



# Software Entitlement on the Cisco IOS XR Software

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. 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.

For complete descriptions of the commands listed in this module, see [Related Documents, on page 12](#). 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 XR 12000 Series Router*.

**Table 1: Feature History for Software Entitlement**

Release	Modification
Release 3.5.0	The software entitlement feature was introduced.
Release 3.6.0	Support for the following features was added to software entitlement: <ul style="list-style-type: none"><li>• Cisco XR 12000 SIP-401 throughput</li><li>• Cisco XR 12000 SIP-501 throughput</li><li>• Cisco XR 12000 SIP-601 throughput</li></ul>

This model contains the following topics:

- [What Is Software Entitlement?, page 2](#)
- [Implementing Default Licensing, page 2](#)
- [Additional References, page 12](#)

# 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:

## Throughput on Cisco XR 12000 SIP

By default, Cisco XR 12000 SIPs operate at either 2.5 Gbps or 5 Gbps. To increase the throughput from 2.5 Gbps to 5 Gbps a 2.5 G to 10 G license must be available. To increase the throughput from 5 Gbps to 10 Gbps, a 5 G to 10 G license must be available. In addition, you must use the **hw-module linecard throughput** command once a license is available.

## Related Topics

[Enabling 10-Gbps Throughput on a SIP, on page 7](#)

# 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.

## 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.

**Related Topics**

[Adding a License for a New Feature, on page 5](#)

[Troubleshooting License Issues after a Software Upgrade, on page 11](#)

**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:c12k-mcast-p-4.0.0.3P disk0:c12k-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:c12k-mcast-p-4.0.0.3P
    disk0:c12k-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:c12k-mcast-supp-4.0.0.3P
  Warning:      disk0:c12k-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: c12k-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: c12k-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-c12k-4.0.0.3P.CSCee40001-1.0.0
Info:   disk0:comp-c12k-4.0.0.3P.CSCee30001-1.0.0
Info:   disk0:comp-c12k-4.0.0.3P.CSCee20001-1.0.0
Info:   disk0:comp-c12k-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:c12k-diags-supp-4.0.0.3P.CSCee30001-1.0.0
Info:   disk0:c12k-fpd-4.0.0.3P.CSCee40001-1.0.0
Info:
Warning: There is no valid license found for package 'disk0:c12k-mcast-supp-4.0.0.3P'

Warning: when activating SMU 'disk0:c12k-mcast-supp-4.0.0.3P.CSCee10001-1.0.0'.
Warning: There is no valid license found for package 'disk0:c12k-mgbl-supp-4.0.0.3P'
Warning: when activating SMU 'disk0:c12k-mgbl-supp-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:   c12k-mcast-supp-4.0.0.3P.CSCee10001-1.0.0
Info:
Info: Sub-operation 2:
Info:   Install Method: Parallel Process Restart
Info:   c12k-mgbl-supp-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.

```

### Related Topics

[Adding a License for a New Feature, on page 5](#)

## 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
<b>Step 1</b>	<b>admin</b>  <b>Example:</b> RP/0/0/CPU0:router# admin	Enters administration EXEC mode.
<b>Step 2</b>	<b>show license udi</b>  <b>Example:</b> RP/0/0/CPU0:router(admin)# show license udi  Mon Jul 13 12:14:58.145 PST  Local Chassis UDI Information: PID : GSR6/120 S/N : TBM10421465 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).
<b>Step 3</b>	<a href="http://www.cisco.com/go/license">http://www.cisco.com/go/license</a>	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.  <b>Note</b> 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.

	Command or Action	Purpose
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	<b>admin</b>  <b>Example:</b> RP/0/0/CPU0:router# admin	Enters administration EXEC mode.
Step 6	<b>license add license-name [ sdr sdr-name ]</b>  <b>Example:</b> RP/0/0/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	<b>configure</b>  <b>Example:</b> RP/0/0/CPU0:router(admin)# configure	Enters administration configuration mode.
Step 8	<b>license license-name location {all   node-id}</b>  <b>Example:</b> 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	<b>exit</b>  <b>Example:</b> RP/0/0/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 *Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router*.

To verify that your Layer 3 VPN configuration is operational, use the **show rsi interface all global** command.

## Enabling 10-Gbps Throughput on a SIP

The default throughput for the Cisco XR 12000 SIP-401 is 2.5 Gbps; for the Cisco XR 12000 SIP-501 it is 5 Gbps. You can configure a Cisco XR 12000 SIP-401 to run at 5 Gbps using a single 2.5 G to 5 G license. You can configure the Cisco XR 12000 SIP-400 to run at 10 Gbps using a single 2.5 G to 10 G license, or

using a 2.5 G to 5 G license together with a 5 G to 10 G license. A Cisco XR 12000 SIP-501 can be configured to run at 10 Gbps using a single 5 G to 10 G license.



**Note** The Cisco XR 12000 SIP-601 operates at 10 Gbps throughput by default and does not require any additional configuration or license.

To configure a Cisco XR 12000 SPA interface processor (SIP) to operate at increased throughput, perform the following task. This must be performed when you add permanent licenses to your router or use implicit licenses.



**Note** When you upgrade your image from an image that does not support software entitlement to one that does, all existing SIPs default to their default throughput.

### Before You Begin

You must have a license on your system for increased 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 location *node-id* { 5g | 10g }**
3. **commit**
4. **show hw-module linecard throughput**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b>	
<b>Step 2</b>	<b>hw-module linecard throughput location <i>node-id</i> { 5g   10g }</b>  <b>Example:</b> RP/0/0/CPU0:router(config)# hw-module linecard throughput location 0/2/CPU0 10g	Enables 5-Gpbs or 10-Gpbs throughput on the SIP in the specified node ID. If this command is not added to your configuration, the SIP continues to work at the default throughput, even if you have a valid license.
<b>Step 3</b>	<b>commit</b>	
<b>Step 4</b>	<b>show hw-module linecard throughput</b>  <b>Example:</b> RP/0/0/CPU0:router# show hw-module linecard throughput	Displays the operational throughput of the line cards in the router.

## Examples

The following example shows sample output from the **show hw-module linecard throughput** command. In this example, the line cards in slots 1, 3, and 5 are configured to operate at increased throughput.

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

Location	----- Throughput -----			
	Lic Acquired	Operating	Configured	Default
0/4/CPU0	No	10G	--	10G
0/2/CPU0	No	10G	--	10G
0/3/CPU0	Yes	10G	10G	2.5G
0/1/CPU0	Yes	5G	5G	2.5G
0/5/CPU0	Yes	10G	10G	5G
0/6/CPU0	No	2.5G	--	2.5G
0/7/CPU0	No	5G	--	5G

## 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
<b>Step 1</b>	<b>admin</b>  <b>Example:</b> RP/0/0/CPU0:router# admin	Enters administration EXEC mode.
<b>Step 2</b>	<b>license backup</b> <i>backup-file</i>  <b>Example:</b> RP/0/0/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.

	Command or Action	Purpose
<b>Step 3</b>	<p><b>show license backup</b> <i>backup-file</i></p> <p><b>Example:</b></p> <pre>RP/0/0/CPU0:router(admin)# show license backup disk1:/license_back</pre>	Displays the contents of the backup file.

## Examples

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

```
RP/0/0/CPU0:router(admin)# show license backup disk0a:/usr/lic_backup
Tue Dec 1 14:41:33.632 PST

Local Chassis UDI Information:
S/N      : TBA09170127
Operation ID: 4

FeatureID: 12K-SIP-UP-501-601 (Slot based, Permanent)
Total licenses 1
Pool: Owner 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	<b>admin</b>  <b>Example:</b> RP/0/0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	<b>show license backup backup-file</b>  <b>Example:</b> RP/0/0/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	<b>license restore backup-file</b>  <b>Example:</b> RP/0/0/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/0/0/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.
```

## 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
```

## Additional References

The following sections provide references related to Cisco IOS XR software entitlement.

### Related Documents

Related Topic	Document Title
Cisco IOS XR software entitlement commands	<i>Software Entitlement Commands on the Cisco IOS XR Software module of Cisco IOS XR System Management Command Reference for the Cisco XR 12000 Series Router</i>
Layer 2 VPN configuration	<i>Implementing MPLS Layer 2 VPNs module of Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router</i>
Layer 3 VPN configuration	<i>Implementing MPLS Layer 3 VPNs on the Cisco IOS XR Software module of Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router</i>
Cisco IOS XR software commands	<i>Cisco IOS XR Commands Master List for the Cisco XR 12000 Series Router</i>
Information on getting started with Cisco IOS XR software	<i>Cisco IOS XR Getting Started Guide for the Cisco XR 12000 Series Router</i>
Information about user groups and task IDs	<i>Configuring AAA Services on the Cisco IOS XR Software module of Cisco IOS XR System Security Configuration Guide for the Cisco XR 12000 Series Router</i>

### Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

### MIBs

MIBs	MIBs Link
—	To locate and download MIBs using Cisco IOS XR software, use the Cisco MIB Locator found at the following URL and choose a platform under the Cisco Access Products menu: <a href="http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml">http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml</a>

**RFCs**

<b>RFCs</b>	<b>Title</b>
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

**Technical Assistance**

<b>Description</b>	<b>Link</b>
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	<a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a>

