverter.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/stomp/DefaultStompHeaders.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/stomp/DefaultLastStompContentSubframe.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/mqtt/MqttCodecUtil.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/compression/Bzip2BitReader.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/mqtt/MqttConnAckVariableHeader.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/channel/udt/nio/NioUdtMessageConnectorChannel.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/sctp/SctpInboundByteStreamHandler.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/traffic/ChannelTrafficShapingHandler.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/traffic/GlobalTrafficShapingHandler.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/traffic/package-info.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/channel/udt/nio/NioUdtMessageAcceptorChannel.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/channel/udt/nio/NioUdtByteAcceptorChannel.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/channel/udt/nio/NioUdtByteConnectorChannel.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/memcache/LastMemcacheContent.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandStatus.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketClientProtocolHandshakeHandler.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/util/internal/NoOpTypeParameterMatcher.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyStreamFrame.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/channel/AbstractCoalescingBufferQueue.java

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 */
/**
 * Handles an I/O event or intercepts an I/O operation, and forwards it to its next handler in
 * its {link ChannelPipeline}.
 * <p>
 * {@link ChannelHandler} itself does not provide many methods, but you usually have to implement one of its
 * subtypes:
 * <ul>
 * <li>{@link ChannelInboundHandler} to handle inbound I/O events, and</li>
 * <li>{@link ChannelOutboundHandler} to handle outbound I/O operations.</li>
 * </ul>
 * <p>
 * Alternatively, the following adapter classes are provided for your convenience:
 * <ul>
 * <li>{@link ChannelInboundHandlerAdapter} to handle inbound I/O events,</li>
 * </ul>
* <li>{@link ChannelOutboundHandlerAdapter} to handle outbound I/O operations, and</li>
* <li>{@link ChannelDuplexHandler} to handle both inbound and outbound events</li>
* </ul>
* </p>
* For more information, please refer to the documentation of each subtype.
* </p>
*
* <h3>The context object</h3>
* 
* A {@link ChannelHandler} is provided with a {@link ChannelHandlerContext} object. A {@link ChannelHandler} is supposed to interact with the
* {@link ChannelPipeline} it belongs to via a context object. Using the
* context object, the {@link ChannelHandler} can pass events upstream or
* downstream, modify the pipeline dynamically, or store the information
* (using {@link AttributeKey}s) which is specific to the handler.
* 
* <h3>State management</h3>
* 
* A {@link ChannelHandler} often needs to store some stateful information.
* The simplest and recommended approach is to use member variables:
* </pre>
* public interface Message {
  // your methods here
}

* public class DataServerHandler extends @link SimpleChannelInboundHandler<Message> {
*     <b>private boolean loggedIn;</b>
*     ...
* }

* } else (message instanceof GetDataMessage) {
*     if (<b>loggedIn</b>) {
*         ctx.writeAndFlush(fetchSecret((GetDataMessage) message));
*     } else {
*         fail();
*     }
* }
* </pre>
* Because the handler instance has a state variable which is dedicated to
* one connection, you have to create a new handler instance for each new
* channel to avoid a race condition where a unauthenticated client can get
* the confidential information:
* <pre>
* // Create a new handler instance per channel.
* // See [@link ChannelInitializer#initChannel(Channel)].
* public class DataServerInitializer extends [@link ChannelInitializer]<@link Channel> {
*     @<code>@Override</code>
*     public void initChannel(<@link Channel> channel) {
*         channel.pipeline().addLast("handler", <b>new DataServerHandler()</b>);
*     }
* }
* </pre>
*
* <h4>Using [@link AttributeKey]s</h4>
*
* Although it's recommended to use member variables to store the state of a
* handler, for some reason you might not want to create many handler instances.
* In such a case, you can use [@link AttributeKey]s which is provided by
* [@link ChannelHandlerContext]:
* <pre>
* public interface Message {
*     // your methods here
* }
* </pre>
*
* [@code @Sharable]
* public class DataServerHandler extends [@link SimpleChannelInboundHandler]<Message> {
*     private final [@link AttributeKey]<@link Boolean> auth =
*           [@link AttributeKey#valueOf(String) AttributeKey.valueOf("auth")];
* 
*     @<code>@Override</code>
*     public void channelRead([@link ChannelHandlerContext] ctx, Message message) {
*         @<code>attr</code>.set(true);
*     }
*     ...
* }
* </pre>
*
* Now that the state of the handler is attached to the [@link ChannelHandlerContext], you can add the
* same handler instance to different pipelines:
* 
* public class DataServerInitializer extends @link ChannelInitializer<Channel>{
* *
*     private static final DataServerHandler <b>SHARED</b> = new DataServerHandler();
* *
*     { @code @Override }
*     public void initChannel(@link Channel channel) {
*         channel.pipeline().addLast("handler", <b>SHARED</b>);
*     }
* }
* }
* </pre>
* 
* 
* <h4>The @code @Sharable annotation</h4>
* 
* In the example above which used an @link AttributeKey{AttributeKey},
* you might have noticed the @code @Sharable annotation.
* 
* If a @link ChannelHandler{ChannelHandler} is annotated with the @code @Sharable
* annotation, it means you can create an instance of the handler just once and
* add it to one or more @link ChannelPipeline{ChannelPipeline}s multiple times without
* a race condition.
* 
* If this annotation is not specified, you have to create a new handler
* instance every time you add it to a pipeline because it has unshared state
* such as member variables.
* 
* This annotation is provided for documentation purpose, just like
* 
* <h3>Additional resources worth reading</h3>
* 
* Please refer to the @link ChannelHandler{ChannelHandler}, and
* @link ChannelPipeline{ChannelPipeline} to find out more about inbound and outbound operations,
* what fundamental differences they have, how they flow in a pipeline, and how to handle
* the operation in your application.
* */

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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/DefaultHeadersImpl.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/CharSequenceValueConverter.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/StreamByteDistributor.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/AbstractInboundHttp2ToHttpAdapterBuilder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/DecoratingHttp2ConnectionEncoder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/DecoratingHttp2ConnectionDecoder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/ValueConverter.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/WeightedFairQueueByteDistributor.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2PromisedRequestVerifier.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2Connection.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2ConnectionDecoder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2Settings.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2ConnectionEncoder.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameReader.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2ServerUpgradeCodec.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameReader.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameWriter.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameReader.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2ServerUpgradeCodec.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameWriter.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameWriter.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameWriter.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameReader.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameWriter.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2FrameWriter.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/Http2Settings.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/hand
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  * /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/util/internal/ResourcesUtil.java
  * /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/util/ByteProcessorUtils.java
  * /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codecs/redis/InlineCommandRedisMessage.java
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  jar/io/netty/channel/DefaultChannelHandlerContext.java
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  jar/io/netty/util/internal/CleanerJava6.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
  jar/io/netty/buffer/UnsafeHeapSwappedByteBuf.java
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  jar/io/netty/util/concurrent/FastThreadLocalThread.java
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  jar/io/netty/buffer/UnsafeDirectSwappedByteBuf.java

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  jar/io/netty/handler/ssl/SslHandshakeTimeoutException.java
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  jar/io/netty/example/stomp/websocket/StompSubscription.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
  jar/io/netty/example/stomp/websocket/StompWebSocketFrameEncoder.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
  jar/io/netty/example/stomp/websocket/StompVersion.java
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  jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshakeException.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/mqtt/MqttSubscriptionOption.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/util/FingerprintTrustManagerFactoryBuilder.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2PriorityFrame.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/codec/mqtt/MqttMessageIdAndPropertiesVariableHeader.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ipfilter/IpSubnetFilter.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/example/haproxy/HAProxyHandler.java

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*/
/**
 * Set the {code TCP_MD5SIG} option on the socket. See {code linux/tcp.h} for more details.
 * Keys can only be set on, not read to prevent a potential leak, as they are confidential.
 * Allowing them being read would mean anyone with access to the channel could get them.
 */
/**
 * Set the {code TCP_QUICKACK} option on the socket.
 * See <a href="https://linux.die.net//man/7/tcp">TCP_QUICKACK</a> for more details.
 */

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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/SniCompletionEvent.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/ssl/SniCompletionEvent.java
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 */

/**
 * Enumeration of supported Base64 dialects.
 * <p>
 * The internal lookup tables in this class has been derived from
 * <a href="http://iharder.sourceforge.net/current/java/base64/">Robert Harder's Public Domain
 * Base64 Encoder/Decoder</a>.
 */

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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/channel/oio/AbstractOioChannel.java
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 */

/*
 * Utility class for {@link ByteBuf} that encodes and decodes to and from
 * <a href="https://en.wikipedia.org/wiki/Base64">Base64</a> notation.
 * <p>
 * The encoding and decoding algorithm in this class has been derived from
 * <a href="http://iharder.sourceforge.net/current/java/base64/">Robert Harder's Public Domain
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 */

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 * under the License.
 */
/**
 * Set the { @code TCP_MD5SIG} option on the socket. See { @code linux/tcp.h} for more details.
 * Keys can only be set on, not read to prevent a potential leak, as they are confidential.
 * Allowing them being read would mean anyone with access to the channel could get them.
 */

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  jar/io/netty/util/internal/shaded/org/jctools/queues/spec/ConcurrentQueueSpec.java

* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
  jar/io/netty/util/internal/shaded/org/jctools/maps/AbstractEntry.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
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jar/io/netty/util/concurrent/PromiseCombiner.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/resolver/dns/NoopDnsCache.java
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  jar/io/netty/util/internal/logging/CommonsLogger.java
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  jar/io/netty/util/internal/logging/Log4JLogger.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
  jar/io/netty/channel/unix/SegmentedDatagramPacket.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
  jar/io/netty/handler/ssl/OpenSslClientSessionCache.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
  jar/io/netty/handler/ssl/OpenSslContextOption.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
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*/
/**
 * A decoder that splits the received {@link ByteBuf}s dynamically by the
 * value of the length field in the message. It is particularly useful when you
 * decode a binary message which has an integer header field that represents the
 * length of the message body or the whole message.
 * <p>
 * {@link LengthFieldBasedFrameDecoder} has many configuration parameters so
 * that it can decode any message with a length field, which is often seen in
 * proprietary client-server protocols. Here are some example that will give
 * you the basic idea on which option does what.
 *<p>
 *<h3>2 bytes length field at offset 0, do not strip header</h3><p>
 *<br>
 *The value of the length field in this example is <tt>12 (0x0C)</tt> which
 *represents the length of "HELLO, WORLD". By default, the decoder assumes
 *that the length field represents the number of the bytes that follows the
 *length field. Therefore, it can be decoded with the simplistic parameter
 *combination.
 *<p>
 *<tt><b>lengthFieldOffset</b> = 0</tt>
 *<tt><b>lengthFieldLength</b> = 2</tt>
 *<tt>lengthAdjustment = 0</tt>
 *<tt>initialBytesToStrip = 0 (= do not strip header)</tt>
 *
 *BEFORE DECODE (14 bytes) AFTER DECODE (14 bytes)
*+---------------+-------------------*
*| Length | Actual Content |
*+---------------+-------------------*
*| 0x000C | "HELLO, WORLD" |
*+---------------+-------------------*
*| 0x000C | "HELLO, WORLD" |
Because we can get the length of the content by calling
{@link ByteBuf#readableBytes()}, you might want to strip the length field by specifying <tt>initialBytesToStrip</tt>. In this example, we specified <tt>2</tt>, that is same with the length of the length field, to strip the first two bytes.
<pre><tt><b>initialBytesToStrip</b> = <b>2</b> (= the length of the Length field)
</tt></pre>

In most cases, the length field represents the length of the message body only, as shown in the previous examples. However, in some protocols, the length field represents the length of the whole message, including the message header. In such a case, we specify a non-zero <tt>lengthAdjustment</tt>. Because the length value in this example message is always greater than the body length by <tt>2</tt>, we specify <tt>-2</tt> as <tt>lengthAdjustment</tt> for compensation.
<pre><tt>lengthFieldOffset   =  0
lengthFieldLength   =  2
<b>lengthAdjustment</b>    = <b>-2</b> (= the length of the Length field)
initialBytesToStrip =  0
</tt></pre>

The following message is a simple variation of the first example. An extra
* header value is prepended to the message. \(<tt\)lengthAdjustment\(</tt\) is zero
* again because the decoder always takes the length of the prepended data into
* account during frame length calculation.
* \(<pre\>
* \(<b\)lengthFieldOffset\(</b\) = \(<b\)2\(</b\) (= the length of Header 1)
* \(<b\)lengthFieldLength\(</b\) = \(<b\)3\(</b\)
* lengthAdjustment    = 0
* initialBytesToStrip = 0
*
* \(<tt\)before decode (17 bytes) \(</tt\)            \(<tt\)after decode (17 bytes) \(</tt\)
* +-------+-------+----------------+      +-------+-------+----------------+
* | Header 1 | Length | Actual Content |----->| Header 1 | Length | Actual Content |
* | 0xCAFE   | 0x0000C| "HELLO, WORLD"|      | 0xCAFE   | 0x0000C| "HELLO, WORLD" |
* +-------+-------+----------------+      +-------+-------+----------------+
* \(<tt\)/\(</tt\>
* *
* \(<tt\)before decode (17 bytes) \(</tt\)            \(<tt\)after decode (17 bytes) \(</tt\)
* +-------+-------+----------------+      +-------+-------+----------------+
* | Length | Header 1 | Actual Content |----->| Length | Header 1 | Actual Content |
* | 0x0000C | 0xCAFE  | "HELLO, WORLD"|      | 0x0000C | 0xCAFE  | "HELLO, WORLD" |
* +-------+-------+----------------+      +-------+-------+----------------+
* \(<tt\)/\(</tt\>
* *
* This is an advanced example that shows the case where there is an extra
* header between the length field and the message body. You have to specify a
* positive \(<tt\)lengthAdjustment\(</tt\) so that the decoder counts the extra
* header into the frame length calculation.
* \(<pre\>
* lengthFieldOffset = 0
* lengthFieldLength = 3
* \(<b\)lengthAdjustment\(</b\) = \(<b\)2\(</b\) (= the length of Header 1)
* initialBytesToStrip = 0
*
* \(<tt\)before decode (17 bytes) \(</tt\)            \(<tt\)after decode (17 bytes) \(</tt\)
* +-------+-------+----------------+      +-------+-------+----------------+
* | Length | Header 1 | Actual Content |----->| Length | Header 1 | Actual Content |
* | 0x0000C | 0xCAFE  | "HELLO, WORLD"|      | 0x0000C | 0xCAFE  | "HELLO, WORLD" |
* +-------+-------+----------------+      +-------+-------+----------------+
* \(<tt\)/\(</tt\>
* *
* This is a combination of all the examples above. There are the prepended
* header before the length field and the extra header after the length field.
* The prepended header affects the \(<tt\)lengthFieldOffset\(</tt\) and the extra
* header affects the \(<tt\)lengthAdjustment\(</tt\). We also specified a non-zero
* \(<tt\)initialBytesToStrip\(</tt\) to strip the length field and the prepended
* header from the frame. If you don't want to strip the prepended header, you
* could specify \(<tt\)0\(</tt\) for \(<tt\)initialBytesToSkip\(</tt\).
* \(<pre\>
* lengthFieldOffset = 1 (= the length of HDR1)
* lengthFieldLength = 2
* `<b>lengthAdjustment</b> = 1` (= the length of HDR2)
* `<b>initialBytesToStrip</b> = 3` (= the length of HDR1 + LEN)

* **BEFORE DECODE (16 bytes) | AFTER DECODE (13 bytes)**
* +----------------+--------+----------------+----------------+
* | HDR1 | Length | HDR2 | Actual Content |
* | 0xCA | 0x0010 | 0xFE | "HELLO, WORLD" |
* +----------------+--------+----------------+

* `<b>lengthAdjustment</b> = -3` (= the length of HDR1 + LEN, negative)
* `<b>initialBytesToStrip</b> = 3`

* **BEFORE DECODE (16 bytes) | AFTER DECODE (13 bytes)**
* +----------------+--------+----------------+----------------+
* | HDR1 | Length | HDR2 | Actual Content |
* | 0xCA | 0x0010 | 0xFE | "HELLO, WORLD" |
* +----------------+--------+----------------+

@see LengthFieldPrepender

```
+----------------+--------+----------------+----------------+
| HDR1 | Length | HDR2 | Actual Content |
| 0xCA | 0x000C | 0xFE | "HELLO, WORLD" |
+----------------+--------+----------------+
```

```
+----------------+--------+----------------+----------------+
| HDR1 | Length | HDR2 | Actual Content |
| 0xCA | 0x000C | 0xFE | "HELLO, WORLD" |
+----------------+--------+----------------+
```

```
+----------------+--------+----------------+----------------+
| HDR1 | Length | HDR2 | Actual Content |
| 0xCA | 0x000C | 0xFE | "HELLO, WORLD" |
+----------------+--------+----------------+
```

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jar/io/netty/handler/codec/http/cors/CorsHandler.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-
jar/io/netty/handler/codec/http/cors/CorsConfig.java
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jar/io/netty/example/http2/helloworld/multiplex/server/HelloWorldHttp2Handler.java
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jar/io/netty/handler/codec/redis/LastBulkStringRedisContent.java
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jar/io/netty/handler/codec/redis/RedisCodecException.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4.1-63-final-sources-jar/io/netty/buffer/search/SearchProcessorFactory.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4.1-63-final-sources-jar/io/netty/buffer/search/KmpSearchProcessorFactory.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4.1-63-final-sources-jar/io/netty/example/http2/helloworld/frame/client/Http2ClientFrameInitializer.java
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jar/io/netty/buffer/search/SearchProcessor.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/buffer/search/AbstractSearchProcessorFactory.java
* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/example/http2/helloworld/frame/client/Http2FrameClient.java
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* /opt/cola/permits/1150446063_1618916486.95/0/netty-all-4-1-63-final-sources-jar/io/netty/handler/pcap/PcapWriter.java

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  jar/io/netty/channel/epoll/EpollRecvByteAllocatorStreamingHandle.java
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  jar/io/netty/channel/epoll/AbstractEpollServerChannel.java
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  jar/io/netty/channel/epoll/EpollRecvByteAllocatorHandle.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
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*/
/**
 * Set the {@code TCP_MD5SIG} option on the socket. See {@code linux/tcp.h} for more details.
 * Keys can only be set on, not read to prevent a potential leak, as they are confidential.
 * Allowing them being read would mean anyone with access to the channel could get them.
 */

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/**
 * Set the {@code TCP_MD5SIG} option on the socket. See {@code linux/tcp.h} for more details.
 */
* Keys can only be set on, not read to prevent a potential leak, as they are confidential.
* Allowing them being read would mean anyone with access to the channel could get them.
*/

/*
 * Set the { @code TCP_QUICKACK} option on the socket. See <a href="http://linux.die.net/man/7/tcp">TCP_QUICKACK</a>
 * for more details.
 */

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jar/netty_epoll_linuxsocket.c
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/netty_epoll_linuxsocket.h
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/LinuxSocket.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/NativeStaticallyReferencedJniMethods.java

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1.597 kubernetes-klog v2.4.0

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1.601 netty-handler 4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslTlsv13X509ExtendedTrustManager.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ExtendedOpenSslSession.java
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  jar/io/netty/handler/ssl/ReferenceCountedOpenSslServerContext.java
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jar/io/netty/handler/ssl/SniCompletionEvent.java
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sources-jar/io/netty/internal/tcnative/SSLSession.java
* /opt/ws_local/PERMITS_SQL/1083459527_1598192340.79/0/netty-tcnative-boringssl-static-2-0-31-final-
sources-jar/io/netty/internal/tcnative/SSLSessionCache.java

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* /opt/cola/permits/1199767181_1630583089.73/0/error-prone-annotations-2-4-0-sources-2-
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* /opt/cola/permits/1199767181_1630583089.73/0/error-prone-annotations-2-4-0-sources-2-jar/com/google/errorprone/annotations/OverridingMethodsMustInvokeSuper.java
* /opt/cola/permits/1199767181_1630583089.73/0/error-prone-annotations-2-4-0-sources-2-jar/com/google/errorprone/annotations/CheckReturnValue.java

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1.628 jctools-core 3.0.0
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No license file was found, but licenses were detected in source scan.

Manifest-Version: 1.0
Bnd-LastModified: 1578049665284
Build-Jdk: 1.8.0_232
Built-By: yak
Bundle-Description: Java Concurrency Tools Core Library
Bundle-License: http://www.apache.org/licenses/LICENSE-2.0.txt
Bundle-ManifestVersion: 2
Bundle-Name: Java Concurrency Tools Core Library
Bundle-SymbolicName: org.jctools.core
Bundle-Version: 3.0.0
Created-By: Apache Maven Bundle Plugin
Import-Package: sun.misc;resolution:=optional
Require-Capability: osgi.ee;filter:="(&(osgi.ee=JavaSE)(version=1.6))"
Tool: Bnd-4.2.0.201903051501

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* /opt/cola/permits/1177956791_1625584358.42/0/jctools-core-3-0-0-5-jar/META-INF/MANIFEST.MF

1.629 go-autorest v0.11.17
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1.630 chunkio 1.1.1

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1.631 certifi 2021.05.30

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ca-bundle.crt -- Bundle of CA Root Certificates

Certificate data from Mozilla as of: Thu Nov  3 19:04:19 2011#
This is a bundle of X.509 certificates of public Certificate Authorities (CA). These were automatically extracted from Mozilla's root certificates file (certdata.txt). This file can be found in the mozilla source tree:
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1.632 slf4j-log4j 1.7.7

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1.633 tzdata 2020a-0+deb9u1

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1.634 commons-collections 3.2.2

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1.635 thrift 0.14.1

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*
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Interruptible SSSE3 AES core implementation.

By Mike Hamburg (Stanford University), 2009

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1.639 hikaricp-java7 2.4.13

1.640 kubernetes-client v0.19.2
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1.641 netty-codec-socks 4.1.61.Final

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jar/io/netty/handler/codec/socksx/v5/Socks5AddressEncoder.java
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jar/io/netty/handler/codec/socks/UnknownSocksRequest.java
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* /opt/cola/permits/1153055905_1618392510.29/0/netty-codec-socks-4-1-61-final-sources-
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* /opt/cola/permits/1153055905_1618392510.29/0/netty-codec-socks-4-1-61-final-sources.jar/io/netty/handler/codec/socks/SocksInitResponseDecoder.java
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* /opt/cola/permits/1153055905_1618392510.29/0/netty-codec-socks-4-1-61-final-sources.jar/io/netty/handler/codec/socksx/v4/Socks4CommandType.java
* /opt/cola/permits/1153055905_1618392510.29/0/netty-codec-socks-4-1-61-final-sources.jar/io/netty/handler/codec/socksx/v5/Socks5InitialRequest.java

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1.642 json-java 20131018

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* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/BitOutputStream.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/Compressor.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/Keep.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/BitInputStream.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/MapKeep.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/PostMortem.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/TrieKeep.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/JSONZip.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/zip/Huff.java
* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/Kim.java

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* /opt/cola/permits/1126439541_1611634442.47/0/json-20131018-sources-jar/org/json/JSONStringer.java
1.643 pierrec-lz4 2.0.5+incompatible

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1.644 aws-sdk-go v1.38.3

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1.645 gogoprotobuf v1.3.1

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/fsnotify.go
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* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/fen.go
* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/integration_test.go
* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/inotify.go
* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/kqueue.go
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* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/inotify_poller_test.go
* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/inotify_poller.go
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* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/fsnotify_test.go
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* /opt/cola/permits/1154536554_1618863768.29/0/useproject-fsnotify-v1-4-9-0-g71155eb-tar-gz/useproject-fsnotify-71155eb/open_mode_darwin.go

1.647 go_serialization_benchmarks v2.2.6

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1.649 netty-transport-native-unix-common
4.1.51.Final
1.649.1 Available under license :

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sources-jar/io/netty/channel/unix/package-info.java

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1.650 object-model 1.0.25

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This License Support and Services Agreement, including any and all Order Forms and SOWs (as defined below) (collectively, this Agreement), defines and governs the products(s), documentation and services provided by Axway UK Limited, a company registered in England and Wales (registered number 2758712) whose registered office is at Tower Bridge House, St Katharine's Way, London E1W 1DD (Axway) provides to your company (Customer).

ARTICLE 1 DEFINITIONS AND INTERPRETATION

1.1. In this Agreement and any Schedules, Order Forms or Statements of Work (SOWs), the following terms are defined as follows, and additional definitions applicable to the Order Forms are included in Attachment A:

Additional Services means the Services described in Article 7 as contained in any Order Forms or SOWs;

Agreement means these General Conditions and the Software/Services Order Form (or Specific Conditions) and Schedules (together, the Order Form); Business Partner or Trading Partner means any external computer interoperating with a Licensed Component through one or more protocols, one or more networks, or one or more adapters; Defect means a reproducible error or defect in the Product that prevents it from operating materially in
accordance with its Documentation; Delivery means delivery of license keys which unlock the Licensed Component (including the Support Access Code number), enabling electronic delivery of the Licensed Component for download, or shipment of a CD ROM which contains the Licensed Component, or shipment of the Hardware Product; Documentation means the documents delivered with the Product which contains Axway’s published specifications and user guide of the Product; Effective Date for an Order Form means the date when Customer executes an Order Form unless specified otherwise in an Order Form; Hardware Product means any hardware appliance or other item of equipment that is delivered to Customer; Licensed Component means the computer program described in the Order Form, as well as: (i) the Documentation, in either machine-readable or printed form; and (ii) all entire or partial authorized copies of such items made by Customer; and (iii) any software release provided by Axway to Customer (provided that Customer is still a subscriber to Support Services); Operating Environment means any operating system based environment hosting the running of a Licensed Component, defined by its resources: Computer, its number of CPUs, its number of Cores per CPUs, its number of Instances, its number of Partitions, the type of its Partitions and the number of CPUs per Partitions; Parties means Axway and the party identified as Customer in the Order Form; Product means Hardware Product(s) and Licensed Component(s); Site means the physical location of the Operating Environment, such address as it is provided in the Order Form; Support Services means annual Product support provided under Axway’s policies available at http://support.axway.com/ for the level of Support Services ordered in the Order Form; Third Party Software means any third party program or software included as an integral part of the Product and delivered with the Product; such program or software is solely for use as embedded with the Product; Use means the installation, loading, utilization, storage or display of the Product by Customer within the constraints in the Order Form; 1.2. Headings are used in this Agreement for ease of reference only and shall not affect interpretation. References in this Agreement to Articles are references to the Articles of the General Conditions unless inconsistent with the context.1.3. The words “include”, “includes”, “including” and “included” will be construed without limitation unless inconsistent with the context.

ARTICLE 2 CONTRACT DOCUMENTS
2.1. This Agreement consists of these General Conditions, and any Order Form(s) or Specific Conditions, which prevail over these General Conditions to the extent of any conflict. 2.2. This Agreement forms the entire agreement between the Parties relating to this subject matter, replaces and supersedes any previous proposals, correspondence and understandings, whether written or oral; including any Customer terms and conditions, which shall not apply. 2.3. This Agreement may not be altered, modified, amended, changed, rescinded or discharged in whole or in part, except by written agreement signed by both Customer and Axway. 2.4. Nothing contained in any document or purchase order submitted by Customer shall in any way modify or add to the terms of this Agreement.

ARTICLE 3 TERM
3.1. This Agreement shall remain in effect unless terminated in accordance with Article 17. The right of Use is granted from the Effective Date, or if none stated, upon Delivery by Axway. 3.2. If purchased by Customer, Support Services shall commence on the Effective Date and shall continue for an initial period of one (1) year (Initial Support Term) except as otherwise set forth in the Order Form. Upon expiration of the Initial Support Term, the Support Services shall be automatically renewed for one (1) year periods, with payments required prior to the start of the new support term, unless and until terminated in accordance with Article 17. 3.3. The terms of this Article 3.3 apply if Customer is obtaining an evaluation license. Subject to the terms of this Agreement, Axway grants to Customer (i) a non-exclusive, nontransferable license, without right of sublicense, to install and Use the evaluation version of the Licensed Component, in object code form and/or (ii) the right to Use the Hardware Product for evaluation and trial purposes only. The term of this license begins upon delivery or download and ends thirty (30) days thereafter, or extends for such longer period as Axway shall have agreed to in writing (the “Evaluation Period”). When the Evaluation Period expires Customer must stop Using the Licensed Component, and return any Product to Axway. Axway disclaims all warranties during this Evaluation Period and Customer waives all claims against Axway related to this Evaluation Period.
ARTICLE 4 USE OF THE LICENSED COMPONENT

4.1. As of the Effective Date of this Agreement, Axway grants to Customer, subject to the terms and conditions of this Agreement, a perpetual, non-exclusive, non-assignable and non-transferable right to Use the Licensed Component for Customers own internal business purposes only. Any delay in any payment of the fees related to this Agreement as set forth in Article 8 thirty (30) days beyond the payment date will automatically suspend the right to Use the Licensed Component for Customer, upon written notice by Axway. The Product, including portions and information or materials thereof, may not be used for any purpose that would be a violation of this Agreement. All rights not addressed herein are specifically reserved by Axway. Customer shall not Use the Product to provide services to third parties, including ASP, facilities management, outsourcing, unless expressly provided for in an Order Form. 4.2. If Customer has purchased a license for Products which are used by Customer to distribute to any third party Trading Partner that has a business need to securely transfer files to or from Customer, then the sublicense such Trading Partner has conveys the right to Use the Product for the purpose of transferring files to and from Customer in the furtherance of Customers internal business purposes only. 4.3. If Customer wishes to permanently transfer the Licensed Component to a new Operating Environment, the Order Form associated with this Agreement will have to be updated accordingly. Once the transfer has been made to the new authorized Operating Environment, Customer shall erase the Licensed Component from the former Operating Environment, within the time frame allowed in the Order Form. 4.4. Customer has the right to make one back-up copy of the Licensed Component for archival purpose only. Any other copies, reproductions and summaries of the Licensed Component or Documentation are prohibited.

ARTICLE 5 DELIVERY AND WARRANTY

5.1. Axway shall provide Customer with the Licensed Component in object code form and with the Documentation. Full title to the Hardware Product passes to Customer upon Delivery. Products are delivered Free On Board (FOB) shipping point with freight and insurance prepaid. 5.2. The Use of certain Licensed Components will require a key. The key will be generated by Axway based on computer-dependent Customer information. Customer agrees to provide the necessary information as required to generate and activate the key. 5.3. THE TERMS OF THIS AGREEMENT ARE INSTEAD OF ALL WARRANTIES, CONDITIONS, TERMS, UNDERTAKINGS AND OBLIGATIONS IMPLIED BY STATUTE, COMMON LAW, CUSTOM, TRADE USAGE, COURSE OF DEALING OR OTHERWISE, ALL OF WHICH ARE HEREBY EXCLUDED TO THE FULLEST EXTENT PERMITTED BY LAW.

ARTICLE 6 SUPPORT SERVICES

6.1. Upon payment of the applicable fees, Axway will provide technical Support Services, at the level specified on the Order Form. 6.2. Axway is under no obligation to provide Support Services (i) if there has been a modification or attempted modification of the Product (other than modifications made by Axway and delivered as part of the Product) or the Product has been improperly installed by Customer or operated or used other than in accordance with this Agreement and the Documentation; or (ii) if Customer has refused, delayed or otherwise failed to implement a release or other modification that Axway has provided or recommended.

ARTICLE 7 ADDITIONAL SERVICES

7.1. In accordance with its expertise and availability, Axway will, if ordered by Customer, provide services that may include installation, implementation, technical and training assistance services for the Product, or subscription-based services ("Additional Services") to Customer at the rates set forth in the Order Form or, if no rates are set forth, the rates in effect at the time that such Services are provided. 7.2. Except for Retained Works (defined below), all right and title to professional services deliverables shall belong to Customer. Axway will be the owner of any Retained Works, which are defined to include: (i) any pre-existing materials, including any of Axway's preexisting software code, proprietary software tools, or training materials incorporated into the deliverables; (ii) any customized
modifications to the Licensed Component unless an applicable work order, SOW or other such similar document expressly provides that such modifications are assigned to Customer; and (iii) any third party programs which are integrated with or incorporated into the deliverables. For any Retained Works incorporated into a deliverable, Axway grants Customer a non-exclusive, worldwide, royalty-free license to use such Retained Works to the same extent that Customer is licensed to use any related Licensed Component.

ARTICLE 8 PAYMENT TERMS AND CONDITIONS
8.1. The fees for the Products and Support Services are listed in the Order Form. In addition to the fees listed in the Order Form, Customer shall be responsible for all personal property, sales, use, value-added, withholding and similar taxes (other than taxes on Axway's net income) arising from the transactions described in this Agreement. Where Customer's Use of the Software or receipt of Services is exempt from sales or other taxes, Customer shall provide Axway with the appropriate exemption certificate. All amounts payable under this Agreement shall be paid net thirty (30) days from the invoice date, unless stated otherwise in an Order Form. 8.2. The license fee is fixed and not subject to revision. It shall be invoiced in full on the Effective Date, unless stated otherwise in an Order Form. 8.3. Support Services fees shall be invoiced on the Effective Date and are due net thirty (30) days from the invoice date unless otherwise stated in an Order Form. Support Services fees are subject to annual revision as stated in the relevant Specific Conditions. 8.4. Fees for professional services shall be invoiced at the end of the month in which they are provided. Travel and accommodation expenses incurred to provide training, technical assistance, support and installation services shall be invoiced to Customer based on the actual and reasonable costs incurred by Axway. Supporting documents will be provided upon reasonable request. Fees for professional services are subject to annual revision as stated in the relevant Specific Conditions. 8.5. Fees or other amounts remaining unpaid for thirty (30) days following the date of invoice shall be considered overdue and shall remain payable by Customer together with interest for late payment from the date payable at the rate of 4% per annum above the base rate for the time being of Lloyds TSB Bank plc. In addition to the above provision for late payment, Axway reserves the right to suspend performance of any Additional Services (which includes hosting services, as applicable).

ARTICLE 9 CUSTOMER RESPONSIBILITIES
9.1. Unless the hosted option is selected, Customer shall be responsible for operating the Product and shall: ensure that the hardware, base program, network and operating system configuration are suitable, develop the operating measures, control procedures and security measures required for data backup and replacement in the event of interruption in Product operation, 9.2. Customer is also responsible for: protecting its own recorded data, and the results obtained and any direct or indirect consequences thereof, making qualified personnel available to resolve any problems, and appointing one of its employees to serve as the primary point of contact with Axway for any technical issues

ARTICLE 10 INTELLECTUAL PROPERTY
10.1. Only a right to Use the Licensed Component is granted to Customer; any extension of the right granted shall be subject to Axways prior written consent. The Parties acknowledge and agree that Customer has only Use rights with respect to the Licensed Component, but Customer owns the Hardware Product. Axway retains title in and to the Licensed Component, including any portion thereof and information, materials or copy made from it or any part of it and copyright in the Licensed Component. 10.2. If Customer wishes to make the Product interoperable with other programs, other than as envisaged in the Documentation, Axway may make the necessary information available to Customer upon receipt of a written request. 10.3. Except as otherwise provided for in this Agreement or permitted under applicable law, Customer will not, directly or through any person or entity, in any form or manner (i) copy, sublicense, lease, assign, distribute, reproduce, incorporate, use or allow access to the Product or modify, prepare derivative works from the Licensed Component except as explicitly permitted under this Agreement or (ii) decrypt, extract, decompile or otherwise reverse engineer the Licensed Component, or otherwise disassemble, derive or attempt to derive the source code of, or any processes, methods, specifications, protocols, algorithms, interfaces,
data structures, or other information embodied or used in, the Product. The restrictions of this Article 10 shall survive the termination of the Agreement. If Customer has purchased licenses for a Trading Partner, Customer shall ensure each Trading Partner is bound to provisions at least as protective of Axway as Articles 4, 10, 12, 14 and 15. Customer shall promptly notify Axway of any unauthorized use, disclosure, reproduction, or distribution of any Product, which comes to Customers attention, or which Customer reasonably suspects. Customer may Use any Third Party Software products or modules supplied by Axway solely with the Licensed Component. 10.4. If, in the performance of any Additional Services hereunder, Axway is required to use any Customer supplied programs, Customer hereby warrants that it has obtained any necessary authorizations and licenses required to allow Axway to access and use such program as necessary for performance of the Services. Customer shall provide any associated supporting documentation to Axway promptly upon request.

ARTICLE 11 INDEMNIFICATION

11.1. Axway agrees to defend, settle and indemnify Customer from and against any amounts payable under judgment, court order or settlement brought by any unaffiliated third party against Customer to the extent that such action results from actual or alleged infringement by any Product of any third party copyright, trade secret or patent existing or issued as of the date that Axway initially Delivered the applicable version of such Product to Customer. In connection with any allegation of infringement of any third party rights, Customer shall (and it shall be a condition of reliance upon the indemnity for Customer to): immediately notify Axway in writing of the allegation; and allow Axway sole control of the defense and any related settlement negotiations; and cooperate in good faith in the said defense and comply with all of Axways reasonable requests (at Axways expense) in defending or settling the claim. 11.2. Should Customers use of the Product be determined to have infringed any third party rights, or if in Axways judgment, such use is likely to be infringing, Axway shall endeavor at its option do one of the following, at its own expense: - procure for Customer the right to continue owning and/or using the Product, as applicable, - replace or modify the Product to make its Use non-infringing while yielding substantially equivalent functionality. If and only if the previous options are not, in Axways reasonable judgment, commercially reasonable, then Axway may terminate this Agreement as it applies to the specific Product and the corresponding rights of Use. Customer agrees to destroy or return the affected Product to Axway on its written request and Axway will then return the Product license fees to Customer as prorated over a five (5) year term commencing on the date of Delivery of the applicable Product by Axway. The obligations of Axway in this Article 11 will not apply to the extent that the infringement or claim thereof is based on (i) Use of the Product other than in accordance with this Agreement, or (ii) modifications or additions to the Product by Customer personnel (other than modifications at Axways direction) or (iii) use of other than the most recent version of any Product if and from the time Axway informs Customer in writing that infringement or misappropriation may be avoided by use of the most recent version of such Product. THIS ARTICLE 11 SETS FORTH THE FULL SCOPE OF AXWAYS LIABILITY AND CUSTOMERS EXCLUSIVE REMEDY, TO THE EXTENT PERMITTED BY LAW, FOR ANY ACTUAL OR ALLEGED INFRINGEMENT OF THIRD PARTY RIGHTS IN CONNECTION WITH THE PRODUCT.

ARTICLE 12 LIABILITY

12.1. Axway does not warrant that the Product will operate in combination with other software selected by Customer, or that the Product will operate uninterrupted or free of non-material Defects. The Customer shall promptly inform Axway of any Defect and afford Axway reasonable opportunity to correct the Defect including, without limitation, the option to provide replacement Product, or correct any deficiency in Support Services. 12.2. Except for Axways obligations with respect to indemnification or confidentiality, Axway is not liable for any special, indirect, exemplary, incidental, punitive or consequential damages of any kind, including, without limitation, damages for loss of goodwill, work stoppage, lost profits, lost data or computer hardware or software damage, failure or malfunction, whether or not Axway has been advised of the possibility of such damages; except for Axways obligations with respect to indemnification or confidentiality, Axways liability hereunder shall not exceed the total amount of license and services fees invoiced under this agreement for the software giving rise to
such liability during the calendar year in which the claim arose. The foregoing limitations of liability and disclaimers of damages apply regardless of the form in which an action (legal, equitable or otherwise) may be brought, whether in contract, tort, or otherwise. The limitations of liabilities, disclaimers of warranties, exclusivity of remedies and other limitations set forth herein are an essential element of the bargain between the parties (without which the transactions contemplated by this agreement would not occur) and will apply even if a remedy fails in its essential purpose. Axway's liability for death and personal injury caused by its negligence and any breach of its obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982 will be unlimited 12.3. This Agreement is enforceable by the Parties to it and by their permitted assignees, otherwise a person who is not a party to this Agreement shall have no right to enforce or rely on any of the terms of this Agreement. The terms of this Article 12 shall survive termination of this Agreement.

ARTICLE 13  ADVERTISING
The Customer must include Axway's name any time it refers to the Product. The Customer hereby authorizes Axway to include its name in a customer list.

ARTICLE 14  ADMINISTRATIVE REQUIREMENTS
The Customer is responsible for obtaining any required legal authorizations arising out of Customers particular use of the Products and is responsible for its compliance with applicable data protection legislation.

ARTICLE 15  CONFIDENTIALITY
15.1. Each Party recognizes that under this Agreement either Party may have access to or otherwise receive trade secrets and confidential or proprietary information of the other, including information concerning products, including but not limited to the names of Customers clients, financial or contractual arrangements. All such information shall constitute "Confidential Information". The Products, including any Documentations or portions thereof and information, material or copy derived therefrom, is proprietary and confidential to Axway. Each Party agrees not to use, other than for the purposes for which it was disclosed or divulged the other party's Confidential Information and to limit disclosure of same to those of its employees and independent contractors who have a need to know the same and to use all reasonable endeavors to prevent its disclosure to or access by any third party without the prior written consent of the disclosing party. 15.2. Confidential Information does not include information that: (i) is or becomes a part of the public domain through no act or omission of the receiving Party; (ii) was in the receiving Party's lawful possession prior to the disclosure and had not been obtained by the receiving Party either directly or indirectly from the disclosing Party; (iii) is lawfully disclosed to the receiving Party by a third party without restriction on disclosure; (iv) is independently developed by the receiving Party without reference to the disclosing Party's Confidential Information; or (v) is required to be disclosed by any court of competent jurisdiction or by a governmental or regulatory authority or where there is a legal right, duty or requirement to disclose. In such event, the receiving Party will (and without breaching any legal or regulatory requirement) where reasonably practicable give the disclosing Party prompt notice in writing of the requirement to disclose. 15.3. The rights and obligations of the Parties under this Article 15 shall continue for three (3) years following expiration or termination of this Agreement.

ARTICLE 16  NON-SOLICITATION
16.1. For the duration of this Agreement and for the period of twelve (12) months following its termination or expiration, neither Party shall, without the prior written consent of the other Party, actively endeavor to solicit or entice away any person employed or engaged by the other Party in the performance or administration of this Agreement. 16.2. If a Party breaches the foregoing obligation, the breaching party shall pay to the other Party twelve times the prior monthly base salary of the relevant person, such sum being deemed by both Parties to be fair compensation for the loss suffered as a result of the breach. 16.3. The provisions of Article 16.2 shall not apply to any individual who can be proven to have responded to a bona fide published recruitment advertisement where the
recruited person is not recruited to work for or with a party's personnel or department involved in this Agreement. Nothing in this Article 16 is intended to restrict the right of any individual to seek employment with whomsoever they wish, but is intended to provide for due compensation where such a situation occurs as a result of entering into this Agreement recognizing that loss of experienced personnel can have a serious effect upon any employer.

ARTICLE 17  TERMINATION
17.1. This Agreement may be terminated by either Party immediately upon written notice if the other Party is in material or continuing breach of any of its obligations under this Agreement and fails to remedy that breach (if capable of remedy) within thirty (30) days after receiving written notice of such breach. 17.2. Either Party may terminate this Agreement forthwith on giving written notice to the other Party if such Party has had a receiver or administrative receiver appointed over the whole or any part of its undertaking or assets or passes a resolution for winding up, or a court of competent jurisdiction makes an order to that effect or if the other Party enters into any voluntary arrangement with its creditors or becomes subject to a bankruptcy administration order or ceases to carry on business. 17.3. Upon termination of the Agreement Customer must, depending on the method of Product delivery, either: (i) return the Licensed Component and the Documentation to Axway and destroy or return any copies of the Licensed Component that it may have made within fifteen (15) days from the termination date or (ii) remove all copies of the Licensed Component and certify in writing that all copies have been removed and destroyed. 17.4. After the Initial Support Term or any of the annual renewal of Support Services terms, either Party may terminate the Support Services on six (6) months prior written notice.

ARTICLE 18  WAIVER
The fact that either Party fails to take action after a breach by the other Party of any of its obligations arising hereunder shall not be construed or operate as a waiver of the obligation in question or of any later breach.

ARTICLE 19  SEVERABILITY
If any of the provisions of this Agreement, or any part thereof, is judged to be illegal or unenforceable, the remaining provisions will continue in full force and effect for the remainder of this Agreement and shall not be prejudiced, unless the substantive purpose of this Agreement is thereby frustrated, in which case either Party may terminate this Agreement forthwith on written notice.

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1.651 kubernetes-apimachinery v0.18.6

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1.653 go-difflib v1.0.0

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import: ../../fossene/db/schema/thing.yml
fields:
  site: string
  author: root
1.655 udev v248

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jar/io/netty/internal/tcnative/SSLContext.java
* /opt/ cola/permits/11 04445043_1604978442.53/0/netty- tcnative-boringssl-static-2-0-31-final-sources-
jar/io/netty/internal/tcnative/Buffer.java
* /opt/ cola/permits/11 04445043_1604978442.53/0/netty- tcnative-boringssl-static-2-0-31-final-sources-
jar/io/netty/internal/tcnative/SSL.java
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  * /opt/cola/permits/1104445043_1604978442.53/0/netty-tnative-boringssl-static-2-0-31-final-sources-jar/io/netty/internal/tcnative/SniHostNameMatcher.java
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Manifest-Version: 1.0
BoringSSL-Revision: 243b5cc9e33979ae2afa79eaa4e4c8d59db161d4
Bundle-Description: A Mavenized fork of Tomcat Native which incorporates various patches. This artifact is statically linked to BoringSSL and Apache APR.
Apr-Version: 1.6.5
Automatic-Module-Name: io.netty.tcnative.boringssl
Bundle-License: http://www.apache.org/licenses/LICENSE-2.0
Bundle-SymbolicName: io.netty.tcnative-boringssl-static
Archiver-Version: Plexus Archiver
Built-By: norman
Bnd-LastModified: 1591785325580
Bundle-ManifestVersion: 2
Bundle-Document-URL: http://netty.io/
Bundle-Vendor: The Netty Project
Import-Package: org.eclipse.jetty.npn;version="[1,2)";resolution=optional,sun.nio.ch;resolution=optional,org.eclipse.jetty.alpn;version="[1,2)";resolution=optional
Tool: Bnd-2.1.0.20130426-122213
Export-Package: io.netty.internal.tcnative;version="2.0.31.Final"
Bundle-Name: Netty/TomcatNative [BoringSSL - Static]
Bundle-Version: 2.0.31.Final
BoringSSL-Branch: chromium-stable
Bundle-NativeCode: META-INF/native/libnetty_tcnative.jnilib;osname=macosx;;processor=x86_64
Created-By: Apache Maven Bundle Plugin
Build-Jdk: 1.8.0_252

Found in path(s):
* /opt/cola/permits/1104445043_1604978442.53/0/netty-tcnative-boringssl-static-2-0-31-final-sources-jar/META-INF/MANIFEST.MF
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1.661 go-openapi-spec v0.19.3
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package spec

import "testing"

func TestIntegrationLicense(t *testing.T) {
    license := License{Name: "the name", URL: "the url"}
    const licenseJSON = `{"name":"the name","url":"the url"}`
    const licenseYAML = "name: the name
url: the url"

    assertSerializeJSON(t, license, licenseJSON)
    assertSerializeYAML(t, license, licenseYAML)
    assertParsesJSON(t, licenseJSON, license)
    assertParsesYAML(t, licenseYAML, license)
}

package spec

// License information for the exposed API.
//
// For more information: http://goo.gl/8us55a#licenseObject
type License struct {
    Name string `json:"name,omitempty"
    URL  string `json:"url,omitempty"
}

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  jar/io/netty/handler/codec/http/websocketx/WebSocketDecoderConfig.java
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Q: Is it possible to create derived works of syslog-ng under the GPL/LGPL licenses?

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Q: Do I need to sign a Contributory License Agreement in order for my contribution to be accepted?

A: No, starting with syslog-ng 3.2, you don't need to sign a CLA in order to have your contributions accepted.

Q: Is it possible to create non-free plugins for syslog-ng?

A: Yes. It is our understanding that plugins are derived works of the syslog-ng core but not derived works of other plugins. Thus, non-free plugins are possible, provided they do not link to any of the GPLd plugins.
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1.684 x-text v0.3.4

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1.685 cloud-google-com-go v0.51.0

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package cloud

import (
    "bytes"
    "io/ioutil"
    "os"
    "path/filepath"
    "strings"
    "testing"
)

var sentinels = []string{
    "Copyright",
    "Google",
    `Licensed under the Apache License, Version 2.0 (the "License");`,
    `from https://github.com/golang/pkgsite.
    "third_party/pkgsite/print_type.go": true,
    "third_party/pkgsite/synopsis.go": true,
    `err := filepath.Walk(".", func(path string, fi os.FileInfo, err error) error {
        if err != nil {
            return err
        }

        if ext := filepath.Ext(path); ext != ".go" && ext != ".proto" {
            return nil
        }

        if strings.HasSuffix(path, ".pb.go") {
            // .pb.go files are generated from the proto files.
            // .proto files must have license headers.
            return nil
        }
        // BSD license, which is compatible, is embedded in the file.
        "cmd/go-cloud-debug-agent/internal/debug/elf/elf.go": true,
    }
}

func TestLicense(t *testing.T) {
    t.Parallel()
    skip := map[string]bool{
        // Automatically generated.
        "bigtable/cmd/cbt/cbt/doc.go": true,
    }

    err := filepath.Walk(".", func(path string, fi os.FileInfo, err error) error {
        if err != nil {
            return err
        }

        if ext := filepath.Ext(path); ext != ".go" && ext != ".proto" {
            return nil
        }

        if strings.HasSuffix(path, ".pb.go") {
            // .pb.go files are generated from the proto files.
            // .proto files must have license headers.
            return nil
        }
    })
if skip[path] {
    return nil
}

src, err := ioutil.ReadFile(path)
if err != nil {
    return nil
}

src = src[:300] // Ensure all of the sentinel values are at the top of the file.

// Find license
for _, sentinel := range sentinels {
    if !bytes.Contains(src, []byte(sentinel)) {
        t.Errorf("%v: license header not present. want %q", path, sentinel)
        return nil
    }
}

return nil

}

if err != nil {
    t.Fatal(err)
}

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1.686 jdom 1.1

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