



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. 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.

The licensing methods supported on Cisco IOS XR software are:

- Smart Licensing
- Default (traditional) Licensing

To locate documentation for other commands that might appear in the course of performing a configuration task, search online in *Cisco ASR 9000 Series Aggregation Services Router Commands Master List*.

Table 1: Feature History for Software Entitlement

Release	Modification
Release 3.9.0	The software entitlement feature was introduced.
Release 4.3.1	NV Satellite license was supported.
Release 5.2.0	Smart Licensing was introduced.
Release 5.3.1	Support for Smart Licensing was introduced on Cisco ASR 9000 High Density 100GE Ethernet line cards. General availability release for Smart Licensing on ASR 9000.

This model contains the following topics:

- [What Is Software Entitlement?, on page 2](#)
- [Implementing Smart Licensing, on page 3](#)
- [Consumption Model, on page 15](#)
- [Implementing Default Licensing, on page 19](#)

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 line card slot on which the feature is being configured. If the advanced IP license is enabled, 4096 Layer 3 VPN routing and forwarding instances (VRFs) can be configured on a line card. If the infrastructure VRF license is enabled, eight Layer 3 VRFs can be configured on the line card.

To activate the Infrastructure VRF license, you need to configure two interfaces or sub-interfaces in separate VRFs, with at least one physical interface in each of the VRFs.

The key is to have multiple (two or more) user-defined VRFs configured in at least one slot and at least one physical interface in each user-defined VRF; and repeated for each slot.

In a non-consumption model line card, configuring a physical interface in multiple VRFs would consume a L3VPN license. However, configuring other virtual interfaces (such as management, bundle, or BVI interfaces) in multiple VRFs would not consume L3VPN license.

See the following modules in *MPLS Configuration Guide for Cisco ASR 9000 Series Routers* for information about Layer 3 VPN configurations:

- *Implementing MPLS Layer 3 VPNs on the Cisco ASR 9000 Series Router*
- *Implementing Virtual Private LAN Services on the Cisco ASR 9000 Series Router*

G.709

If a G.709 license is available, G.709 can be enabled on 10-Gigabit Ethernet interfaces on the following line cards:

- 2-port 10 Gigabit Ethernet / 20-port Gigabit Ethernet line card
- 8-port 10 Gigabit Ethernet line card
- 24-port 10 Gigabit Ethernet line card
- 36-port 10 Gigabit Ethernet line card
- 4-port 10 Gigabit Ethernet modular port adapter
- 2-port 10 Gigabit Ethernet modular port adapter

Refer to the *Configuring Dense Wavelength Division Multiplexing Controllers on the Cisco ASR 9000 Series Router* module in *Interface and Hardware Component Configuration Guide for Cisco ASR 9000 Series Routers*.

Video Monitoring

Video monitoring can be enabled for the Cisco ASR 9000 chassis by using a video monitoring license.

Satellite Network Virtualization (nV)

The Satellite nV license entitles satellite devices to connect to the Cisco ASR 9000 chassis. Satellite licenses are chassis licenses, and can provide the ability for one, five or 20 satellites to connect to a Cisco ASR 9000 host remotely.



Note Smart Licensing is supported on a cluster set-up. There are two A9K-NV-CLUSTER-LIC licenses required/requested, one for each of the chassis.

Implementing Smart Licensing

Information About Smart Licensing

Smart Licensing is a cloud-based, software license management solution that enables you to automate time-consuming, manual licensing tasks. The solution allows you to easily track the status of your license and software usage trends.

Smart Licensing helps simplify three core functions:

- **Purchasing:** The software that you have installed in your network can automatically self-register themselves, without Product Activation Keys (PAKs).
- **Management:** You can automatically track activations against your license entitlements. Additionally, there is no need to install the license file on every node. You can create license pools (logical grouping of licenses) to reflect your organization structure. Smart Licensing offers you Cisco Smart Software Manager, a centralized portal that enables you to manage all your Cisco software licenses from one centralized website. [Cisco Smart Software Manager Overview](#), on page 13 provides details.
- **Reporting:** Through the portal, Smart Licensing offers an integrated view of the licenses you have purchased and what has been actually deployed in your network. You can use this data to make better purchase decisions, based on your consumption.

Smart Versus Traditional Licensing

Traditional (node locked) licencing	Smart (dynamic) licencing
You must procure the license and manually install it on the device.	Your device initiates a call home and requests the licenses it needs. <i>Configuring Call Home on the Cisco ASR 9000 Series Router</i> describes the Smart Call Home feature.
Node-locked licences - license is associated with a specific device.	Pooled licences - licences are company account-specific, and can be used with any compatible device in your company. You can activate or deactivate different types of licenses on the device without actually installing a license file on the device.
No common install base location to view licenses purchased or software usage trends	Licenses are stored securely on Cisco servers accessible 24x7x365.

No easy means to transfer licenses from one device to another.	Licenses can be moved between product instances without a license transfer. This greatly simplifies the reassignment of a software license as part of the Return Material Authorization (RMA) process.
Limited visibility into all software licenses being used in the network. Licenses are tracked only on per node basis.	Complete view of all Smart Software Licenses used in the network using a consolidated usage report of software licenses and devices in one easy-to-use portal.

[Traditional Licensing Consideration in Smart Licensing, on page 15](#) describes the scenarios in which you may want to retain the default mode of licensing. It also explains what happens to your traditional license files if you choose to switch to Smart Licensing.

Create a Cisco Smart Account

Cisco Smart Account is an account where all products enabled for Smart Licensing are deposited. Cisco Smart Account allows you to manage and activate your licenses to devices, monitor license use, and track Cisco license purchases. Through transparent access, you have a real-time view into your Smart Licensing products. IT administrators can manage licenses and account users within your organization's Smart Account through the Smart Software Manager.

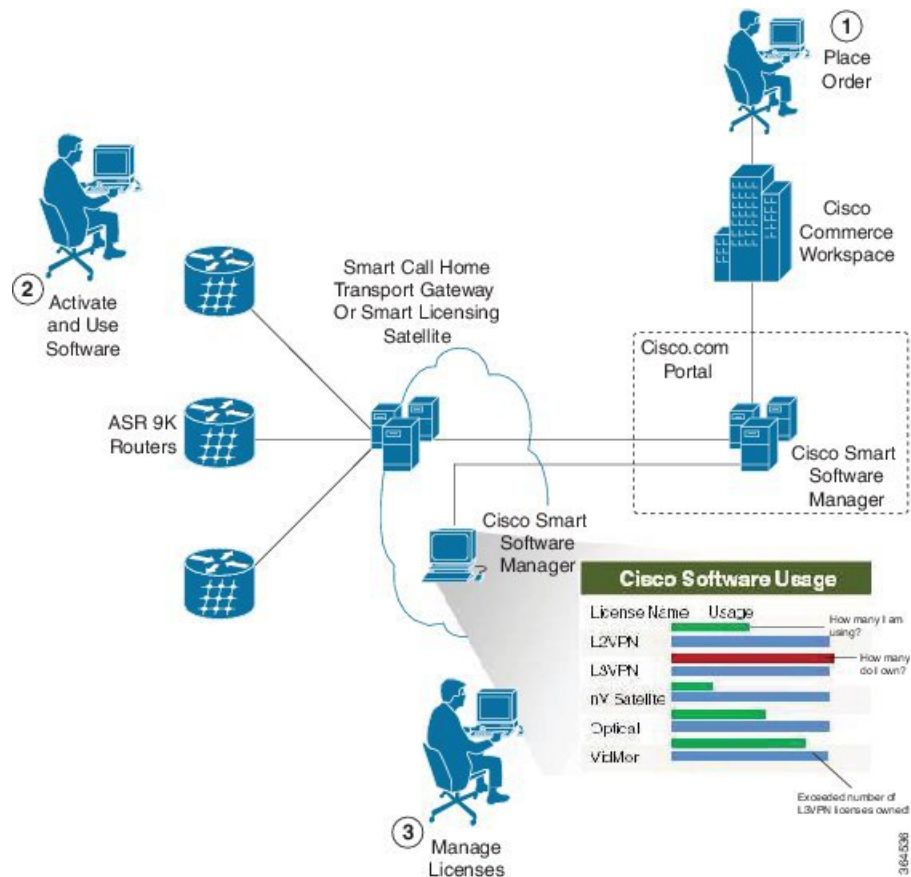
You can create your Cisco Smart Account at this webpage: <https://webapps.cisco.com/software/company/smartaccounts/home#accountcreation-account/request>.

For information on how to create a Cisco Smart Account, see: <http://www.cisco.com/c/en/us/products/collateral/software/one-software/solution-overview-c22-733273.html>.

Smart Licensing Working

Smart Licensing involves the three steps shown in the illustration below, that depicts the working model of the Smart Licensing.

Figure 1: Smart Licensing - Example



- **Setting up Smart Licensing:** You can place the order for Smart Licensing, to manage licenses on Cisco.com portal. You agree to the terms and conditions governing the use and access of Smart Licensing in the Smart Software Manager portal at <http://www.cisco.com/c/en/us/products/collateral/software/one-software/solution-overview-c22-733273.html>.
- **Enabling and Use Smart Licensing:** Follow the steps to enable Smart Licensing. *Smart Licensing Workflow* provides an illustration.

After you enable Smart Licensing, you can use either of the following options to communicate:

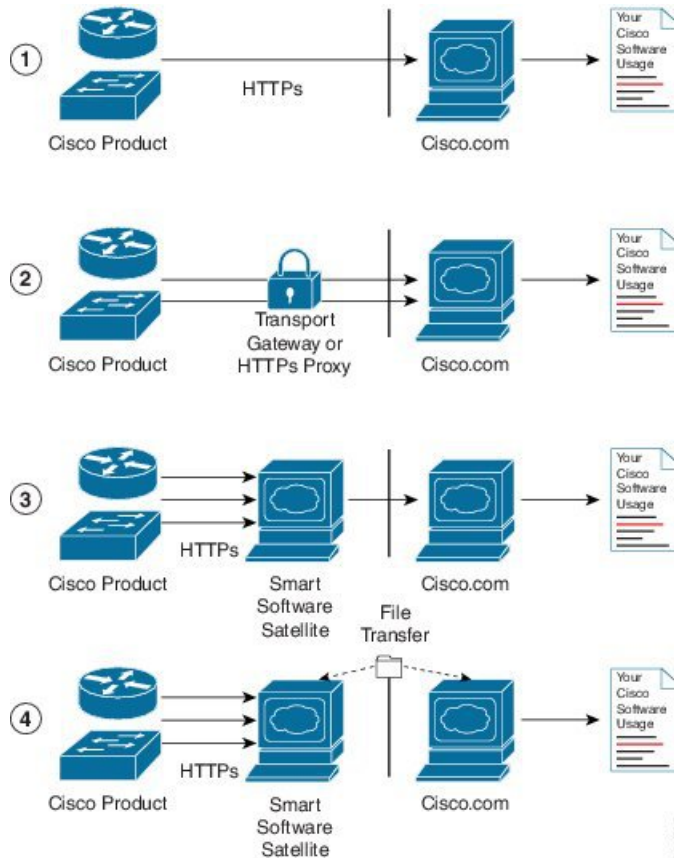
- **Smart Call Home:** The Smart Call Home feature is automatically configured after the Smart Licensing is enabled. Smart Call Home is used by Smart Licensing as a medium for communication with the Cisco license service. Call Home feature allows Cisco products to periodically call-home and perform an audit and reconciliation of your software usage information. This information helps Cisco efficiently track your install base, keep them up and running, and more effectively pursue service and support contract renewals, without much intervention from your end. For more information on Smart Call Home feature, see http://www.cisco.com/c/dam/en/us/td/docs/switches/lan/smart_call_home/SCH_Deployment_Guide.pdf.
- **Smart Licensing Satellite:** The Smart licensing satellite option provides an on-premises collector that can be used to consolidate and manage Smart license usage, as well facilitate communications back to Cisco License Service at <http://www.cisco.com>.

- **Manage and Report Licenses:** You can manage and view reports about your overall software usage in the Smart Software Manager portal. [Compliance reporting, on page 15](#) describes the types of Smart Licensing reports.

Deployment Options for Smart Licensing

The following illustration shows the various options available for deploying Smart Licensing:

Figure 2: Smart Licensing Deployment Options



1. **Direct cloud access:** In direct cloud access deployment method, Cisco products send usage information directly over the internet to Cisco.com (Cisco license service); no additional components are needed for deployment.
2. **Direct cloud access through an HTTPs proxy:** In direct cloud access through an HTTPs proxy deployment method, Cisco products send usage information over the internet through a proxy server - either a Smart Call Home Transport Gateway or off-the-shelf Proxy (such as Apache) to Cisco License Service on <http://www.cisco.com>.
3. **Mediated access through an on-premises collector-connected:** In mediated access through an on-premises collector-connected deployment method, Cisco products send usage information to a locally-connected collector, which acts as a local license authority. Periodically, the information is exchanged to keep the databases in synchronization.

4. **Mediated access through an on-premises collector-disconnected:** In the mediated access through an on-premises collector-disconnected deployment method, Cisco products send usage information to a local disconnected collector, which acts as a local license authority. Exchange of human-readable information is performed occasionally (maybe once a month) to keep the databases in synchronization.

Options **1** and **2** provide an easy deployment option, and options **3** and **4** provide a secure environment deployment option. Smart Software Satellite provides support for options **3** and **4**.

The communication between Cisco products and Cisco license service is facilitated by the Smart Call Home software. For information on Smart Call Home, see [About Call Home](#)

Configure Licenses Using Smart Licensing

Enable Smart Licensing

Smart Licensing components are packaged into the asr9k mini image. The https client required for configuring the Smart Call Home is packaged into the asr9k-k9sec PIE. By default, traditional licensing mode is on. Use the steps described here to enable Smart Licensing.

**Note**

Smart Licensing on Cisco ASR 9001-S Router is not supported. Hence you should use the Product Authorization Key (PAK) to activate a license. PAK is provided when you order and purchase the right to use a feature set for a particular device. The PAK is an 11-character alphanumeric key printed on the purchase order document that is shipped with your device hardware. The PAK serves as a receipt and is an important component used in the process of obtaining, upgrading, and activating a license.

For information on how to activate a license using PAK, refer [Cisco ASR 9001-S 120G Upgrade License Configuration Guide](#).

On successful registration, the device will receive an identity certificate. This certificate is saved on your device and automatically used for all future communications with Cisco. Every 30 days, Smart Licensing will automatically renew the registration information with Cisco. If registration fails, an error will be logged. Additionally, license usage data is collected and a report is sent to you every month. If required, you can configure your Smart Call Home settings such that sensitive information (like hostname, username and password) are filtered out from the usage report.

**Note**

Once Smart Licensing mode is enabled, all CLIs related to the traditional licensing mode are disabled.

Before you begin

You must have purchased the product for which you are adding the license. When you purchase the product, you are provided with a user name and password to the Cisco Smart Software Manager portal, from where you can generate the product instance registration tokens.

SUMMARY STEPS

1. Login to Cisco Smart Software Manager at <https://tools.cisco.com/rhodu/index>.
2. **admin**

3. **configure**
4. **license smart enable**
5. **commit**
6. **admin**
7. **license smart register idtoken** *token_ID*

DETAILED STEPS

	Command or Action	Purpose
Step 1	Login to Cisco Smart Software Manager at https://tools.cisco.com/rhodu/index .	Get a token from the Cisco portal using the link. You must log in to the portal using a Cisco provided username and password. Once you have generated the token, select Copy hyperlink to copy the token or download the token to a text file. The token is used to register and activate a device, and assign the device to a virtual account. Note This token is valid for 30 days.
Step 2	admin Example: RP/0/RSP0/CPU0:router# admin	Enters administration EXEC mode.
Step 3	configure Example: RP/0/RSP0/CPU0:router(admin)# configure	Enters administration configuration mode.
Step 4	license smart enable Example: RP/0/RSP0/CPU0:router(admin-config)#license smart enable RP/0/RSP0/CPU0:router(admin-config)#show config Building configuration... !! IOS XR Configuration 5.2.0.19I license smart enable end	Enables basic Smart Licensing. Use the no form of this command to disable Smart Licensing and revert to the traditional or strict mode of licensing.
Step 5	commit	
Step 6	admin Example: RP/0/RSP0/CPU0:router# admin	Enters administration EXEC mode.
Step 7	license smart register idtoken <i>token_ID</i> Example: RP/0/RSP0/CPU0:router(admin)#license smart register idtoken NmE1Yzg0OWMtYmJ4	Use the token ID procured in step 1 to register your device.

	Command or Action	Purpose
	license smart register: Registration process is in progress. Please check the syslog for the registration status and result	

What to do next

You can use the Cisco Smart Software Manager to:

- Create virtual accounts
- Assign a registered device to a virtual account
- View licenses in a virtual account
- Manage product instance registration tokens
- Transfer a license
- View, transfer or remove product instances in a virtual account

Verify Smart Licensing Configuration

After enabling Smart Licensing, you can use the **show** commands to verify the default Smart Licensing configuration. If any issue is detected, take corrective action before making further configurations.

SUMMARY STEPS

1. **admin**
2. **show license status**
3. **show license register-status**
4. **show license entitlement**
5. **show license pool**
6. **show license cert**
7. **show license features**
8. **show license ha**
9. **show license all**
10. **exit**
11. **show call-home smart-licensing statistics**

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RSP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	show license status Example: RP/0/RSP0/CPU0:router(admin)#show license status	Displays the compliance status of Smart Licensing. Following are the possible status: <ul style="list-style-type: none"> • Waiting: Indicates the initial state after your device has made a license entitlement request. The device establishes communication with Cisco and

	Command or Action	Purpose
		<p>successfully registers itself with the Cisco license manager.</p> <ul style="list-style-type: none"> • Authorized: Indicates that your device is able to communicate with the Cisco license manager, and is authorised to initiate requests for license entitlements. • Out-Of-Compliance: Indicates that one or more of your licenses are out-of-compliance. You must buy additional licenses. • Eval Period: Indicates that Smart Licensing is consuming the evaluation period. You must register the device with the Cisco Licensing manager, else your license expires. • Grace Period: Indicates that connectivity to the Cisco license manager is lost. You must try restore connectivity to renew the authorization period. • Disabled: Indicates that Smart Licensing is disabled. • Invalid: Indicates that Cisco does not recognize the entitlement tag as it is not in the database.
Step 3	show license register-status Example: RP/0/RSP0/CPU0:router(admin)#show license register-status	Displays the Smart Licensing registration status. If your registration is pending or failed, check for connectivity issues with the Cisco license manager or register the device with a new token ID.
Step 4	show license entitlement Example: RP/0/RSP0/CPU0:router(admin)#show license entitlement	Displays the details of the various entitlements you own.
Step 5	show license pool Example: RP/0/RSP0/CPU0:router(admin)#show license pool	Displays the pool to which the device belongs.
Step 6	show license cert Example: RP/0/RSP0/CPU0:router(admin)#show license cert	Displays details of the licensing certificate.
Step 7	show license features Example: RP/0/RSP0/CPU0:router(admin)#show license features	Displays the licenses that are supported on a given chassis. You can go ahead and buy the required licenses.
Step 8	show license ha Example: RP/0/RSP0/CPU0:router(admin)#show license ha	Displays the Smart Licensing high availability status, whether it is in active or standby mode.

	Command or Action	Purpose
Step 9	show license all Example: RP/0/RSP0/CPU0:router(admin)#show license all	Displays all entitlements in use. It can also be used to check if Smart Licensing is enabled. Additionally, it shows associated licensing certificates, compliance status, UDI, and other details.
Step 10	exit Example: RP/0/RSP0/CPU0:router(admin)# exit	Exits administration EXEC mode and returns to EXEC mode.
Step 11	show call-home smart-licensing statistics	Displays the statistics of communication between the Smart Licensing manager and the Cisco back-end using Smart Call Home. In case communication fails or drops, check your call home configuration for any errors.

The following example shows sample output from the **show call-home smart-licensing statistics** command:

```
RP/0/RSP0/CPU0:router#show call-home smart-licensing statistics
Success: Successfully sent and response received.
Failed : Failed to send or response indicated error occurred.
Inqueue: In queue waiting to be sent.
Dropped: Dropped due to incorrect call-home configuration.
```

Msg Subtype	Success	Failed	Inqueue	Dropped	Last-sent (GMT-07:00)
ENTITLEMENT	2	0	0	0	2014-04-24 18:24:34
REGISTRATION	1	0	0	0	2014-04-25 03:53:57
ACKNOWLEDGEMENT	1	0	0	0	2014-04-23 19:21:21
RENEW	1	0	0	0	2014-04-23 19:21:11
DEREGISTRATION	1	0	0	0	2014-04-25 03:31:35

Renew Smart Licensing Registration

In general, your registration is automatically renewed every 30 days. Use this option to make an on-demand manual update of your registration. Thus, instead of waiting 30 days for the next registration renewal cycle, you can issue this command to instantly find out the status of your license.

Before you begin

You must ensure that the following conditions are met to renew your smart license:

- Smart licensing is enabled.
- The device is registered.

SUMMARY STEPS

1. **admin**
2. **license smart renew {auth | id}**

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RSP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	license smart renew {auth id} Example: RP/0/RSP0/CPU0:ROA(admin)#license smart renew auth Tue Apr 22 09:12:37.086 PST license smart renew auth: Authorization process is in progress. Please check the syslog for the authorization status and result.	Renew your ID or authorization with Cisco smart licensing. If ID certification renewal fails, then the product instance goes to an unidentified state and starts consuming the evaluation period. Note Authorization periods are renewed by the Smart Licensing system every 30 days. As long as the license is in an 'Authorized' or 'Out-of-compliance' (OOC), the authorization period is renewed. Grace period starts when an authorization period expires. During the grace period or when the grace period is in the 'Expired' state, the system continues to try renew the authorization period. If a retry is successful, a new authorization period starts.

De-register Smart Licensing

When your device is taken off the inventory, shipped elsewhere for redeployment or returned to Cisco for replacement using the return merchandise authorization (RMA) process, you can use the de-register option to cancel the registration on your device. Use the following steps to cancel device registration:

SUMMARY STEPS

1. admin
2. license smart deregister

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RSP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	license smart deregister Example: RP/0/RSP0/CPU0:IMC0(admin)#license smart deregister license smart deregister: Success	Cancels the device registration, and sends it into a 30-day evaluation mode. All Smart Licensing entitlements and certificates on the platform are removed. Note Though the product instance has been de-registered from the Cisco license cloud service, Smart Licensing is still enabled.

Smart Licensing Workflow

The diagram illustrates the lifecycle of Smart Licensing and ID Certificates. It begins with an 'Un-configured' state, which transitions to 'Un-identified' upon 'Enable Smart Licensing'. From 'Un-identified', a 'Register Product Instance' leads to a 'Registered' state. This state is divided into 'Authorized' and 'Grace Expired' sub-states, both of which can transition to 'Out of Compliance'. The 'Authorized' state has a '90 days authorization period', while the 'Grace Expired' state has a '90 days grace period'. The 'Out of Compliance' state triggers a 'Registration request', 'Authorization renewal', and 'ID certificate renewal'. The 'Authorized' state also leads to a '90 days Smart Licensing evaluation period'. The 'Out of Compliance' state leads to a '1 year ID certificate expiration period'.

Cisco Smart Software Manager enables you to manage all of your Cisco Smart software licenses from one centralized website. With Cisco Smart Software Manager, you organize and view your licenses in groups called virtual accounts (collections of licenses and product instances). Use the Cisco Smart Software Manager to do the following tasks:

- The Cisco Smart Software Manager **Help** describes the procedures for carrying out these tasks. You can access the Cisco Smart Software Manager on <https://webapps.cisco.com/software/csws/ws/platform/home>, by clicking **Licensing**, and then selecting **Smart Software Manager**; and then login using the username and password provided by Cisco.



Licenses, Product Instances, and Registration Tokens

Software Entitlement

Licenses are required for all Cisco products. All Cisco product licenses are one of two types which vary depending on the product:

- Perpetual licenses—Licenses that do not expire.
- Term licenses—Licenses that automatically expire after a set amount of time: one year, three years, or whatever term was purchased.

In addition, there are demo licenses that expire after at most 60 days. As implied by the name, demo licenses are not intended for production use.

All product licenses reside in a virtual account.

**Note**

Starting from IOS XR 5.3.3 release, if you are trying to register a software instance with Cisco Smart Software Manager satellite, ensure that the **crypto ca trustpool policy crl optional** command is configured on the router. When certification revocation list is set to optional, the revocation checking of the certificate is disabled when the trust policy is in use. For more information about this command, see http://www.cisco.com/c/en/us/td/docs/routers/asr9000/software/asr9k_r5-3/security/command/reference/b-syssec-cr-53xasr9k/b-syssec-cr-53xasr9k_chapter_0111.html#wp3675118629

Product Instances

A product instance is an individual device with a unique device identifier (UDI) that is registered using a product instance registration token (or registration token). You can register any number of instances of a product with a single registration token. Each product instance can have one or more licenses residing in the same virtual account. Product instances must periodically connect to the Cisco Smart Software Manager servers during a specific renewal period. If a product instance fails to connect, it is marked as having a license shortage, but continues to use the license. If you remove the product instance, its licenses are released and made available within the virtual account.

Product Instance Registration Tokens

A product requires a registration token until you have registered the product. Registration tokens are stored in the Product Instance Registration Token Table associated with your enterprise account. Once the product is registered the registration token is no longer necessary and can be revoked and removed from the table without effect. Registration tokens can be valid from 1 to 365 days.

Virtual Accounts

Smart Licencing allows you to create multiple license pools or virtual accounts within the Smart Software Manager portal. Using the **Virtual Accounts** option you can aggregate licenses into discrete bundles associated with a cost center so that one section of an organization cannot use the licenses of another section of the organization. For example, if you segregate your company into different geographic regions, you can create a virtual account for each region to hold the licenses and product instances for that region.

All new licenses and product instances are placed in the default virtual account in the Smart Software Manager, unless you specify a different one during the order process. Once in the default account, you may choose to transfer them to any other account as desired, provided you have the required access permissions. See [Licenses, Product Instances, and Registration Tokens](#), on page 13 for details.

Use the Smart Software Manager portal at <https://tools.cisco.com/rhodui/index> to create license pools or transfer licenses.

Compliance reporting

On a periodic basis, as described by the terms of the Smart Licensing contract, reports are automatically sent to you containing inventory and license compliance data. These reports will take one of three forms:

- **Periodic Record:** This record is generated on a periodic (configurable) basis with relevant inventory data saved at a given point of time. This report is saved within the Cisco cloud for archival.
- **Manual Record:** You can manually generate this record with relevant inventory data saved at any given point of time. This report will be saved within the Cisco cloud for archival.
- **Compliance Warning Report:** This report is automatically or manually generated when a license compliance event occurs. This report does not contain a full inventory data, but only any shortfalls in entitlements for a given software license.

You can view these reports from the Smart Software Manager portal at <https://tools.cisco.com/rhodu/index>.

Traditional Licensing Consideration in Smart Licensing

Traditional licensing, and the associated commands, currently co-exist with Smart Licensing. By default, the software image is loaded with the traditional, strictly-enforced mode of licensing. You may want to retain the traditional licensing model in the following scenarios:

- when there are multiple users, and you do not know the actual end user of your software.
- when the software is deployed in a location with limited access to the license and inventory management solution.
- when the user has opted not to establish a Smart Call Home relationship with Cisco.
- when a Smart Call Home relationship cannot be maintained with the user owing to logistics and a fallback is required.



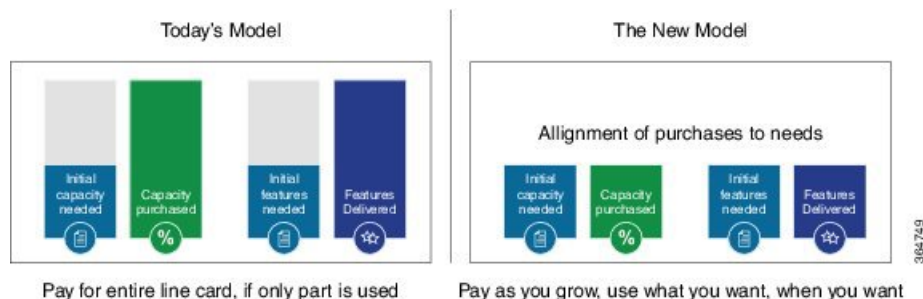
Note

All traditional licensing CLI commands are disabled if Smart Licensing is enabled. However, you can continue to access the traditional licenses stored under: `/disk0:/license/*`. Certificates used by Smart Licensing are located under `/disk0:/sla/`. Respective CLIs are restored when licensing schemes are switched.

Consumption Model

The consumption model is a new pricing model for line cards to align the initial purchase to your actual needs. This model provides the ability to deploy a line card on day 1 with minimum ports activated to meet the current traffic demands. Over time as the traffic grows, you can add additional ports in 10G port increments. This provides a flexible deployment model with the ability to increase bandwidth to meet your demands.

Figure 3: Comparison - Current Purchasing Model And The New Consumption Model

**Note**

The consumption model line cards require the users to deploy Smart Licensing to help track and provide visibility into license usage across their network. For information on Smart Licensing see [Information About Smart Licensing, on page 3](#).

You must have a Smart Account created to place an order for the consumption model line card. You can create your Cisco Smart Account at this webpage: <https://webapps.cisco.com/software/company/smartaccounts/home#accountcreation-account/request>. For information on how to create a Cisco Smart Account, see: <http://www.cisco.com/c/en/us/products/collateral/software/one-software/solution-overview-c22-733273.html>.

Supported Consumption Model Line Cards

The line cards that can be deployed using consumption model are referred to as the consumption model line cards. The supported consumption model line cards are:

- A9K-8X100GE-CM

Ordering the Consumption Model Line Card using the Consumption Model

The three steps involved in ordering a consumption model line card using the Consumption Model are:

Figure 4: Steps involved in ordering the consumption model line card using the Consumption Model

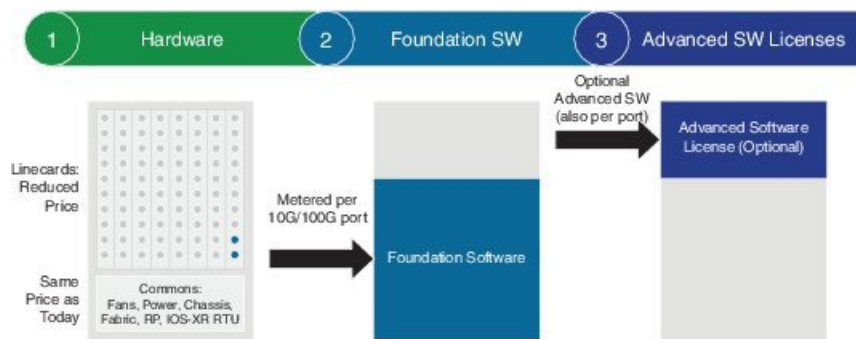
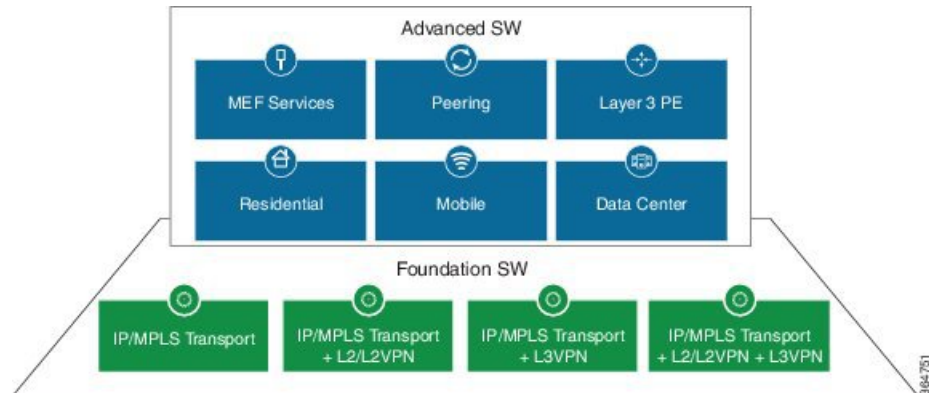


Figure 5: Foundation Software Licenses And Advanced Software Licenses

1. Choose the hardware: Select a line card that supports Consumption Model.

The consumption model line cards require Smart Licensing to be installed at your location to function. When placing an order, you must enter their Smart Account information. For more information on how to create a Cisco Smart Account, see: <http://www.cisco.com/c/en/us/products/collateral/software/one-software/solution-overview-c22-733273.html>.

Table 2: Minimum Foundation Software Licenses for the CM line cards

PID	Minimum Foundation Software License Required
A9K-8X100GE-CM	300G (30 x 10G)
A99-8X100GE-CM	300G (30 x 10G)
A99-12X100GE-CM	400G (40 x 10G)
A9K-MOD400-CM-BUN	200G (20 x 10G)

2. Choose your foundation software licenses: This provides the transport protocol (IP/MPLS, L2VPN, L3VPN, or L2VPN and L3VPN) as well as "per 10G" port activation.

Pick your foundation software licenses based on the feature set and the scale required. The following is the list of the available licenses. The licenses listed are per 10G RTU (Right to Use) and are required to activate a port.

Table 3: Foundation Software Licenses for Cisco IOS XR

Foundation License PID	Description
S-A9K-IPB-10G	ASR 9000 IP/MPLS Basic 10G Foundational License
S-A9K-IPP-10G	ASR 9000 IP/MPLS Premium 10G Foundational License
S-A9K-L2B-10G	ASR 9000 IP/MPLS/L2VPN Basic 10G Foundational License
S-A9K-L2P-10G	ASR 9000 IP/MPLS/L2VPN Premium 10G Foundational License
S-A9K-L3B-10G	ASR 9000 IP/MPLS/L3VPN Basic 10G Foundational License
S-A9K-L3P-10G	ASR 9000 IP/MPLS/L3VPN Premium 10G Foundational License
S-A9K-L2L3B-10G	ASR 9000 IP/MPLS/L2VPN/L3VPN Basic 10G Foundational License

Foundation License PID	Description
S-A9K-L2L3P-10G	ASR 9000 IP/MPLS/L2VPN/L3VPN Premium 10G Foundational License

3. Choose your advanced software licenses: This provides the advanced feature support such as hierarchical QoS, OAM (Operations, Administration, and Maintenance), and virtual interfaces.

Pick your advanced software licenses, optional, you can select one or more of them from the following list. The licenses listed are per 10G RTU (Right to Use).

Table 4: Advanced Software Licenses for Cisco IOS XR

Advanced Software License PID	Description
S-A9K-HQOS-RTU-10	ASR 9000 H-QoS 10G Right to Use License
S-A9K-MAP-RTU-10	ASR 9000 CGN Stateless MAP 10G Right to Use License
S-A9K-OAM-RTU-10	ASR 9000 OAM 10G Right to Use License
S-A9K-VIRT-RTU-10	ASR 9000 Virtual Interfaces 10G Right to Use License
S-A9K-EVPN-RTU-10	ASR 9000 E-VPN 10G Right to Use License
S-A9K-VXLN-RTU-10	ASR 9000 VxLAN 10G Right to Use License
S-A9K-DWDM-RTU-10	ASR 9000 IPoDWDM 10G Right to Use License
S-A9K-MAC-RTU-10	ASR 9000 MACSec 10G Right to Use License
S-A9K-MAC-RTU-40	ASR 9000 MACSec 40G (4x10G) Right to Use License
S-A9K-MAC-RTU-100	ASR 9000 MACSec 100G (10x10G) Right to Use License

Configuration Examples:

The Consumption Model line cards provide the flexibility to configure the line card on a per 10G port basis. Here are a few examples of configurations of the existing TR and SE versions of line cards using the Consumption Model.

TR Equivalent Configuration

The TR equivalent configuration is a configuration with L2 Premium Foundation Software License plus OAM and Virtual Advanced Software licenses.

Line Card PID	Description	Quantity
A9K-8X100GE-CM	ASR 9000 8-port 100GE Consumption Model Line Card	1
Foundation Software PID	Scale	Quantity of 10G Licenses
S-A9K-L2P-10G	L2-P (Layer 2 Premium Foundation Software License)	30

Line Card PID	Description	Quantity
Advanced Software PID	Description	Quantity
S-A9K-OAM-RTU-10	ASR 9000 OAM 10Gbps Right to Use License	30
S-A9K-VIRT-RTU-10	ASR 9000 Virtual Interfaces 10Gbps Right to Use License	30

SE Equivalent Configuration

The SE equivalent configuration is a configuration with L2 Premium Foundation Software License plus H-QoS, OAM, and Virtual Advanced Software licenses.

Line Card PID	Description	Quantity
A9K-8X100GE-CM	ASR 9000 8-port 100GE Consumption Model Line Card	1
Foundation Software PID	Scale	Quantity of 10G Licenses
S-A9K-L2P-10G	L2-P (Layer 2 Premium Foundation Software License)	30
Advanced Software PID	Description	Quantity
S-A9K-HQOS-RTU-10	ASR 9000 H-QoS 10Gbps Right to Use License	30
S-A9K-OAM-RTU-10	ASR 9000 OAM 10Gbps Right to Use License	30
S-A9K-VIRT-RTU-10	ASR 9000 Virtual Interfaces 10Gbps Right to Use License	30

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.

Router License Pools

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

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 readed.

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 the router, 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.

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 evaluation licenses with permanent licenses.

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.

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: <pre>RP/0/RSP0/CPU0:router# admin</pre>	Enters administration EXEC mode.
Step 2	show license udi Example: <pre>RP/0/RSP0/CPU0:router(admin)# show license udi Mon Jul 13 04:36:32.715 PST Local Chassis UDI Information: PID : ASR-9010-AC S/N : FOX1232H67M Operation ID: 1</pre>	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	<p>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.</p> <p>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.</p>
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: <pre>RP/0/RSP0/CPU0:router# admin</pre>	Enters administration EXEC mode.

	Command or Action	Purpose
Step 6	license add <i>license-name</i> [sdr <i>sdr-name</i>] Example: RP/0/RSP0/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/RSP0/CPU0:router(admin)# configure	Enters administration configuration mode.
Step 8	license <i>license-name</i> location { all <i>node-id</i> } Example: RP/0/RSP0/CPU0:router(admin-config)# license A9K-ADV-OPTIC-LIC location 0/0/CPU0	(Optional) Binds the license to the slot where it is to be used. Note Beginning with Cisco IOS XR Release 4.3.1, this command is optional. If you do not use this command, it is configured as though the license is bound to all slots.
Step 9	exit Example: RP/0/RSP0/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 Cisco ASR 9000 Series Routers*.

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

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:	Enters administration EXEC mode.

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router# admin	
Step 2	license backup <i>backup-file</i> Example: RP/0/RSP0/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/RSP0/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/RSP0/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-C-40G   Slot based,      Permanent      2
XC-L3VPN       Slot based,      Permanent      1
```

```
RP/0/RSP0/CPU0:router(admin)# show license backup disk0:/lic_backup.pkg
```

```
Tue Jul 27 17:12:44.982 pst
```

```
Local Chassis UDI Information:
  S/N           : FOX1316G5TL
  Operation ID:   9

FeatureID: A9K-ADV-OPTIC-LIC (Slot based, Permanent)
Total licenses 1
  Pool: Owner 1
  Allocated Node(s):
    0/0/CPU0 1 [Owner]
```

```
FeatureID: A9K-ADV-VIDEO-LIC (Slot based, Evaluation)
Total licenses 1
  Pool: Owner 1
  Allocated Node(s):
    0/RSP0/CPU0 1 [Owner]
```

```

FeatureID: A9K-iVRF-LIC (Slot based, Permanent)
Total licenses  1
Pool: Owner  1

FeatureID: A9K-iVRF-LIC (Slot based, Evaluation)
Total licenses  3
Pool: Owner  3
Allocated Node(s):
  0/1/CPU0 1 [Owner]

```

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/RSP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	show license backup <i>backup-file</i> Example: RP/0/RSP0/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/RSP0/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/RSP0/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 20](#).

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	save configuration running Example: <pre>RP/0/RSP0/CPU0:router# configure RP/0/RSP0/CPU0:router(config)# save configuration running tftp://192.10.10.10/mylicenses/rc_03132013 RP/0/RSP0/CPU0:router(config)# exit RP/0/RSP0/CPU0:router# admin RP/0/RSP0/CPU0:router(admin)# configure RP/0/RSP0/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	load Example: <pre>RP/0/RSP0/CPU0:router# configure RP/0/RSP0/CPU0:router(config)# load tftp://192.10.10.10/mylicenses/rc_03132013 RP/0/RSP0/CPU0:router(config)# exit RP/0/RSP0/CPU0:router# admin RP/0/RSP0/CPU0:router(admin)# configure RP/0/RSP0/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 20 .	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 20](#) for more information.

SUMMARY STEPS

1. **admin**
2. **license add** *license-name*
3. **configure**
4. **license** *license-name* **location** {**all** | *node-id* }
5. Remove the old line cards and install the new ones.
6. **show license**

DETAILED STEPS

	Command or Action	Purpose
Step 1	admin Example: RP/0/RSP0/CPU0:router# admin	Enters administration EXEC mode.
Step 2	license add <i>license-name</i> Example: RP/0/RSP0/CPU0:router(admin)# license add tftp://192.10.10.10/mylicenses/A9K-24X10G-AIP-TR-lic	Adds the license to the license pool.
Step 3	configure Example: RP/0/RSP0/CPU0:router(admin)# configure	Enters administration configuration mode.
Step 4	license <i>license-name</i> location { all <i>node-id</i> } Example: RP/0/RSP0/CPU0:router(admin-config)# license A9K-24X10G-AIP-TR location 0/0/CPU0	(Optional) Binds the license to the slot where it is used. Note Beginning with Cisco IOS XR Release 4.3.1, this command is optional. If you do not use this command, it is configured as though the license is bound to all slots.
Step 5	Remove the old line cards and install the new ones.	Associates the new license on the slot with the new line card.

	Command or Action	Purpose
		Note You need to wait for the new line cards to boot.
Step 6	show license Example: RP/0/RSP0/CPU0:router# show license 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]	Verifies the status of the licenses. Note Old licenses remaining on the router are not a problem.

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
```

