



Software Entitlement

Cisco IOS XR software contains all the supported features for a given release. Before the introduction of software entitlement on Cisco IOS XR software, you could freely activate all available software packages on your network devices and could enable all the bundled features. The same was true for hardware, as well. For example, modular services cards (MSCs) can be programmed to run in 20-Gbps or 40-Gbps modes. Before Release 3.5.0 of Cisco IOS XR software, all MSCs ran in 40-Gbps mode. Software entitlement has been introduced so you pay only for the features that you need today, but can upgrade when necessary while keeping your investment safe. Licensing enables you to purchase individual software features and upgrade hardware capacity in a safe and reliable way.

To locate documentation for other commands that might appear in the course of performing a configuration task, search online in *Cisco IOS XR Commands Master List for the Cisco CRS Router*.

Table 1: Feature History for Software Entitlement

Release	Modification
Release 3.5.0	The software entitlement feature was introduced.
Release 4.3.0	CRS- FP140 license was supported.

This model contains the following topics:

- [What Is Software Entitlement?](#), on page 1
- [Implementing Default Licensing](#), on page 2

What Is Software Entitlement?

Software entitlement is a system that consists of a license manager on a Cisco IOS XR device that manages licenses for various software and hardware features. The license manager parses and authenticates a license before accepting it. The software features on the router use the license manager APIs to check out and release licenses. Licenses are stored in persistent storage on the router.

Core routing features are available for use without any license. The following features can be enabled on your router using licenses:

Layer 3 VPN

Layer 3 (virtual private network) VPN can be configured only if there is an available Layer 3 VPN license for the modular services card (MSC) slot on which the feature is being configured. The Layer 3 VPN

license is included with the MSC, but it must be purchased separately to use with the 40G forwarding processor (CRS-FP40).

See the following modules in *MPLS Configuration Guide for the Cisco CRS Routers* for information about Layer 3 VPN configurations:

- *Implementing MPLS Layer 3 VPNs on the Cisco IOS XR Software*
- *Implementing Virtual Private LAN Services on the Cisco IOS XR Software*

Performance Netflow

The CRS-FP40 card can support down to 1:360 netflow sample rate running 45 Mpps at a 40-Gbps line rate. Without this license, the CRS-FP40 and CRS-FP140 can support down to 1:1500 netflow sample rate. The MSC includes this license.

Advanced Features

Lawful Interception, GRE tunnel, and L2TPv3. The MSC includes this license.

Modular Services Card Bandwidth

Modular services cards (MSCs) can operate at 40-Gbps throughput when a license is enabled. You must use the **hw-module linecard throughput** command to enable 40-Gbps throughput once a license is available.

Scale

The CRS-FP140 can support increased route scale (more than 1 million IPv4 routes) and traffic engineering scale (more than 3,000 tunnels per system using licenses).

Multichassis Support

The CRS-FP140 can support a multichassis system using a license.

Implementing Default Licensing

Prerequisites for Configuring Software Entitlement

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Information About Default (Traditional) Licensing

To configure software license entitlements using the default mode of licensing, you need to understand the concepts described in this module.

Types of Licenses

The following types of licenses are currently defined:

- Permanent licenses—Licenses that enable a designated feature permanently, as long as the license resides on the router.

- **Implicit evaluation licenses**—Set of evaluation licenses that are included with the software image (upgrade or initial install). Like regular evaluation licenses, these are valid for a period of ninety days, but the countdown to expiry starts as soon as the router is booted with an image containing these licenses.

SDR License Pools

License pools are maintained according to secure domain router (SDR). By default, all added licenses are allocated to the owner SDR license pool, and they can be freely allocated to any slot in any SDR. Features on cards belonging to the owner SDR are granted licenses based on availability in the owner SDR license pool.

You can create SDR-specific license pools by using the **license pool create** command. License requests for features running on cards belonging to SDRs with SDR-specific pools are not served from the owner license pool, even if the owner SDR license pool has licenses available. You must allocate licenses from the owner SDR to other SDRs explicitly for these license requests to succeed. Similarly, if a slot in the owner SDR had a feature license and subsequently was moved to some other SDR with an SDR-specific license pool, the feature license stays with the original SDR license pool.

You can explicitly add new licenses to a particular SDR license pool or move available licenses from the owner SDR license pool to any other SDR.

Chassis-Locked Licenses

Licenses are locked to a unique device identifier (UDI). The UDI is comprised of the chassis serial number, along with an additional identifier. The complete set of UDI information can be displayed using the **show license udi** command. The license manager parses the user-provided license and verifies that it is valid for the chassis it is running on and determines if the license is being readded.

Multiple single-chassis Cisco CRS-1 routers can be connected using a fabric chassis to form a multishelf system. In multishelf systems, licenses are locked to the UDI of the individual chassis, but can be used to enable features on any chassis. The list of available licenses for a multishelf system is a collection of all licenses on each contributing chassis.

Slot-Based Licenses

Feature licenses are allocated to router slots and not cards. Therefore, if a card is replaced, the existing license is applied to the newly inserted card. For example, if you have eight licenses for Layer 3 VPN in the system, you can configure Layer 3 VPN features on any eight cards in an SDR, and the licenses are allocated to the slots within which the cards are installed. If a card is removed from one of these licensed slots, say slot 3, and entered into an empty slot with no license, say slot 5, the license remains with slot 3 and the feature cannot be activated on slot 5 with the permanent license entered earlier by the user. In this case, you can release the license to the appropriate license pool by removing the configuration of the card (while it is inserted), or by using the **license move slot** command. When you configure the feature on slot 5, the license is checked out.

Using Implicit Licenses After a Software Image Upgrade

When you upgrade your Cisco IOS XR software image from a release that does not support software entitlement to one that does, you are provided with implicit licenses to use for all configured features in your original configuration. This enables you to upgrade your software without worrying about the implications of software entitlement.

Implicit licenses are good for a period of 90 days. As soon as the new image boots, the license manager displays a syslog message to the console once a day, indicating that an implicit license is being used and must

be replaced with a permanent license. This frequency increases to once an hour on the last day before the expiry of the implicit licenses, to ensure that you do not miss it.

Before your implicit licenses expire, you should purchase licenses for all features that you want to keep running.

Features that Require Licenses After a Software Image Upgrade

When you upgrade your Cisco IOS XR software image from a release that does not support software entitlement to one that does, a warning message is displayed to the console port for each feature that requires a license. You must acquire either an evaluation license or a permanent license in order to continue using any features that require a license.

During an install activate operation, if the installation fails to acquire a license (through the license manager) for a package that requires licensing then the install operation is allowed but a warning message similar to the following is displayed:

```
Fri Nov 20 15:26:52.311 UTC

Install operation 3 started by user 'lab' via CLI at 15:21:18
UTC Fri Nov 20 2009.
(admin) install activate disk0:hfr-mcast-p-4.0.0.3P disk0:hfr-mgbl-p-4.0.0.3P
Install operation 3 completed successfully at 15:25:21 UTC Fri Nov 20 2009.

Install logs:
  Install operation 3 '(admin) install activate disk0:hfr-mcast-p-4.0.0.3P
    disk0:hfr-mgbl-p-4.0.0.3P' started by user 'lab' via CLI at 15:21:18 UTC
    Fri Nov 20 2009.
  Warning: There is no valid license for the following packages:
  Warning:
  Warning:      disk0:hfr-mcast-supp-4.0.0.3P
  Warning:      disk0:hfr-mgbl-supp-4.0.0.3P
  Warning:
  Info:      The following sequence of sub-operations has been determined to
  Info:      minimize any impact:
  Info:
  Info:      Sub-operation 1:
  Info:          Install Method: Parallel Process Restart
  Info:          hfr-mcast-supp-4.0.0.3P
  Info:          iosxr-mcast-4.0.0.3P
  Info:
  Info:      Sub-operation 2:
  Info:          Install Method: Parallel Process Restart
  Info:          hfr-mgbl-supp-4.0.0.3P
  Info:          iosxr-mgbl-4.0.0.3P
  Info:
  Info:      The changes made to software configurations will not be
  Info:      persistent across system reloads. Use the command '(admin)
  Info:      install commit' to make changes persistent.
  Info:      Please verify that the system is consistent following the
  Info:      software change using the following commands:
  Info:          show system verify
  Info:          install verify packages
  Install operation 3 completed successfully at 15:25:21 UTC Fri Nov 20 2009.
```

If you activate an SMU whose corresponding package requires a license but a license was not acquired successfully, then the install operation is allowed but a warning message similar to the following is displayed:

```
Wed Nov 25 15:02:23.418 PST
```

```
Install operation 8 started by user 'lab' via CLI at 14:59:46 PST Wed Nov 25 2009.
(admin) install activate id 7
Install operation 8 completed successfully at 15:02:13 PST Wed Nov 25 2009.
```

Install logs:

```
Install operation 8 '(admin) install activate id 7' started by user 'lab'
via CLI at 14:59:46 PST Wed Nov 25 2009.
Info: This operation will activate the following packages:
Info: disk0:comp-crs1-4.0.0.3P.CSCee40001-1.0.0
Info: disk0:comp-crs1-4.0.0.3P.CSCee30001-1.0.0
Info: disk0:comp-crs1-4.0.0.3P.CSCee20001-1.0.0
Info: disk0:comp-crs1-4.0.0.3P.CSCee10001-1.0.0
Info: The following SMUs are not being activated as they do not apply to
Info: any packages on the router:
Info:
Info: disk0:hfr-diags-sup-4.0.0.3P.CSCee30001-1.0.0
Info: disk0:hfr-fpd-4.0.0.3P.CSCee40001-1.0.0
Info:
Warning: There is no valid license found for package 'disk0:hfr-mcast-sup-4.0.0.3P'
Warning: when activating SMU 'disk0:hfr-mcast-sup-4.0.0.3P.CSCee10001-1.0.0'.
Warning: There is no valid license found for package 'disk0:hfr-mgbl-sup-4.0.0.3P'
Warning: when activating SMU 'disk0:hfr-mgbl-sup-4.0.0.3P.CSCee20001-1.0.0'.
Warning:
Info: The following sequence of sub-operations has been determined to minimize any
Info: impact:
Info: Sub-operation 1:
Info: Install Method: Parallel Process Restart
Info: hfr-mcast-sup-4.0.0.3P.CSCee10001-1.0.0
Info:
Info: Sub-operation 2:
Info: Install Method: Parallel Process Restart
Info: hfr-mgbl-sup-4.0.0.3P.CSCee20001-1.0.0
Info:
Info: The changes made to software configurations will not be persistent
Info: across system reloads. Use the command '(admin) install commit' to
Info: make changes persistent.
Info: Please verify that the system is consistent following the software
Info: change using the following commands:
Info: show system verify
Info: install verify packages
Install operation 8 completed successfully at 15:02:13 PST Wed Nov 25 2009.
```

Configure Licenses Using Default Licensing

Adding a License for a New Feature

This task describes how to acquire a permanent license for a feature that you have purchased or an evaluation license for a feature that you have arranged with your sales representative to try. Use this procedure to replace implicit or evaluation licenses with permanent licenses.



Note Evaluation licenses cannot be installed if permanent licenses for the same feature are valid on the chassis. Also note that if you add a permanent license to a chassis, all evaluation or implicit licenses of the same type are disabled.

Before you begin

You must have purchased the feature for which you are adding the license. When you purchase the feature, you are provided with a product authorization key (PAK) that you use to download the license.



Note All implicit or evaluation licenses for a feature are disabled when at least one permanent license for a feature is added to the router. This is true even if you had more evaluation licenses than permanent licenses.

SUMMARY STEPS

1. **admin**
2. **show license udi**
3. <http://www.cisco.com/go/license>
4. Copy the license to your TFTP server.
5. **admin**
6. **license add** *license-name* [**sdr** *sdr-name*]
7. **configure**
8. **license** *license-name* **location** {**all** | *node-id*}
9. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	show license udi Example: RP/0/RP0/CPU0:P1_CRS-8(admin)# show license udi Tue Jul 14 03:22:21.829 PST Local Chassis UDI Information: PID : CRS-8-LCC S/N : TBA09370035 Operation ID: 0	Displays the UDI of the chassis. This consists of a product identifier (PID), serial number (S/N), and operation identifier (Operation ID).
Step 3	http://www.cisco.com/go/license	Go to the license tool on Cisco.com. You must log in to the site before you can access the license tool. Follow the instructions for product license registration. You are required to enter the feature PAK and the chassis UDI to acquire the license.

	Command or Action	Purpose
		Note If you are installing a permanent license, you should have received the PAK when you purchased the feature. If you are installing an evaluation license, your sales representative should provide you with the PAK.
Step 4	Copy the license to your TFTP server.	You will be issued a license. You can copy the license and store it on your computer, or alternatively, you can request that the license be sent to you in an e-mail. When you have received the license, copy it to a TFTP server that is accessible by your router.
Step 5	admin Example: RP/0/RP0/CPU0:router# admin	Enters administration EXEC mode.
Step 6	license add license-name [sdr sdr-name] Example: RP/0/RP0/CPU0:router(admin)# license add tftp://192.10.10.10/mylicenses/lc40g_lic	Adds the license to the SDR license pool. By default, the license is added to the owner SDR license pool.
Step 7	configure Example: RP/0/RP0/CPU0:router(admin)# configure	Enters administration configuration mode.
Step 8	license license-name location {all node-id} Example: RP/0/RSP0/CPU0:router(admin-config)# license A9K-ADV-OPTIC-LIC location 0/0/CPU0	Binds the license to the slot where it is to be used.
Step 9	exit Example: RP/0/RP0/CPU0:router(admin)# exit	Exits administration EXEC mode.

What to do next

To use the feature associated with the added license, you must configure it on your router. To configure Layer 3 VPN, see the *Implementing MPLS Layer 3 VPNs on Cisco IOS XR Software* module in *MPLS Configuration Guide for the Cisco CRS Routers*.

To verify that your MSC is operating at 40-Gbps throughput, use the **show hw-module linecard throughput** command. To verify that your Layer 3 VPN configuration is operational, use the **show rsi interface all global** command.

Enabling 40-Gbps Throughput on an MSC

To configure a modular services card (MSC) to operate at 40-Gbps throughput, perform the following task. This must be performed when you add permanent licenses to your router to replace implicit licenses. It also must be performed if you are purchasing a new license for 40-Gbps throughput after using the MSC with the default 20-Gbps throughput.



Note When you upgrade your image from an image that does not support software entitlement to one that does, all existing MSCs default to the 40-Gbps configuration as long as there are active implicit licenses. When the implicit licenses expire, the configuration reverts to the default 20-Gbps.

Before you begin

You must have a license on your system for 40-Gbps throughput to enable this feature. This could be an implicit license, evaluation license, or permanent license.

SUMMARY STEPS

1. **configure**
2. **hw-module linecard throughput 40 location *node-id***
3. **commit**
4. **show hw-module linecard throughput**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RP0/CPU0:router# configure	Enters global configuration mode.
Step 2	hw-module linecard throughput 40 location <i>node-id</i> Example: RP/0/RP0/CPU0:router(config)# hw-module linecard throughput 40 location 0/6/0	Enables 40-Gbps throughput on the MSC in the specified <i>node-id</i> . If this command is not added to your configuration, the MSC continues to work at 20 Gbps, even if you have a valid license.
Step 3	commit	
Step 4	show hw-module linecard throughput Example: RP/0/RP0/CPU0:router# show hw-module linecard throughput	Displays the operational throughput on the MSCs in the router.

Examples

The following example shows sample output from the **show hw-module linecard throughput** command. In this example, the MSC in slot 6 has no license to run at 40 Gbps, while the MSC in slot 1 has a license and is operating at 40 Gbps.


```
RP/0/RP0/CPU0:router# show hw-module linecard throughput

----- Throughput -----
Location          Configured      Lic Acquired    Operating
0/6/CPU0          no config       No              20G
0/1/CPU0          no config       Yes             40G
```

Backing Up Licenses

When your router is configured with the licenses that you require, you should perform this task to back up all licenses. Backing up licenses makes it easier to restore them if there is a problem.

SUMMARY STEPS

1. **admin**
2. **license backup** *backup-file*
3. **show license backup** *backup-file*

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	license backup <i>backup-file</i> Example: RP/0/RP0/CPU0:router(admin)# license backup disk1:/license_back License command "license backup disk1:/license_back" completed successfully.	Backs up all licenses on the router to a backup file in the specified location. The backup file can be a local file or a remote file on a TFTP or RCP server.
Step 3	show license backup <i>backup-file</i> Example: RP/0/RP0/CPU0:router(admin)# show license backup disk1:/license_back	Displays the contents of the backup file.

Examples

The following example shows sample output from the **show license backup** command.

```
RP/0/RP0/CPU0:router(admin)# show license backup disk1:/license_back
```

```

Local Chassis UDI Information:
  S/N       : TBA09370035
  Operation ID: 5
Licenses   :
FeatureID  Type                #installed
CRS-MS-40G Slot based,      Permanent    2
XC-L3VFN   Slot based,      Permanent    1

```

Restoring Licenses

If your licenses become corrupted, and you have previously created a backup of your licenses, you can perform this task to restore the licenses to your router.

Before you begin

You must have created a backup file of your licenses before you can restore them on your router.

SUMMARY STEPS

1. **admin**
2. **show license backup** *backup-file*
3. **license restore** *backup-file*

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	show license backup <i>backup-file</i> Example: RP/0/RP0/CPU0:router(admin)# show license backup disk1:/license_back	Displays the contents of the backup file. You should verify the contents of the backup file before you restore your licenses.
Step 3	license restore <i>backup-file</i> Example: RP/0/RP0/CPU0:router(admin)# license restore disk1:/license_back	Restores all licenses on the router from a backup file in the specified location. This can be a local file, or a remote file on a TFTP or RCP server.

Examples

This example shows sample output from the **license restore** command.

```

RP/0/RP0/CPU0:router(admin)# license restore disk1:/license_back

Info: This command will erase all existing licenses.
Info: It is strongly recommended to backup existing licenses first.
Do you wish to proceed? [yes/no]: y

```

License command "license restore disk1:/license_back" completed successfully.

Transferring Licenses to a new Route Switch Processor 440

To upgrade a route switch processor (RSP) to the RSP440 with your active licenses, perform this task.

SUMMARY STEPS

1. Save the original license file that you received from Cisco, in a USB drive or TFTP server.
2. **save configuration running**
3. Replace the RSP with the RSP440.
4. **load**
5. Add all licenses as described in [Adding a License for a New Feature, on page 5](#).

DETAILED STEPS

	Command or Action	Purpose
Step 1	Save the original license file that you received from Cisco, in a USB drive or TFTP server.	Stores the license files in a location that is accessible to the new RSP after it is installed.
Step 2	<p>save configuration running</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# configure RP/0/RP0/CPU0:router(config)# save configuration running tftp://192.10.10.10/mylicenses/rc_03132013 RP/0/RP0/CPU0:router(config)# exit RP/0/RP0/CPU0:router# admin RP/0/RP0/CPU0:router(admin)# configure RP/0/RP0/CPU0:router(admin-config)# save configuration running tftp://192.10.10.10/mylicenses/rc_admin_03132013</pre>	Saves the running-configuration from both global configuration and administration configuration modes to files. The administration configuration contains user group information that is required for the licenses.
Step 3	Replace the RSP with the RSP440.	
Step 4	<p>load</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# configure RP/0/RP0/CPU0:router(config)# load tftp://192.10.10.10/mylicenses/rc_03132013 RP/0/RP0/CPU0:router(config)# exit RP/0/RP0/CPU0:router# admin RP/0/RP0/CPU0:router(admin)# configure RP/0/RP0/CPU0:router(admin-config)# load tftp://192.10.10.10/mylicenses/rc_admin_03132013</pre>	Loads the saved running-configuration files on the new RSP440. This must be done in both global configuration mode and administration configuration mode.
Step 5	Add all licenses as described in Adding a License for a New Feature, on page 5 .	Installs the licenses to the new RSP.

Upgrading Line Cards and Licenses

You may have a number of licenses running on the line cards in your router. Before you upgrade these line cards to advanced models, you need to install new licenses that are appropriate for these line cards. This task describes the steps necessary to upgrade your line cards and their licenses.

Before you begin

- You must have purchased all relevant licenses for the line cards that you are upgrading, prior to performing this task.
- You must have placed the license files on your router disk drive or a TFTP server such that they are accessible from your router. Refer to [Adding a License for a New Feature, on page 5](#) for more information.

SUMMARY STEPS

1. **admin**
2. **license add** *license-name*
3. **configure**
4. Remove the old line cards and install the new ones.
5. **show license**

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	license add <i>license-name</i> Example: RP/0/RP0/CPU0:router(admin)# license add tftp://192.10.10.10/mylicenses/A9K-24X10G-AIP-TR-lic	Adds the license to the SDR license pool. By default, the license is added to the owner SDR license pool.
Step 3	configure Example: RP/0/RP0/CPU0:router(admin)# configure	Enters administration configuration mode.
Step 4	Remove the old line cards and install the new ones.	Associates the new license on the slot with the new line card. Note You need to wait for the new line cards to boot.
Step 5	show license Example: RP/0/RP0/CPU0:router# show license	Verifies the status of the licenses. Note Old licenses remaining on the router are not a problem.

Command or Action	Purpose
<pre>Thu May 31 08:52:39.876 PST FeatureID: A9K-24X10G-AIP-TR (Slot based, Permanent) Total licenses 1 Available for use 0 Allocated to location 0 Active 1 Store name Permanent Store index 3 Pool: Owner Total licenses in pool: 1 Status: Available 0 Operational: 1 Locations with licenses: (Active/Allocated) [SDR] 0/0/CPU0 (1/0) [Owner]</pre>	

Troubleshooting License Issues after a Software Upgrade

In the instance that you were running Cisco IOS XR Release 3.9.0 and had the optic feature enabled on a interface and the A9K-ADV-OPTIC-LIC license was active on a particular slot, when you upgrade to Cisco IOS XR Release 4.0.0, the A9K-ADV-OPTIC-LIC license is still active, but you may get the following warning message:

```
RP/0/RSP0/CPU0:Jul 27 14:22:22.594 : licmgr[236]:
%LICENSE-LICMGR-4-PACKAGE_LOCATION_LICENSE_INVALID :
Feature associated to package A9K-ADV-OPTIC-LIC configured
on node 0/4/CPU0 without a valid license
```

To solve this issue, configure the **license** command in administration EXEC mode. This binds the A9K-ADV-OPTIC-LIC license to the slot on which you are using the license. For example:

```
RP/0/RSP0/CPU0:router(admin-config)# license A9K-ADV-OPTIC-LIC location 0/4/CPU0
RP/0/RSP0/CPU0:router(admin-config)# commit
```

