



Installing the Software

This chapter includes the following sections:

- [Overview, on page 1](#)
- [ROMMON Images, on page 1](#)
- [Rommon Compatibility Matrix , on page 2](#)
- [Provisioning Files, on page 6](#)
- [File Systems, on page 6](#)
- [Autogenerated File Directories and Files, on page 7](#)
- [Flash Storage, on page 8](#)
- [Configuring the Configuration Register for Autoboot, on page 8](#)
- [Licensing, on page 9](#)

Overview

Installing software on the router involves installing a consolidated package (bootable image). This consists of a bundle of subpackages (modular software units), with each subpackage controlling a different set of functions.

These are the two main methods to install the software:

- [Managing and Configuring a Router to Run Using a Consolidated Package, on page 16](#)—This method allows for individual upgrade of subpackages and generally has reduced boot times compared to the method below. Use this method if you want to individually upgrade a module's software.
- [Managing and Configuring a Router to Run Using Individual Packages, on page 21](#)—This a simple method that is similar to a typical Cisco router image installation and management that is supported across Cisco routers.

It is better to upgrade software in a planned period of maintenance when an interruption in service is acceptable. The router needs to be rebooted for a software upgrade to take effect.

ROMMON Images

A ROMMON image is a software package used by ROM Monitor (ROMMON) software on a router. The software package is separate from the consolidated package normally used to boot the router. For more

information on ROMMON, see the "ROM Monitor Overview and Basic Procedures" section in the [Upgrading Field-Programmable Hardware Devices for Cisco 4000 Series ISRs](#) guide.

An independent ROMMON image (software package) may occasionally be released and the router can be upgraded with the new ROMMON software. For detailed instructions, see the documentation that accompanies the ROMMON image.



Note A new version of the ROMMON image is not necessarily released at the same time as a consolidated package for a router.

Rommon Compatibility Matrix

The following table provides information about Cisco 4000 Series Integrated Services Routers supported in each ROMMON release.

Table 1: Supported ROMMON Releases for Cisco 4000 Series Integrated Service Routers

| Platform | 16.2(1r) | 16.2(2r) | 16.4(3r) | 16.7(3r) | 16.7(4r) | 16.7(5r) | 16.8(1r) | 16.9(1r) | 16.12(1r) | 16.12(2r) | 17.6.1 |
|----------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|--------|
| Cisco 4221 ISR | — | — | Yes | Yes | Yes | Yes | — | Yes | Yes | Yes | Yes |
| Cisco 4321 ISR | Yes | Yes | Yes | Yes | Yes | Yes | — | Yes | Yes | Yes | Yes |
| Cisco 4331 ISR | Yes | Yes | Yes | Yes | Yes | Yes | — | Yes | Yes | Yes | Yes |
| Cisco 4351 ISR | Yes | Yes | Yes | Yes | Yes | Yes | — | Yes | Yes | Yes | Yes |
| Cisco 4431 ISR | Yes | — | — | — | Yes | Yes | — | — | — | Yes | Yes |
| Cisco 4451 ISR | Yes | — | — | — | Yes | Yes | — | — | — | Yes | Yes |
| Cisco 4461 ISR | — | — | — | — | — | — | — | Yes | Yes | Yes | Yes |



Note When you upgrade from Cisco IOS XE 3.x to 16.x image, you should first upgrade the rommon release to the 16.7(5r) rommon release. After upgrading to the 16.7(5r) rommon release, based on the IOS XE 16.x image, the rommon release can be auto-upgraded to a later rommon release.



Note The rommon release 16.9(1r) is the first release that supports the Cisco BIOS Protection. After a device is upgraded to the 16.9(1r) rommon release, the rommon release cannot be downgraded to a release earlier than 16.9(1r). All future rommon releases can be downgraded to the 16.9(1r) release. Also, if a platform has a 16.9(1r) or later release installed, an IOS XE 16.9.1 or later release or a SD-WAN 16.11.1 or later release must be used for the upgrade.



Note ROMMON images for IOS XE Release 17.1.x through 17.5.x are aligned with release 16.12(2r).



Note From Cisco IOS XE Release 17.6.1 onwards, the ROMMON image will not be released as a standalone package, and will be packaged with the IOS XE image. 17.6.1 ROMMON will only be used in devices with manufacturing date equal or later than 2535. You can view your device manufacturing date with the CLI command **show license udi**. For example,

```
elixir_plb_l1#show license udi
UDI: PID:C1131X-8PWB, SN: FGL2451L5MJ
```

The device manufacturing date in this example is 2451.

Minimum Supported ROMMON Release

The following table provides the minimum supported ROMMON release in Cisco IOS XE 16.x.x releases.

Table 2: Minimum Supported ROMMON Release in Cisco IOS XE 16.x.x Releases

| Cisco IOS XE Release | Cisco 4321 ISR | Cisco 4321 ISR | Cisco 4331 ISR | Cisco 4351 ISR | Cisco 4431 ISR | Cisco 4451 ISR | Cisco 4461 ISR |
|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Cisco IOS XE 16.3.x | — | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | — |
| Cisco IOS XE 16.4.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | — |
| Cisco IOS XE 16.5.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | — |
| Cisco IOS XE 16.6.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | — |

| Cisco IOS XE Release | Cisco 4321 ISR | Cisco 4321 ISR | Cisco 4331 ISR | Cisco 4351 ISR | Cisco 4431 ISR | Cisco 4451 ISR | Cisco 4461 ISR |
|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Cisco IOS XE 16.7.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | — |
| Cisco IOS XE 16.8.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | — |
| Cisco IOS XE 16.9.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | 16.9(1r) |
| Cisco IOS XE 16.10.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | 16.9(1r) |
| Cisco IOS XE 16.11.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | 16.9(1r) |
| Cisco IOS XE 16.12.x | 16.7(4r) | 16.7(3r) | 16.7(3r) | 16.7(3r) | 16.7(4r) | 16.7(4r) | 16.9(1r) |
| Cisco IOS XE 17.1.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.2.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.3.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.4.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.5.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.6.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |



Note For devices with manufacturing date equal or later than 2535, the minimum supported ROMMON version is 17.6.1. These devices cannot downgrade to older ROMMON versions.

Recommended ROMMON Release

The following table lists the recommended ROMMON release for the routing platforms in each Cisco IOS XE 16.x.x releases.

Table 3: Recommended ROMMON Release for Cisco IOS XE 16.x.x Releases

| Cisco IOS XE Release | Cisco 4321 ISR | Cisco 4321 ISR | Cisco 4331 ISR | Cisco 4351 ISR | Cisco 4431 ISR | Cisco 4451 ISR | Cisco 4461 ISR |
|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Cisco IOS XE 16.3.x | — | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | — |
| Cisco IOS XE 16.4.x | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | — |
| Cisco IOS XE 16.5.x | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | — |
| Cisco IOS XE 16.6.x | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | — |
| Cisco IOS XE 16.7.x | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | — |
| Cisco IOS XE 16.8.x | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | 16.7(5r) | — |
| Cisco IOS XE 16.9.x | 16.9(1r) | 16.9(1r) | 16.9(1r) | 16.9(1r) | 16.12(2r) | 16.12(2r) | 16.9(1r) |
| Cisco IOS XE 16.10.x | 16.9(1r) | 16.9(1r) | 16.9(1r) | 16.9(1r) | 16.12(2r) | 16.12(2r) | 16.9(1r) |
| Cisco IOS XE 16.11.x | 16.9(1r) | 16.9(1r) | 16.9(1r) | 16.9(1r) | 16.12(2r) | 16.12(2r) | 16.9(1r) |
| Cisco IOS XE 16.12.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.1.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.2.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.3.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.4.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.5.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |
| Cisco IOS XE 17.6.x | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) | 16.12(2r) |



Note For devices with manufacturing date equal or later than 2535, the minimum supported ROMMON version is 17.6.1. These devices cannot downgrade to older ROMMON versions. For devices with IOS XE 16.12 and preinstalled ROMMON 17.6.1r, the minimum supported ROMMON version is 17.6.1r. Do not downgrade the ROMMON to 16.12(2r); these devices cannot downgrade to older ROMMON versions.

Provisioning Files

This section provides background information about the files and processes used in [Managing and Configuring a Router to Run Using Individual Packages, on page 21](#).

The consolidated package on a router consists of a collection of subpackages and a provisioning file titled `packages.conf`. To run the software, the usual method used is to boot the consolidated package, which is copied into memory, expanded, mounted, and run within memory. The provisioning file's name can be renamed but subpackage file's names cannot be renamed. The provisioning file and subpackage files must be kept in the same directory. The provisioning file does not work properly if any individual subpackage file is contained within a different directory.



Note An exception to this is that if a new or upgraded module firmware package is subsequently installed, it need not be in the same directory as the provisioning file.

Configuring a router to boot, using the provisioning file `packages.conf`, is beneficial because no changes have to be made to the boot statement after the Cisco IOS XE software is upgraded.

File Systems

The following table provides a list of file systems that can be seen on the Cisco 4000 series routers.

Table 4: Router File Systems

| File System | Description |
|-------------|---|
| bootflash: | Boot flash memory file system. |
| flash: | Alias to the boot flash memory file system above. |
| harddisk: | Hard disk file system (if NIM-SSD, NIM-HDD, or internal mSATA flash device is present in the router). Note The internal mSATA flash device is supported only on Cisco ISR4300 Series routers. |
| cns: | Cisco Networking Services file directory. |
| nvrnram: | Router NVRAM. You can copy the startup configuration to NVRAM or from NVRAM. |

| File System | Description |
|-------------|--|
| obfl: | File system for Onboard Failure Logging (OBFL) files. |
| system: | System memory file system, which includes the running configuration. |
| tar: | Archive file system. |
| tmpsys: | Temporary system files file system. |
| usb0: | The Universal Serial Bus (USB) flash drive file systems. |
| usb1: | Note The USB flash drive file system is visible only if a USB drive is installed in usb0: or usb1: ports. |

Use the ? help option, or use the **copy** command in command reference guides, if you find a file system that is not listed in the table above.

Autogenerated File Directories and Files

This section discusses the autogenerated files and directories that can be created, and how the files in these directories can be managed.

Table 5: Autogenerated Files

| File or Directory | Description |
|----------------------|--|
| crashinfo files | Crashinfo files may appear in the bootflash: file system. These files provide descriptive information of a crash and may be useful for tuning or troubleshooting purposes. However, the files are not part of router operations, and can be erased without impacting the functioning of the router. |
| core directory | The storage area for .core files. If this directory is erased, it will automatically regenerate itself at bootup. The .core files in this directory can be erased without impacting any router functionality, but the directory itself should not be erased. |
| lost+found directory | This directory is created on bootup if a system check is performed. Its appearance is completely normal and does not indicate any issues with the router. |
| tracelogs directory | The storage area for trace files. Trace files are useful for troubleshooting. If the Cisco IOS process fails, for instance, users or troubleshooting personnel can access trace files using diagnostic mode to gather information related to the Cisco IOS failure. Trace files, however, are not a part of router operations, and can be erased without impacting the router's performance. |

Important Notes About Autogenerated Directories

Important information about autogenerated directories include:

- Autogenerated files on the bootflash: directory should not be deleted, renamed, moved, or altered in any way unless directed by Cisco customer support.



Note Altering autogenerated files on the bootflash: may have unpredictable consequences for system performance.

- Crashinfo, core, and trace files can be deleted.

Flash Storage

Subpackages are installed to local media storage, such as flash. For flash storage, use the **dir bootflash:** command to list the file names.



Note Flash storage is required for successful operation of a router.

Configuring the Configuration Register for Autoboot

The configuration register can be used to change router behavior. This includes controlling how the router boots. Set the configuration register to 0x0 to boot into ROM, by using one of the following commands:

- In Cisco IOS configuration mode, use the **config-reg 0x0** command.
- From the ROMMON prompt, use the **confreg 0x0** command.

For more information about the configuration register, see [Use of the Configuration Register on All Cisco Routers](#) and [Configuring a Router to Boot the Consolidated Package via TFTP Using the boot Command: Example, on page 17](#).



Note Setting the configuration register to 0x2102 will set the router to autoboot the Cisco IOS XE software.



Note The console baud rate is set to 9600 after changing the **confreg** to 0x2102 or 0x0. If you cannot establish a console session after setting **confreg**, or garbage output appears, change the setting on your terminal emulation software to 9600.

Licensing

Cisco Software Licensing

Cisco software licensing consists of processes and components to activate Cisco IOS software feature sets by obtaining and validating Cisco software licenses.

You can enable licensed features and store license files in the bootflash of your router. Licenses pertain to consolidated packages, technology packages, or individual features.

An evaluation license is automatically converted to a Right to Use model after 60 days and this license is valid permanently. The conversion to a permanent license applies only to evaluation licenses. For other features supported on your router, you must purchase a permanent license.

See the "Configuring the Cisco IOS Software Activation Feature" chapter of the [Software Activation Configuration Guide, Cisco IOS XE Release 3S](#).

Consolidated Packages

One of the following two consolidated packages (images) is preinstalled on the router:

- **universalk9**—Contains the **ipbasek9** base package and the **securityk9**, **uck9**, and **appxk9** technology packages.
- **universalk9_npe**—Contains the **ipbasek9** base package and the **securityk9_npe**, **uck9**, and **appxk9** technology packages. This image has limited crypto functionality.



Note The term npe stands for No Payload Encryption.



Note The terms super package and image also refer to a consolidated package.

To obtain software images for the router, go to <http://software.cisco.com/download/navigator.html>.

An image-based license is used to help bring up all the subsystems that correspond to a license. This license is enforced only at boot time.

Apart from the **universalk9** and **universalk9_npe** images, a Boot ROMMON image is available. For more information, see *ROMMON Images* section.

For more information about identifying digitally signed Cisco software and how to show the digital signature information of an image file, see the "Digitally Signed Cisco Software" section in the [Loading and Managing System Images Configuration Guide, Cisco IOS XE Release 3S](#).

The following examples show how to obtain software authenticity information and internal details of a package:

- *Displaying Digitally Signed Cisco Software Signature Information* section
- *Obtaining the Description of a Module or Consolidated Package* section

Many features within the consolidated package are contained in the **ipbasek9** base package. The license key for the **ipbasek9** package is activated by default.

Technology Packages

Technology packages contain software features within a consolidated package. To use different sets of features, enable the licenses of selected technology packages. You can enable the licenses for any combination of technology packages.

Each technology package has an evaluation license that converts to a Right to Use (RTU) license after 60 days and is then valid permanently.

The following is a list of technology packages:



Note

In Cisco 1000 Series Integrated Series Routers, although L2TPv2 sessions comes up without appxk9, you need the appxk9 license for the traffic to go through the sessions. You also need the appxk9 license to apply the QoS policies to the L2TPv2 sessions.

securityk9

The **securityk9** technology package includes all crypto features, including IPsec, SSL/SSH, Firewall, and Secure VPN.

The **securityk9_npe** package (npe = No Payload Encryption) includes all the features in the **securityk9** technology package without the payload-encryption functionality. This is to fulfill export restriction requirements. The **securityk9_npe** package is available only in the **universalk9_npe** image. The difference in features between the **securityk9** package and the **securityk9_npe** package is therefore the set of payload-encryption-enabling features such as IPsec and Secure VPN.

uck9

The Unified Communications technology package is required to enable Cisco Unified Border Element (Cisco UBE) functionality. To use Cisco UBE features, you will require session licenses and a Security technology package to secure the media.

appxk9

The **appxk9** technology package contains Application Experience features, which are similar to the features in the DATA package of the Cisco Integrated Services Routers Generation 2 routers. For more information, see: http://www.cisco.com/c/en/us/products/collateral/cloud-systems-management/software-activation-on-integrated-services-routers-isr/white_paper_c11_556985.html#wp9000791.

There are many features in the **appxk9** package, including MPLS, PfR, L2/L3 VPN, Broadband, and AVC.

Feature Licenses

To use each of the following features, enable a corresponding feature license, as explained in the following sections:

HSECK9

The **HSECK9** license is required for a feature to have full crypto functionality. Without the **HSECK9** license, only 225 secure tunnels and 85 Mbps of crypto bandwidth would be available. The **HSECK9** license allows features in the **securityk9** technology package to use the maximum number of secure tunnels and crypto bandwidth. To enable the **HSECK9** license, purchase the **FL-44-HSEC-K9** license from Cisco.com and install it using the **license install license-files** command. For further information on obtaining and installing feature licenses, see [Configuring the Cisco IOS Software Activation Feature](#).



Note The **HSECK9** feature does not have an evaluation license that converts to an RTU license after 60 days; a feature license must be obtained.

If you do not enable the export control functionality, the device does not send the HSECK9 license request to the Smart Licensing server even if the HSECK9 license feature is configured on the device.



Note Starting from IOS XE Fuji 16.8.1, limits for number of tunnels and crypto throughput are enhanced. Without HSEC, the new throughput limit is 250 Mbps each direction and number of tunnels is 1000.

To enable the license for the **HSECK9** feature, the **securityk9** technology package is also required. For more information about the **securityk9** technology package, see [securityk9, on page 10](#).

Performance

The performance feature, which allows for increased throughput, is enabled by the performance license. This feature is part of the **ipbasek9** technology package. To enable the feature, order the performance license (part number FL-44-PERF-K9). The license is displayed as the throughput license.

You can upgrade the throughput of the ESP from 2.5 Gbps to 5 Gbps by activating the right-to-use license and then reloading the router. For more information on the right-to-use license activation, see **Configuring Cisco Right-To-Use License Configuration Guide**. If you want to determine the current throughput level of the ESP, run the `show platform hardware throughput level` command. The following example shows the output of this command before the performance upgrade license is applied:

To configure the throughput level, perform the following steps and to upgrade the throughput level use the `platform hardware throughput level { 2500000 | 5000000 }` command.

1. In the user EXEC configuration mode, enter the `enable` command.
2. Enter `configure terminal` command to enter the global configuration mode.
3. To upgrade the throughput level, enter the `platform hardware throughput level {2500000|5000000}` command.
4. To exit global configuration mode, enter `exit`.
5. To save the configuration, enter the `copy running-config startup-config` command.
6. To reload the router enter `reload`. A reload is required to activate the throughput level.

```
show platform hardware throughput level
The current throughput level is 2500000 kb/s
```

To configure the throughput level, perform the following steps and to upgrade the throughput level use the `platform hardware throughput level { 2500000 | 5000000}` command.

1. In the user EXEC configuration mode, enter the `enable` command.
2. Enter `configure terminal` command to enter the global configuration mode.
3. To upgrade the throughput level, enter the `platform hardware throughput level {2500000|5000000}` command.
4. To exit global configuration mode, enter `exit`.
5. To save the configuration, enter the `copy running-config startup-config` command.
6. To reload the router enter `reload`. A reload is required to activate the throughput level.

The following example shows how to upgrade the throughput level:

```
Router>enable
Router#configure terminal
Router(config)#platform hardware throughput level 5000000
% The config will take effect on next reboot
Router(config)#exit
Router#copy running-config startup-config
Router#reload
```

Boost Performance Licenses

Cisco Boost performance license allows you to increase the throughput bandwidth. You can enable Boost performance license in the following modes:



Note To use the Boost performance license, the device must be running the Cisco IOS XE software version 16.07.01 or later. Also, the boost license command will not be available if the device is registered in CSSM before the license is added to license CSSM repository. You have to deregister and register back the device from the CSSM to execute the boost license command.



Note When you enable boost license on Cisco 4000 Series ISRs, you cannot configure the virtual-service container for Snort IPS and ISR-WAAS.

Activating Boost Performance License in CSL Mode

To activate the Boost performance license in Cisco Software License (CSL) mode, perform the following steps:

1. Configure the device with the `license install bootflash:xxx` command as shown in this example.

```
Device#license install bootflash:FDO203520HU_201804090203446350.lic
Installing licenses from "bootflash:FDO203520HU_201804090203446350.lic"
Installing...Feature:booster_performance...Successful:Supported
1/1 licenses were successfully installed
0/1 licenses were existing licenses
0/1 licenses were failed to install

Building configuration...
```

```
[OK]
% Throughput boost is configured, it will take effect after reload
```

- The following message will be displayed in the logs.

```
*Apr  9 07:40:11.674: %LICENSE-6-INSTALL: Feature booster_performance 1.0 was installed
in this device.
UDI=ISR4331/K9:FDO203520HU; StoreIndex=2:Primary License Storage
```

- The **platform hardware throughput level boost** is automatically added to the configuration.

```
Device#show running-config | include throughput

platform hardware throughput level boost
```

- Save the configuration and reload the device to enable Boost performance license. After the reload, the Boost Performance is activated as shown in this example.

```
Device#show platform hardware throughput level

The current throughput level is unthrottled

Device#show license

<output omitted>

Index 11 Feature: booster_performance
  Period left: Life time
  License Type: Permanent
  License State: Active, In Use
  License Count: Non-Counted
  License Priority: Medium
```

- To exit global configuration mode, enter `exit`.
- To save the configuration, enter the `copy running-config startup-config` command.

Boost Performance License in Smart License Mode

This section describes the processes to activate and deactivate the Boost performance license from the device with two use-cases.

Enable the boost performance license:

- Boot the device in Smart License mode. The boost performance command is not visible without registering in the Smart Portal.
- After successfully registering to the Smart Portal, check the availability of the boost performance licenses in the smart account.
- Use the **platform hardware throughput level boost** command to enable the feature. You need to save the configuration. If a valid license is still available in the smart account, the Boost Performance feature is enabled after the device is reloaded.
- To check for the platform hardware throughput level, use the **show platform hardware throughput level boost** command. If there are not enough licenses, it shows an Out of Compliance (OOC) message, and the throughput level change does not take effect even after the device is reloaded.

Return of license:

- The device is in the smart license mode with **boost performance** command configured.

- Use **show running-config** and the **show license summary** commands to display the boost performance information from the smart account.
- Use the **no platform hardware throughput level boost** command to disable the functionality.



Note The command is removed from the configuration, but the license is released only after the device is reloaded. The throughput level does not take effect until the device is reloaded. The license visibility is available till the device is reloaded.

One count of boost performance license is reduced from the usage pool, and one license is returned to its original pool.

Cisco Software License to Smart Licensing

This section describe a use-case when the device is moving from Cisco Software License(CSL) to Smart License when **boost performance license** is on CSL. The boost performance behavior is determined by the availability of the license in its Smart Account with Boost Performance activated in CSL:

To configure the throughput level, perform the following steps and to upgrade the throughput level use the

1. Configure the device with the **platform hardware throughput level boost** command and then use **show running-config** to check if the boost performance license is activated.
2. Use **show license** to verify if boost performance is in use and in a permanent license mode.
3. Enable smart license by `license smart enable` command. After registration in success, the license request is sent to the smart portal for validation. Boost performance is valid if successful, no reload is required. Otherwise the **platform hardware throughput level boost** is unattached from configuration. Boost performance functionality is disabled after reload.
4. During the transition but before the registration, we have to maintain the Evaluation mode for the license if the is existing to avoid an extra reload later.
5. To exit global configuration mode, enter exit.
6. To save the configuration, enter the `copy running-config startup-config` command.
7. To reload the router enter reload. A reload is required to activate the throughput level.

Smart Licensing to Cisco Software Licensing

This section includes these two use-cases that describe what happens during the transition from Smart License to Cisco Software License.

When boost performance is in use:

- Device # **platform hardware throughput level boost**
- Device# **show license** to ensure that Smart License and Boost performance licenses are enabled.
- Check the Smart License Account if the boost performance license is consumed from the corresponding device.
- Remove Smart License

- Device# **no license smart enable**
- Check the availability of the boost performance license, you may decide to retain the boost command.
- No extra reload is required.

When boost performance is not in use:

- Use **no platform hardware throughput level boost** in the show running-configuration.
- Device # **show license** to check if smart license is enabled, but boost performance license is not in the list.
- Check the Smart License Account, the boost performance license is not used from the corresponding device.
- To remove Smart License, use **no license smart enable**
- Check the availability of the **boost permanent license** to add the **boost** keyword.
- Boost Performance is activated and is in-use after reload



Note If there is no permanent license available, then **no boost performance** command and functionality is likely to change.

- **When hybrid Cisco IOS XE Release is in use:**
- When you use the hybrid Cisco IOS XE Release (IOS XE 16.9.x) and want to rollback from Smart license to right-to-use (RTU) license, you must reload the router twice to move the license to the "Active, In-Use" state.
- Device# **configuration terminal**
- To remove Smart License, use **no license smart enable**
- Device# **no license smart enable**
- Device# **exist**
- To remove Smart License, reload the router.
- Device# **configure terminal**
- Enter **yes** to accept the end-user license agreement.
- Device# **exist**
- To move RTU license to In-Use state, reload the router.

LED Indicators

For information on LEDs on the router, see "LED Indicators" in the "Overview" section of the [Hardware Installation Guide for the Cisco 4000 Series Integrated Services Routers](#).

For information on LEDs on the SSD Carrier Card NIM, see "Overview of the SSD Carrier Card NIM (NIM-SSD)" in the "Installing and Upgrading Internal Modules and FRUs" section of the [Hardware Installation Guide for the Cisco 4000 Series Integrated Services Routers](#).

Related Documentation

For further information on software licenses, see [Software Activation on Cisco Integrated Services Routers and Cisco Integrated Service Routers G2](#).

For further information on obtaining and installing feature licenses, see [Configuring the Cisco IOS Software Activation Feature](#).

How to Install and Upgrade the Software

To install or upgrade the software, use one of the following methods to use the software from a consolidated package or an individual package. Also see the overview section.

- [Managing and Configuring a Router to Run Using a Consolidated Package, on page 16](#)
- [Managing and Configuring a Router to Run Using Individual Packages, on page 21](#)

Managing and Configuring a Router to Run Using a Consolidated Package



Note Do not use these procedures if you also need to install any optional subpackages or plan to upgrade individual subpackages. See [Managing and Configuring a Router to Run Using Individual Packages, on page 21](#).

- [Managing and Configuring a Consolidated Package Using copy and boot Commands, on page 16](#)
- [Configuring a Router to Boot the Consolidated Package via TFTP Using the boot Command: Example, on page 17](#)

Managing and Configuring a Consolidated Package Using copy and boot Commands

To upgrade a consolidated package, copy the consolidated package to the **bootflash:** directory on the router using the **copy** command. After making this copy of the consolidated package, configure the router to boot using the consolidated package file.

The following example shows the consolidated package file being copied to the **bootflash:** file system via TFTP. The config register is then set to boot using **boot system** commands, and the **boot system** commands instruct the router to boot using the consolidated package stored in the **bootflash:** file system. The new configuration is then saved using the **copy running-config startup-config** command, and the system is then reloaded to complete the process.

```
Router# dir bootflash:
Directory of bootflash:/
11 drwx 16384 Dec 4 2007 04:32:46 -08:00 lost+found
86401 drwx 4096 Dec 4 2007 06:06:24 -08:00 .ssh
14401 drwx 4096 Dec 4 2007 06:06:36 -08:00 .rollback_timer
28801 drwx 4096 Mar 18 2008 17:31:17 -07:00 .prst_sync
43201 drwx 4096 Dec 4 2007 04:34:45 -08:00 .installer

928862208 bytes total (712273920 bytes free)
```



```

Router# copy tftp: bootflash:
Address or name of remote host []? 172.17.16.81
Source filename []? /auto/tftp-users/user/isr4400-universalk9.03.10.00.S.153-3.S-ext.SPA.bin
Destination filename [isr4400-universalk9.03.10.00.S.153-3.S-ext.SPA.bin]?
Accessing
tftp://172.17.16.81//auto/tftp-users/user/isr4400-universalk9.03.10.00.S.153-3.S-ext.SPA.bin
...
Loading /auto/tftp-users/user/isr4400-universalk9.03.10.00.S.153-3.S-ext.SPA.bin from
172.17.16.81 (via GigabitEthernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!
[OK - 208904396 bytes]
208904396 bytes copied in 330.453 secs (632176 bytes/sec)
Router# dir bootflash:
Directory of bootflash:/
11 drwx 16384 Dec 4 2007 04:32:46 -08:00 lost+found
86401 drwx 4096 Dec 4 2007 06:06:24 -08:00 .ssh
14401 drwx 4096 Dec 4 2007 06:06:36 -08:00 .rollback_timer
28801 drwx 4096 Mar 18 2008 17:31:17 -07:00 .prst_sync
43201 drwx 4096 Dec 4 2007 04:34:45 -08:00 .installer
12 -rw- 208904396 May 28 2008 16:17:34 -07:00
isr4400-universalk9.03.10.00.S.153-3.S-ext.SPA.bin
928862208 bytes total (503156736 bytes free)
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# boot system flash bootflash:isr4400-universalk9.03.10.00.S.153-3.S-ext.SPA.bin
Router(config)# config-reg 0x2102
Router(config)# exit
Router# show run | include boot
boot-start-marker
boot system flash bootflash:isr4400-universalk9.03.10.00.S.153-3.S-ext.SPA.bin
boot-end-marker
Router# copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
Router# reload

```

Configuring a Router to Boot the Consolidated Package via TFTP Using the boot Command: Example

```

Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#boot system tftp://10.81.116.4/rtp-isr4400-54/isr4400.bin
Router(config)#config-register 0x2102
Router(config)#exit
Router# show run | include boot
boot-start-marker
boot system tftp://10.81.116.4/rtp-isr4400-54/isr4400.bin
boot-end-marker
license boot level advenenterprise
Router# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router# reload
Proceed with reload? [confirm]
Sep 13 17:42:54.445 RO/0: %PMAN-5-EXITACTION: Process manager is exiting: process exit with
reload chassis code

```

```
Initializing Hardware ...

System integrity status: c0000600
Failures detected:
Boot FPGA corrupt

Key Sectors: (Primary,GOOD), (Backup,GOOD), (Revocation,GOOD)
Size of Primary = 2288 Backup = 2288 Revocation = 300

ROM:RSA Self Test Passed
ROM:Sha512 Self Test Passed
Self Tests Latency: 58 msec

System Bootstrap, Version 12.2(20120618:163328) [username-ESGROM_20120618_GAMMA 101],
DEVELOPMENT SOFTWARE
Copyright (c) 1994-2014 by cisco Systems, Inc.
Compiled Mon 05/27/2014 12:39:32.05 by username

Current image running: Boot ROM0

Last reset cause: LocalSoft

Cisco ISR 4400 platform with 4194304 Kbytes of main memory

IP_ADDRESS: 172.18.42.119
IP_SUBNET_MASK: 255.255.255.0
DEFAULT_GATEWAY: 172.18.42.1
TFTP_SERVER: 10.81.116.4
TFTP_FILE: rtp-isr4400-54/isr4400.bin
TFTP_MACADDR: a4:4c:11:9d:ad:97
TFTP_VERBOSE: Progress
TFTP_RETRY_COUNT: 18
TFTP_TIMEOUT: 7200
TFTP_CHECKSUM: Yes
ETHER_PORT: 0

ETHER_SPEED_MODE: Auto Detect
link up...
Receiving rtp-isr4400-54/isr4400.bin from 10.81.116.4
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
File reception completed.
Boot image size = 424317088 (0x194a90a0) bytes

ROM:RSA Self Test Passed
ROM:Sha512 Self Test Passed
Self Tests Latency: 58 msec

Package header rev 1 structure detected
Calculating SHA-1 hash...done
validate_package: SHA-1 hash:
calculated 7294dfc:892a6c35:a7a133df:18c032fc:0670b303
expected 7294dfc:892a6c35:a7a133df:18c032fc:0670b303
Signed Header Version Based Image Detected

Using FLASH based Keys of type = PRIMARY KEY STORAGE
Using FLASH based Keys of type = ROLLOVER KEY STORAGE
RSA Signed DEVELOPMENT Image Signature Verification Successful.
Package Load Test Latency : 5116 msec
Image validated
```

```
%IOSXEBOOT-4-BOOT_ACTIVITY_LONG_TIME: (local/local): load_modules took: 2 seconds,
expected max time 2 seconds
```

Restricted Rights Legend

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c) of the Commercial Computer Software - Restricted Rights clause at FAR sec. 52.227-19 and subparagraph (c) (1) (ii) of the Rights in Technical Data and Computer Software clause at DFARS sec. 252.227-7013.

cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706

```
Cisco IOS Software, ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version
15.4(20140527:095327)
[v154_3_s_xe313_throttle-BLD-BLD_V154_3_S_XE313_THROTTLE_LATEST_20140527_070027-ios 156]
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Tue 27-May-14 21:28 by mcpre
```

Cisco IOS-XE software, Copyright (c) 2005-2014 by cisco Systems, Inc. All rights reserved. Certain components of Cisco IOS-XE software are licensed under the GNU General Public License ("GPL") Version 2.0. The software code licensed under GPL Version 2.0 is free software that comes with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such GPL code under the terms of GPL Version 2.0. For more details, see the documentation or "License Notice" file accompanying the IOS-XE software, or the applicable URL provided on the flyer accompanying the IOS-XE software.

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to export@cisco.com.

```
Warning: the compile-time code checksum does not appear to be present.
cisco ISR4451/K9 (2RU) processor with 1133585K/6147K bytes of memory.
Processor board ID FGL1619100P
4 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of Compact flash at bootflash:.
7816688K bytes of USB flash at usb0:.
```

Press RETURN to get started!

```
Router>
Router>
Router>enable
Router# show version
Cisco IOS XE Software, Version BLD_V154_3_S_XE313_THROTTLE_LATEST_20140527_070027-ext
Cisco IOS Software, ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version
15.4(20140527:095327)
v154_3_s_xe313_throttle-BLD-BLD_V154_3_S_XE313_THROTTLE_LATEST_20140527_070027-ios 156]
```

```
IOS XE Version: BLD_V154_3_S_XE313_THROTTLE_LATEST
```

Cisco IOS-XE software, Copyright (c) 2005-2014 by cisco Systems, Inc.
All rights reserved. Certain components of Cisco IOS-XE software are licensed under the GNU General Public License ("GPL") Version 2.0. The software code licensed under GPL Version 2.0 is free software that comes with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such GPL code under the terms of GPL Version 2.0. For more details, see the documentation or "License Notice" file accompanying the IOS-XE software, or the applicable URL provided on the flyer accompanying the IOS-XE software.

```
ROM: IOS-XE ROMMON
```

```
Router uptime is 0 minutes
Uptime for this control processor is 3 minutes
System returned to ROM by reload
System image file is "tftp://10.81.116.4/rtp-isr4400-54/isr4400.bin"
Last reload reason: Reload Command
```

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to export@cisco.com.

```
License Level: advenenterprise
License Type: EvalRightToUse
--More-- Next reload license Level: advenenterprise
```

```
cisco ISR4451/K9 (2RU) processor with 1133585K/6147K bytes of memory.
Processor board ID FGL1619100P
4 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of Compact flash at bootflash:.
7816688K bytes of USB flash at usb0:.
```

```
Configuration register is 0x2102
```

Managing and Configuring a Router to Run Using Individual Packages

To choose between running individual packages or a consolidated package, see *Installing the Software - Overview* section.

The following topics are included in this section:

- [Installing Subpackages from a Consolidated Package, on page 21](#)
- [Installing a Firmware Subpackage, on page 32](#)
- [Installing Subpackages from a Consolidated Package on a Flash Drive, on page 26](#)

Installing Subpackages from a Consolidated Package

Perform the following procedure to obtain the consolidated package from a TFTP server.

Another variation of this procedure obtains the consolidated package from a USB flash drive. This is described in *Installing Subpackages from a Consolidated Package on a Flash Drive*.

Before you begin

Copy the consolidated package to the TFTP server.

SUMMARY STEPS

1. **show version**
2. **dir bootflash:**
3. **show platform**
4. **mkdir bootflash:** *URL-to-directory-name*
5. **request platform software package expand file** *URL-to-consolidated-package* **to** *URL-to-directory-name*
6. **reload**
7. **boot** *URL-to-directory-name/packages.conf*
8. **show version installed**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | show version Example: <pre>Router# show version Cisco IOS Software, IOS-XE Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version 15.3(20120627:221639) [build_151722 111] Copyright (c) 1986-2012 by Cisco Systems, Inc. Compiled Thu 28-Jun-12 15:17 by mcpre . . .</pre> | Shows the version of software running on the router. This can later be compared with the version of software to be installed. |

| | Command or Action | Purpose |
|---------------|---|---|
| Step 2 | dir bootflash: Example: Router# dir bootflash: | Displays the previous version of software and that a package is present. |
| Step 3 | show platform Example: Router# show platform Chassis type: ISR4451/K9 | Displays the inventory. |
| Step 4 | mkdir bootflash: URL-to-directory-name Example: Router# mkdir bootflash:mydir | Creates a directory to save the expanded software image. You can use the same name as the image to name the directory. |
| Step 5 | request platform software package expand file <i>URL-to-consolidated-package to URL-to-directory-name</i> Example: Router# request platform software package expand file bootflash:isr4400-universalk9-NIM.bin to bootflash:mydir | Expands the software image from the TFTP server (<i>URL-to-consolidated-package</i>) into the directory used to save the image (<i>URL-to-directory-name</i>), which was created in Step 4. |
| Step 6 | reload Example: Router# reload rommon > | Enables ROMMON mode, which allows the software in the consolidated file to be activated. |
| Step 7 | boot URL-to-directory-name/packages.conf Example: rommon 1 > boot bootflash:mydir/packages.conf | Boots the consolidated package, by specifying the path and name of the provisioning file: packages.conf. |
| Step 8 | show version installed Example: Router# show version installed Package: Provisioning File, version: n/a, status: active | Displays the version of the newly installed software. |

Examples

The initial part of the example shows the consolidated package, `isr4400-universalk9.164422SSA.bin`, being copied to the TFTP server. This is a prerequisite step. The remaining part of the example shows the consolidated file, `packages.conf`, being booted.

```
Router# copy tftp:isr4400/isr4400-universalk9.164422SSA.bin bootflash:
Address or name of remote host []? 192.0.2.1
Destination filename [isr4400-universalk9.164422SSA.bin]?
Accessing tftp://192.0.2.1/isr4400/isr4400-universalk9.164422SSA.bin...
Loading isr4400/isr4400-universalk9.164422SSA.bin from 192.0.2.1 (via GigabitEthernet0):
!!!!!!!!!!
```

```
[OK - 410506248 bytes]
```

```
410506248 bytes copied in 338.556 secs (1212521 bytes/sec)
```

```
Router# show version
```

```
Cisco IOS Software, IOS-XE Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version
```

```
15.3(20120627:221639) [build_151722_111]  
Copyright (c) 1986-2012 by Cisco Systems, Inc.  
Compiled Thu 28-Jun-12 15:17 by mcpre
```

```
IOS XE Version: 2012-06-28_15.31_mcpre
```

```
Cisco IOS-XE software, Copyright (c) 2005-2012 by cisco Systems, Inc.  
All rights reserved. Certain components of Cisco IOS-XE software are  
licensed under the GNU General Public License ("GPL") Version 2.0. The  
software code licensed under GPL Version 2.0 is free software that comes  
with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such  
GPL code under the terms of GPL Version 2.0. For more details, see the  
documentation or "License Notice" file accompanying the IOS-XE software,  
or the applicable URL provided on the flyer accompanying the IOS-XE  
software.
```

```
ROM: IOS-XE ROMMON
```

```
Router uptime is 0 minutes  
Uptime for this control processor is 3 minutes  
System returned to ROM by reload  
System image file is "tftp:isr4400/isr4400.bin"  
Last reload reason: Reload Command
```

```
This product contains cryptographic features and is subject to United  
States and local country laws governing import, export, transfer and  
use. Delivery of Cisco cryptographic products does not imply  
third-party authority to import, export, distribute or use encryption.  
Importers, exporters, distributors and users are responsible for  
compliance with U.S. and local country laws. By using this product you  
agree to comply with applicable laws and regulations. If you are unable  
to comply with U.S. and local laws, return this product immediately.
```

```
A summary of U.S. laws governing Cisco cryptographic products may be found at:  
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
```

```
If you require further assistance please contact us by sending email to  
export@cisco.com.
```

```
License Level: advenenterprise  
License Type: EvalRightToUse  
Next reload license Level: advenenterprise  
cisco ISR4451/K9 (2RU) processor with 1136676K/6147K bytes of memory.  
Processor board ID FGL161611AB  
4 Gigabit Ethernet interfaces  
32768K bytes of non-volatile configuration memory.  
4194304K bytes of physical memory.  
7393215K bytes of Compact flash at bootflash:.
```

```
Configuration register is 0x8000
```

```
Router# dir bootflash:
```

```
Directory of bootflash:/
```

```
11 drwx 16384 May 3 2012 19:58:37 +00:00 lost+found
```

```

178465 drwx 4096 Jun 6 2012 15:20:20 +00:00 core
584065 drwx 4096 Jul 13 2012 19:19:00 +00:00 .prst_sync
405601 drwx 4096 May 3 2012 19:59:30 +00:00 .rollback_timer
113569 drwx 4096 Jul 13 2012 19:19:32 +00:00 tracelogs
64897 drwx 4096 May 3 2012 19:59:42 +00:00 .installer
13 -rw- 1305 May 7 2012 17:43:42 +00:00 startup-config
14 -rw- 1305 May 7 2012 17:43:55 +00:00 running-config
15 -r-- 1541 Jun 4 2012 18:32:41 +00:00 debug.conf
16 -rw- 1252 May 22 2012 19:58:39 +00:00 running-config-20120522
519169 drwx 4096 Jun 4 2012 15:29:01 +00:00 vman_fdb

7451738112 bytes total (7067635712 bytes free)

```

```
Router# show platform
```

```
Chassis type: ISR4451/K9
```

| Slot | Type | State | Insert time (ago) |
|------|------------------|------------|-------------------|
| 0 | ISR4451/K9 | ok | 15:57:33 |
| 0/0 | ISR4451-6X1GE | ok | 15:55:24 |
| 1 | ISR4451/K9 | ok | 15:57:33 |
| 1/0 | SM-1T3/E3 | ok | 15:55:24 |
| 2 | ISR4451/K9 | ok | 15:57:33 |
| 2/0 | SM-1T3/E3 | ok | 15:55:24 |
| R0 | ISR4451/K9 | ok, active | 15:57:33 |
| F0 | ISR4451-FP | ok, active | 15:57:33 |
| P0 | Unknown | ps, fail | never |
| P1 | XXX-XXXX-XX | ok | 15:56:58 |
| P2 | ACS-4450-FANASSY | ok | 15:56:58 |

| Slot | CPLD Version | Firmware Version |
|------|--------------|--------------------------------|
| 0 | 12090323 | 15.3(01r)S [ciscouser-ISRRO... |
| 1 | 12090323 | 15.3(01r)S [ciscouser-ISRRO... |
| 2 | 12090323 | 15.3(01r)S [ciscouser-ISRRO... |
| R0 | 12090323 | 15.3(01r)S [ciscouser-ISRRO... |
| F0 | 12090323 | 15.3(01r)S [ciscouser-ISRRO... |

```
Router# mkdir bootflash:isr4400-universalk9.dir1
```

```
Create directory filename [isr4400-universalk9.dir1]?
```

```
Created dir bootflash:/isr4400-universalk9.dir1
```

```
Router# request platform software package expand file bootflash:isr4400-universalk9.NIM.bin
```

```
to bootflash:isr4400-universalk9.dir1
```

```
Verifying parameters
```

```
Validating package type
```

```
Copying package files
```

```
SUCCESS: Finished expanding all-in-one software package.
```

```
Router# reload
```

```
Proceed with reload? [confirm]
```

```
*Jul 13 19:39:06.354: %SYS-5-RELOAD: Reload requested by console.Reload Reason: Reload Command.
```

```
rommon 1 > boot bootflash:isr4400-universalk9.dir1/packages.conf
```

```
File size is 0x00002836
```

```
Located isr4400-universalk9.dir1/packages.conf
```

```
Image size 10294 inode num 324484, bks cnt 3 blk size 8*512
```

```
#
```

```
File is comprised of 1 fragments (33%)
```



```

is_valid_shalhash: SHA-1 hash:
calculated 62f6235a:fc98eb3a:85ce183e:834f1cb3:8alf71d1
expected 62f6235a:fc98eb3a:85ce183e:834f1cb3:8alf71d1
File size is 0x04b3dc00
Located isr4400-universalk9.dir1/isr4400-mono-universalk9-build_164422SSA.pkg
Image size 78896128 inode num 324491, bks cnt 19262 blk size 8*512
#####
File is comprised of 21 fragments (0%)
.....

```

Router# **show version installed**

```

Package: Provisioning File, version: n/a, status: active
File: bootflash:isr4400-universalk9.dir1/packages.conf, on: RP0
Built: n/a, by: n/a
File SHA1 checksum: ad09affd3f8820f4844f27acc1add502e0b8f459

Package: rpbase, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9-build_164422SSA.pkg, on:
  RP0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 5e95c9cbc4eaf5a4a5alac846ee2d0f41d1a026b

Package: firmware_attributes, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_attributes_164422SSA.pkg, on:
  RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 71614f2d9cbe7f96d3c6e99b67d514bd108c6c99

Package: firmware_dsp_sp2700, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_dsp_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 8334565edf7843fe246783b1d5c6ed933d96d79e
Package: firmware_fpge, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_fpge_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: eb72900ab32c1c50652888ff486cf370ac901dd7

Package: firmware_sm_1t3e3, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_sm_1t3e3_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 803005f15d8ea71ab088647e2766727ac2269871

Package: rpcontrol, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 980fd58fe581e9346c44417b451d1c09ebb640c2

Package: rpios-universalk9, version: dir1, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.23, by: mcpre
File SHA1 checksum: 27084f7e30ald69d45a33e05d1b00345040799fb
Package: rpaccess, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 0119802deda2da91c38473c47a998fb3ed423448

Package: firmware_attributes, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_attributes_164422SSA.pkg, on:
  RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 71614f2d9cbe7f96d3c6e99b67d514bd108c6c99

```

```

Package: firmware_dsp_sp2700, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_dsp_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 8334565edf7843fe246783b1d5c6ed933d96d79e

Package: firmware_fpge, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_fpge-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: eb72900ab32c1c50652888ff486cf370ac901dd7

Package: firmware_sm_lt3e3, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_sm_lt3e3-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 803005f15d8ea71ab088647e2766727ac2269871

Package: rpcontrol, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpcontrol-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 980fd58fe581e9346c44417b451d1c09ebb640c2

Package: rprios-universalk9, version: 2012-07-10_16.23_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpios-universalk9-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.23, by: mcpre
File SHA1 checksum: 27084f7e30ald69d45a33e05d1b00345040799fb

Package: rpaccess, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpaccess-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 0119802deda2da91c38473c47a998fb3ed423448

Package: rpbase, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpbase-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 5e95c9cbc4eaf5a4a5a1ac846ee2d0f41d1a026b

Package: firmware_attributes, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_attributes-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP1/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 71614f2d9cbe7f96d3c6e99b67d514bd108c6c99

Package: firmware_dsp_sp2700, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_dsp_sp2700-BLD-BLD_MCP_DEV_LATEST_20120710_164422SSA.pkg, on: RP1/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 8334565edf7843fe246783b1d5c6ed933d96d79e

Package: firmware_fpge, version: 2012-07-10_16.22_mcpre, status: n/a

```

Installing Subpackages from a Consolidated Package on a Flash Drive

The steps for installing subpackages from a consolidated package on a USB flash drive are similar to those described in Installing Subpackages from a Consolidated Package section .

-
- | | |
|---------------|--|
| Step 1 | show version |
| Step 2 | dir usb: |
| Step 3 | show platform |
| Step 4 | mkdir bootflash:URL-to-directory-name |
| Step 5 | request platform software package expand fileusb: package-name to URL-to-directory-name |
| Step 6 | reload |
| Step 7 | boot URL-to-directory-name/packages.conf |
| Step 8 | show version installed |
-

How to Install and Upgrade the Software for Cisco IOS XE Denali Release 16.3

To install or upgrade the software, use one of the following methods to use the software from a consolidated package or an individual package. Also see *Overview* section.

- *Managing and Configuring a Router to Run Using a Consolidated Package* section
- *Managing and Configuring a Router to Run Using Individual Packages* section
- *Configuring a Router to Boot the Consolidated Package via TFTP Using the boot Command: Example* section
- *Upgrading to Cisco IOS XE Denali Release 16.3* section

Upgrading to Cisco IOS XE Denali Release 16.3

Upgrading the device to Cisco IOS XE Denali Release 16.3 for the first time uses the same procedures as specified in the earlier section. In addition, Cisco IOS XE Denali Release 16.3 requires a minimum ROMMON version. When the device boots up with Cisco IOS XE Denali image for the first time, the device checks the installed version of the ROMMON, and upgrades if the system is running an older version. During the upgrade, do not power cycle the device. The system automatically power cycles the device after the new ROMMON is installed. After the installation, the system will boot up with the Cisco IOS XE image as normal.



Note When the device boots up for first time and if the device requires an upgrade, the entire boot process may take several minutes. This process will be longer than a normal boot due to the ROMMON upgrade.

The following example illustrates the boot process of a consolidated package:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#boot system tftp://10.81.116.4/rtp-isr4400-54/isr4400.bin
Router(config)#config-register 0x2102
Router(config)#exit
Router# show run | include boot
boot-start-marker
boot system tftp://10.81.116.4/rtp-isr4400-54/isr4400.bin
boot-end-marker
license boot level adventerprise
Router# copy running-config startup-config
Destination filename [startup-config]?
```

```

Building configuration...
[OK]
Router# reload
Proceed with reload? [confirm]
Sep 13 17:42:54.445 R0/0: %PMAN-5-EXITACTION: Process manager is exiting: process exit with

reload chassis code

Initializing Hardware ...

System integrity status: c0000600

Key Sectors:(Primary,GOOD),(Backup,GOOD),(Revocation,GOOD)
Size of Primary = 2288 Backup = 2288 Revocation = 300

ROM:RSA Self Test Passed
ROM:Sha512 Self Test Passed
Self Tests Latency: 58 msec

System Bootstrap, Version 12.2(20120618:163328) [username-ESGROM_20120618_GAMMA 101],
DEVELOPMENT SOFTWARE
Copyright (c) 1994-2014 by cisco Systems, Inc.
Compiled Mon 05/27/2014 12:39:32.05 by username

Current image running: Boot ROM0

Last reset cause: LocalSoft

Cisco ISR 4400 platform with 4194304 Kbytes of main memory

IP_ADDRESS: 172.18.42.119
IP_SUBNET_MASK: 255.255.255.0
DEFAULT_GATEWAY: 172.18.42.1
TFTP_SERVER: 10.81.116.4
TFTP_FILE: rtp-isr4400-54/isr4400.bin
TFTP_MACADDR: a4:4c:11:9d:ad:97
TFTP_VERBOSE: Progress
TFTP_RETRY_COUNT: 18
TFTP_TIMEOUT: 7200
TFTP_CHECKSUM: Yes
ETHER_PORT: 0

ETHER_SPEED_MODE: Auto Detect
link up...
Receiving rtp-isr4400-54/isr4400.bin from 10.81.116.4
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
File reception completed.
Boot image size = 504063931 (0x1e0b67bb) bytes

ROM:RSA Self Test Passed
ROM:Sha512 Self Test Passed
Self Tests Latency: 58 msec

Package header rev 1 structure detected
Calculating SHA-1 hash...done
validate_package: SHA-1 hash:
calculated 7294dffc:892a6c35:a7a133df:18c032fc:0670b303
expected 7294dffc:892a6c35:a7a133df:18c032fc:0670b303
Signed Header Version Based Image Detected

```

```
Using FLASH based Keys of type = PRIMARY KEY STORAGE
Using FLASH based Keys of type = ROLLOVER KEY STORAGE
RSA Signed DEVELOPMENT Image Signature Verification Successful.
Package Load Test Latency : 5116 msec
Image validated
```

```
Detected old ROMMON version 12.2(20150910:184432), upgrade required
Upgrading to newer ROMMON version required by this version of IOS-XE, do not power cycle
the system. A reboot will automatically occur for the new ROMMON to take effect.
selected : 1
Booted : 1
Reset Reason: 1
```

```
Info: Upgrading entire flash from the rommon package
Switching to ROM 0
Upgrade image MD5 signature is b702a0a59a46a20a4924f9b17b8f0887
Upgrade image MD5 signature verification is b702a0a59a46a20a4924f9b17b8f0887
Switching back to ROM 1
ROMMON upgrade complete.
```

```
To make the new ROMMON permanent, you must restart the RP.
ROMMON upgrade successful. Rebooting for upgrade to take effect.
```

```
Initializing Hardware ...
```

```
System integrity status: 00300610
Key Sectors: (Primary,GOOD), (Backup,GOOD), (Revocation,GOOD)
Size of Primary = 2288 Backup = 2288 Revocation = 300
```

```
ROM:RSA Self Test Passed
```

```
Expected hash:
ddaf35a193617abacc417349ae204131
12e6fa4e89a97ea20a9eeee64b55d39a
2192992a274fc1a836ba3c23a3feebbd
454d4423643ce80e2a9ac94fa54ca49f
```

```
Obtained hash:
ddaf35a193617abacc417349ae204131
12e6fa4e89a97ea20a9eeee64b55d39a
2192992a274fc1a836ba3c23a3feebbd
454d4423643ce80e2a9ac94fa54ca49f
ROM:Sha512 Self Test Passed
Self Tests Latency: 418 msec
Rom image verified correctly
```

```
System Bootstrap, Version 12.2(20120618:163328) [username-ESGROM_20120618_GAMMA 101],
DEVELOPMENT SOFTWARE
Copyright (c) 1994-2014 by cisco Systems, Inc.
Compiled Mon 05/27/2014 12:39:32.05 by username
```

```
CPLD Version: 33 (MM/DD/YY): 06/23/14 Cisco ISR4351/K9 Slot:0
```

```
Current image running: Boot ROM1
```

```
Last reset cause: ResetRequest
Reading confreg 0x2102
```

```
Reading monitor variables from NVRAM
Enabling interrupts...done
```

```

Checking for PCIe device presence...done
Cisco ISR4351/K9 platform with 16777216 Kbytes of main memory

autoboot entry: NVRAM VALUES: bootconf: 0x0, autobootstate: 0
autobootcount: 0, autobootsptr: 0x0
Rommon upgrade requested
Flash upgrade reset 0 in progress
.....
Initializing Hardware ...

Checking for PCIe device presence...done
Reading confreg 2102
System integrity status: 0x300610
Key Sectors:(Primary, GOOD),(Backup,GOOD),(Revocation,GOOD)
Size of Primary = 2288 Backup = 2288 Revocation = 288
RSA Self Test Passed

Expected hash:
DDAF35A193617ABACC417349AE204131
12E6FA4E89A97EA20A9EEEE64B55D39A
2192992A274FC1A836BA3C23A3FEEBBD
454D4423643CE80E2A9AC94FA54CA49F

Obtained hash:
DDAF35A193617ABACC417349AE204131
12E6FA4E89A97EA20A9EEEE64B55D39A
2192992A274FC1A836BA3C23A3FEEBBD
454D4423643CE80E2A9AC94FA54CA49F
Sha512 Self Test Passed
Rom image verified correctly

System Bootstrap, Version 16.2(1r), RELEASE SOFTWARE
Copyright (c) 1994-2016 by cisco Systems, Inc.

Current image running: *Upgrade in progress* Boot ROM0

Last reset cause: BootRomUpgrade
ISR4351/K9 platform with 16777216 Kbytes of main memory

Cisco ISR 4400 platform with 4194304 Kbytes of main memory

IP_ADDRESS: 172.18.42.119
IP_SUBNET_MASK: 255.255.255.0
DEFAULT_GATEWAY: 172.18.42.1
TFTP_SERVER: 10.81.116.4
TFTP_FILE: rtp-isr4400-54/isr4400.bin
TFTP_MACADDR: a4:4c:11:9d:ad:97
TFTP_VERBOSE: Progress
TFTP_RETRY_COUNT: 18
TFTP_TIMEOUT: 7200
TFTP_CHECKSUM: Yes
ETHER_PORT: 0

ETHER_SPEED_MODE: Auto Detect
link up...
Receiving rtp-isr4400-54/isr4400.bin from 10.81.116.4
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
File reception completed.
Boot image size = 504063931 (0x1e0b67bb) bytes

```

```

Image Base is: 0x56834018
Image Size is: 0x1E089706
Package header rev 1 structure detected
Package type:30000, flags:0x0
IsoSize = 503874534
Parsing package TLV info:
000: 0000000900000001D4B45595F544C565F - KEY_TLV_
010: 5041434B4147455F434F4D5041544942 - PACKAGE_COMPATIB
020: 494C495459000000000000090000000B - ILITY
030: 4652555F52505F54595045000000009 - FRU_RP_TYPE
040: 000000184B45595F544C565F5041434B - KEY_TLV_PACK
050: 4147455F424F4F544152434800000009 - AGE_BOOTARCH
060: 0000000E415243485F693638365F5459 - ARCH_i686_TY
070: 50450000000000009000000144B45595F - PE KEY_
080: 544C565F424F4152445F434F4D504154 - TLV_BOARD_COMPAT
090: 00000009000000012424F4152445F6973 - BOARD_is
0A0: 72343330305F5459504500000000009 - r4300_TYPE
0B0: 000000184B45595F544C565F43525950 - KEY_TLV_CRYPT
0C0: 544F5F4B4559535452494E4700000009 - TO_KEYSTRING

TLV: T=9, L=29, V=KEY_TLV_PACKAGE_COMPATIBILITY
TLV: T=9, L=11, V=FRU_RP_TYPE
TLV: T=9, L=24, V=KEY_TLV_PACKAGE_BOOTARCH
TLV: T=9, L=14, V=ARCH_i686_TYPE
TLV: T=9, L=20, V=KEY_TLV_BOARD_COMPAT
TLV: T=9, L=18, V=BOARD_isr4300_TYPE
TLV: T=9, L=24, V=KEY_TLV_CRYPTO_KEYSTRING
TLV: T=9, L=10, V=EnCrYpTiOn
TLV: T=9, L=11, V=CW_BEGIN=$$
TLV: T=9, L=19, V=CW_FAMILY=$isr4300$
TLV: T=9, L=59, V=CW_IMAGE=$isr4300-universalk9.2016-06-29_23.31_paj.SSA.bin$
TLV: T=9, L=19, V=CW_VERSION=$16.3.1$
TLV: T=9, L=52, V=CW_DESCRIPTION=$Cisco IOS Software, IOS-XE Software$
TLV: T=9, L=9, V=CW_END=$$
Found DIGISIGN TLV type 12 length = 392
RSA Self Test Passed

```

Expected hash:

```

DDAF35A193617ABACC417349AE204131
12E6FA4E89A97EA20A9EEEE64B55D39A
2192992A274FC1A836BA3C23A3FEEBBD
454D4423643CE80E2A9AC94FA54CA49F

```

Obtained hash:

```

DDAF35A193617ABACC417349AE204131
12E6FA4E89A97EA20A9EEEE64B55D39A
2192992A274FC1A836BA3C23A3FEEBBD
454D4423643CE80E2A9AC94FA54CA49F

```

Sha512 Self Test Passed

Found package arch type ARCH_i686_TYPE

Found package FRU type FRU_RP_TYPE

Calculating SHA-1 hash...Validate package: SHA-1 hash:

calculated 8B082C48:35C23C9E:8A091441:D6FACEE6:B5111533

expected 8B082C48:35C23C9E:8A091441:D6FACEE6:B5111533

Image validated

Restricted Rights Legend

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c) of the Commercial Computer Software - Restricted Rights clause at FAR sec. 52.227-19 and subparagraph (c) (1) (ii) of the Rights in Technical Data and Computer

Software clause at DFARS sec. 252.227-7013.

cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706

Cisco IOS Software, ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version
16.3(20160527:095327)
[v163_throttle]
Copyright (c) 1986-2016 by Cisco Systems, Inc.
Compiled Tue 27-May-16 21:28 by mcpre

Cisco IOS-XE software, Copyright (c) 2005-2016 by cisco Systems, Inc.
All rights reserved. Certain components of Cisco IOS-XE software are
licensed under the GNU General Public License ("GPL") Version 2.0. The
software code licensed under GPL Version 2.0 is free software that comes
with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such
GPL code under the terms of GPL Version 2.0. For more details, see the
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to
export@cisco.com.

Warning: the compile-time code checksum does not appear to be present.
cisco ISR4451/K9 (2RU) processor with 1133585K/6147K bytes of memory.
Processor board ID FGL1619100P
4 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of Compact flash at bootflash:.
7816688K bytes of USB flash at usb0:.

Press RETURN to get started!

Installing a Firmware Subpackage

Before you begin

Obtain a consolidated package that contains your required firmware package and expand the package. (See [Managing and Configuring a Router to Run Using Individual Packages, on page 21.](#)) Make a note of the

location and name of the firmware package and use this information in the steps below for *URL-to-package-name*.

You can install a firmware subpackage if the router has been configured using, for example, [Managing and Configuring a Router to Run Using Individual Packages, on page 21](#).

Firmware subpackages are not released individually. You can select a firmware package from within a consolidated package after expanding the consolidated package. The firmware package can then be installed as shown in the procedure below.



Note Read the Release Notes document pertaining to the consolidated package to verify that the firmware within the consolidated package is compatible with the version of Cisco IOS XE software that is currently installed on a router.

SUMMARY STEPS

1. **show version**
2. **dir bootflash:**
3. **show platform**
4. **mkdir bootflash:** *URL-to-directory-name*
5. **request platform software package expand file** *URL-to-consolidated-package to URL-to-directory-name*
6. **reload**
7. **boot** *URL-to-directory-name /packages.conf*
8. **show version installed**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|---|
| Step 1 | show version Example: <pre>Router# show version Cisco IOS Software, IOS-XE Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version 15.3 (20120627:221639) [build_151722 111] Copyright (c) 1986-2012 by Cisco Systems, Inc. Compiled Thu 28-Jun-12 15:17 by mcpre . .</pre> | Shows the version of software running on the router. This can later be compared with the version of software to be installed. |
| Step 2 | dir bootflash: Example: <pre>Router# dir bootflash:</pre> | Displays the previous version of software and that a package is present. |
| Step 3 | show platform Example: <pre>Router# show platform Chassis type: ISR4451/K9</pre> | Checks the inventory. Also see the example in Installing Subpackages from a Consolidated Package section. |

| | Command or Action | Purpose |
|---------------|---|---|
| Step 4 | mkdir bootflash: <i>URL-to-directory-name</i> Example: Router# mkdir bootflash:mydir | Creates a directory to save the expanded software image. You can use the same name as the image to name the directory. |
| Step 5 | request platform software package expand file <i>URL-to-consolidated-package to URL-to-directory-name</i> Example: Router# request platform software package expand file bootflash:isr4400-universalk9-NIM.bin to bootflash:mydir | Expands the software image from the TFTP server (<i>URL-to-consolidated-package</i>) into the directory used to save the image (<i>URL-to-directory-name</i>), which was created in the Step 4. |
| Step 6 | reload Example: Router# reload rommon > | Enables ROMMON mode, which allows the software in the consolidated file to be activated. |
| Step 7 | boot URL-to-directory-name /packages.conf Example: rommon 1 > boot bootflash:mydir/packages.conf | Boots the consolidated package by specifying the path and name of the provisioning file: packages.conf. |
| Step 8 | show version installed Example: Router# show version installed Package: Provisioning File, version: n/a, status: active | Displays the version of the newly installed software. |

Examples

The initial part of the following example shows the consolidated package, isr4400-universalk9.164422SSA.bin, being copied to the TFTP server. This is a prerequisite step. The remaining part of the example shows the consolidated file, packages.conf, being booted.

```
Router# tftp:isr4400/isr4400-universalk9.164422SSA.bin bootflash:
Address or name of remote host []? 192.0.2.1
Destination filename [isr4400-universalk9.164422SSA.bin]?
Accessing tftp://192.0.2.1/isr4400/isr4400-universalk9.164422SSA.bin...
Loading isr4400/isr4400-universalk9.164422SSA.bin from 192.0.2.1 (via GigabitEthernet0):
!!!!!!!!!!
[OK - 410506248 bytes]

410506248 bytes copied in 338.556 secs (1212521 bytes/sec)

Router# show version
Cisco IOS Software, IOS-XE Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version

15.3(20120627:221639) [build_151722 111]
Copyright (c) 1986-2012 by Cisco Systems, Inc.
Compiled Thu 28-Jun-12 15:17 by mcpre
```

IOS XE Version: 2012-06-28_15.31_mcp

Cisco IOS-XE software, Copyright (c) 2005-2012 by Cisco Systems, Inc. All rights reserved. Certain components of Cisco IOS-XE software are licensed under the GNU General Public License ("GPL") Version 2.0. The software code licensed under GPL Version 2.0 is free software that comes with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such GPL code under the terms of GPL Version 2.0. For more details, see the documentation or "License Notice" file accompanying the IOS-XE software, or the applicable URL provided on the flyer accompanying the IOS-XE software.

ROM: IOS-XE ROMMON

Router uptime is 0 minutes
Uptime for this control processor is 3 minutes
System returned to ROM by reload
System image file is "tftp:isr4400/isr4400.bin"
Last reload reason: Reload Command

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to export@cisco.com.

License Level: adventerprise
License Type: EvalRightToUse
Next reload license Level: adventerprise
cisco ISR4451/K9 (2RU) processor with 1136676K/6147K bytes of memory.
Processor board ID FGL161611AB
4 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of Compact flash at bootflash:.

Configuration register is 0x8000

Router# **dir bootflash:**
Directory of bootflash:/

```
11 drwx 16384 May 3 2012 19:58:37 +00:00 lost+found
178465 drwx 4096 Jun 6 2012 15:20:20 +00:00 core
584065 drwx 4096 Jul 13 2012 19:19:00 +00:00 .prst_sync
405601 drwx 4096 May 3 2012 19:59:30 +00:00 .rollback_timer
113569 drwx 40960 Jul 13 2012 19:19:32 +00:00 tracelogs
64897 drwx 4096 May 3 2012 19:59:42 +00:00 .installer
13 -rw- 1305 May 7 2012 17:43:42 +00:00 startup-config
14 -rw- 1305 May 7 2012 17:43:55 +00:00 running-config
15 -r-- 1541 Jun 4 2012 18:32:41 +00:00 debug.conf
16 -rw- 1252 May 22 2012 19:58:39 +00:00 running-config-20120522
519169 drwx 4096 Jun 4 2012 15:29:01 +00:00 vman_fdb
```

7451738112 bytes total (7067635712 bytes free)

```

Router# show platform
Chassis type: ISR4451/K9

Slot Type State Insert time (ago)
-----
0 ISR4451/K9 ok 15:57:33
0/0 ISR4451-6X1GE ok 15:55:24
1 ISR4451/K9 ok 15:57:33
1/0 SM-1T3/E3 ok 15:55:24
2 ISR4451/K9 ok 15:57:33
2/0 SM-1T3/E3 ok 15:55:24
R0 ISR4451/K9 ok, active 15:57:33
F0 ISR4451-FP ok, active 15:57:33
P0 Unknown ps, fail never
P1 XXX-XXXX-XX ok 15:56:58
P2 ACS-4450-FANASSY ok 15:56:58

Slot CPLD Version Firmware Version
-----
0 12090323 15.3(01r)S [ciscouser-ISRRO...
1 12090323 15.3(01r)S [ciscouser-ISRRO...
2 12090323 15.3(01r)S [ciscouser-ISRRO...
R0 12090323 15.3(01r)S [ciscouser-ISRRO...
F0 12090323 15.3(01r)S [ciscouser-ISRRO...

Router# mkdir bootflash:isr4400-universalk9.dir1
Create directory filename [isr4400-universalk9.dir1]?
Created dir bootflash:/isr4400-universalk9.dir1
Router# request platform software package expand file bootflash:isr4400-universalk9.NIM.bin
to
bootflash:isr4400-universalk9.dir1
Verifying parameters
Validating package type
Copying package files
SUCCESS: Finished expanding all-in-one software package.

Router# reload
Proceed with reload? [confirm]

*Jul 13 19:39:06.354: %SYS-5-RELOAD: Reload requested by console. Reload Reason: Reload
Command.

rommon 1 > boot bootflash:isr4400-universalk9.dir1/packages.conf

File size is 0x00002836
Located isr4400-universalk9.dir1/packages.conf
Image size 10294 inode num 324484, bks cnt 3 blk size 8*512
#
File is comprised of 1 fragments (33%)

is_valid_shalhash: SHA-1 hash:
calculated 62f6235a:fc98eb3a:85ce183e:834f1cb3:8a1f71d1
expected 62f6235a:fc98eb3a:85ce183e:834f1cb3:8a1f71d1
File size is 0x04b3dc00
Located isr4400-universalk9.dir1/isr4400-mono-universalk9-build_164422SSA.pkg
Image size 78896128 inode num 324491, bks cnt 19262 blk size 8*512
#####
File is comprised of 21 fragments (0%)
.....

```

```
Router# show version installed
Package: Provisioning File, version: n/a, status: active
File: bootflash:isr4400-universalk9.dir1/packages.conf, on: RP0
Built: n/a, by: n/a
File SHA1 checksum: ad09affd3f8820f4844f27acc1add502e0b8f459

Package: rpbase, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9-build_164422SSA.pkg, on:
  RP0
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 5e95c9cbc4eaf5a4a5alac846ee2d0f41d1a026b

Package: firmware_attributes, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_attributes_164422SSA.pkg, on:
  RP0/0
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 71614f2d9cbe7f96d3c6e99b67d514bd108c6c99

Package: firmware_dsp_sp2700, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_dsp_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 8334565edf7843fe246783b1d5c6ed933d96d79e
Package: firmware_fpge, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_fpge_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: eb72900ab32c1c50652888ff486cf370ac901dd7

Package: firmware_sm_lt3e3, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_sm_lt3e3_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 803005f15d8ea71ab088647e2766727ac2269871

Package: rpcontrol, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 980fd58fe581e9346c44417b451d1c09ebb640c2

Package: rpios-universalk9, version: dir1, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.23, by: mcpred
File SHA1 checksum: 27084f7e30ald69d45a33e05dlb00345040799fb
Package: rpaccess, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:isr4400-universalk9.dir1/isr4400-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 0119802deda2da91c38473c47a998fb3ed423448

Package: firmware_attributes, version: 2012-07-10_16.22_mcpred, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_attributes_164422SSA.pkg, on:
  RP0/1
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 71614f2d9cbe7f96d3c6e99b67d514bd108c6c99

Package: firmware_dsp_sp2700, version: 2012-07-10_16.22_mcpred, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_dsp_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: 8334565edf7843fe246783b1d5c6ed933d96d79e

Package: firmware_fpge, version: 2012-07-10_16.22_mcpred, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_fpge-BLD-BLD_DEV_LATEST_
  20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpred
File SHA1 checksum: eb72900ab32c1c50652888ff486cf370ac901dd7
```

```

Package: firmware_sm_lt3e3, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_sm_lt3e3-BLD-BLD_MCP_DEV_LATEST_
20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 803005f15d8ea71ab088647e2766727ac2269871

Package: rpcontrol, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpcontrol-BLD-BLD_MCP_DEV_LATEST_20120710_
164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 980fd58fe581e9346c44417b451d1c09ebb640c2

Package: rprios-universalk9, version: 2012-07-10_16.23_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpios-universalk9-BLD-BLD_MCP_DEV_LATEST_
20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.23, by: mcpre
File SHA1 checksum: 27084f7e30ald69d45a33e05d1b00345040799fb

Package: rpaccess, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpaccess-BLD-BLD_MCP_DEV_LATEST_20120710_
164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 0119802deda2da91c38473c47a998fb3ed423448

Package: rpbase, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-rpbase-BLD-BLD_MCP_DEV_LATEST_20120710_
164422SSA.pkg, on: RP1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 5e95c9cbc4eaf5a4a5alac846ee2d0f41d1a026b

Package: firmware_attributes, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_attributes-BLD-BLD_MCP_DEV_LATEST_
20120710_164422SSA.pkg, on: RP1/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 71614f2d9cbe7f96d3c6e99b67d514bd108c6c99

Package: firmware_dsp_sp2700, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:isr4400-universalk9.dir1/isr4400-firmware_dsp_sp2700-BLD-BLD_MCP_DEV_LATEST_
20120710_164422SSA.pkg, on: RP1/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 8334565edf7843fe246783b1d5c6ed933d96d79e

Package: firmware_fpge, version: 2012-07-10_16.22_mcpre, status: n/a

```

Upgrading the Firmware on xDSL NIMs

To upgrade the firmware on a xDSL Network Interface Module (NIM), perform these steps:

Before you begin

When you boot the router in packages.conf mode with the Cisco IOS XE image (super package) during the installation period, you can upgrade or downgrade the firmware without reloading the router. You need to follow the steps described in Installing a Firmware Subpackage section before proceeding with the firmware upgrade.

If you do not boot the router in packages.conf mode with the Cisco IOS XE image, you need to follow the below prerequisites before proceeding with the firmware upgrade:

- Copy the firmware subpackage (NIM firmware) into bootflash:/mydir.

- Send a request to the platform software package expand file `bootflash:/mydir/<IOS-XE image>` to expand the super package.
- Reload the hardware module subslot to boot the module with the new firmware.
- Verify that the module is booted up with the new firmware using the **show platform software subslot x/y module firmware** command.

SUMMARY STEPS

1. copy Cisco IOS XE image into bootflash: **mydir**.
2. **request platform software package expand file** `bootflash:/mydir/<IOS-XE image>` to expand super package.
3. **reload**.
4. **boot bootflash:mydir/ /packages.conf**.
5. copy NIM firmware subpackage to the folder **bootflash:mydir/**.
6. **request platform software package install** `rp 0 file bootflash:/mydir/<firmware subpackage>`.
7. **hw-module subslot x/y reload** to boot the module with the new firmware.
8. **show platform software subslot 0/2 module firmware** to verify that the module is booted up with the new firmware.

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|---|
| Step 1 | copy Cisco IOS XE image into bootflash: mydir . Example: Router# <code>mkdir bootflash:mydir</code> | Creates a directory to save the expanded software image. You can use the same name as the image to name the directory. |
| Step 2 | request platform software package expand file <code>bootflash:/mydir/<IOS-XE image></code> to expand super package. Example: Router# <code>request platform software package expand file bootflash:/mydir/isr4400-universalk9.03.14.00.S.155-1.S-std.SPA.bin</code> | Expands the platform software package to super package. |
| Step 3 | reload . Example: Router# <code>reload</code> rommon > | Enables ROMMON mode, which allows the software in the super package file to be activated. |
| Step 4 | boot bootflash:mydir/ /packages.conf . Example: rommon 1 > <code>boot bootflash:mydir/packages.conf</code> | Boots the super package by specifying the path and name of the provisioning file: packages.conf. |
| Step 5 | copy NIM firmware subpackage to the folder bootflash:mydir/ . Example: | Copies the NIM firmware subpackage into bootflash:mydir. |

| | Command or Action | Purpose |
|---------------|--|---|
| | <pre>Router#copy bootflash:isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg bootflash:mydir/</pre> | |
| Step 6 | <p>request platform software package install <i>rp 0 file</i> <i>bootflash:/mydir/<firmware subpackage></i>.</p> <p>Example:</p> <pre>Router#request platform software package install rp 0 file bootflash:mydir/isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg</pre> | Installs the software package. |
| Step 7 | <p>hw-module subslot x/y reload to boot the module with the new firmware.</p> <p>Example:</p> <pre>Router#hw-module subslot 0/2 reload</pre> | Reloads the hardware module subslot and boots the module with the new firmware. |
| Step 8 | <p>show platform software subslot 0/2 module firmware to verify that the module is booted up with the new firmware.</p> <p>Example:</p> <pre>Router# show platform software subslot 0/2 module firmware Pe</pre> | Displays the version of the newly installed firmware. |

Examples

The following example shows how to perform firmware upgrade in a router module:

```
Router#mkdir bootflash:mydir
Create directory filename [mydir]?
Created dir bootflash:/mydir
Router#
Router#copy bootflash:isr4400-universalk9.03.14.00.S.155-1.S-std.SPA.bin bootflash:mydir/
Destination filename [mydir/isr4400-universalk9.03.14.00.S.155-1.S-std.SPA.bin]?
Copy in progress...CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCC
425288648 bytes copied in 44.826 secs (9487544 bytes/sec)
Router#
Router#
Router#dir bootflash:mydir
Directory of bootflash:/mydir/

632738 -rw-          425288648  Dec 12 2014 09:16:42 +00:00
isr4400-universalk9.03.14.00.S.155-1.S-std.SPA.bin

7451738112 bytes total (474025984 bytes free)
Router#

Router#request platform software package
expand file bootflash:/mydir/isr4400-universalk9.03.14.00.S.155-1.S-std.SPA.bin
```



```

Verifying parameters
Validating package type
Copying package files
SUCCESS: Finished expanding all-in-one software package.

```

```

Router#reload
Proceed with reload? [confirm]

```

```

*Dec 12 09:26:09.874: %SYS-5-RELOAD: Reload requested by console. Reload Reason:
Reload Command.Dec 12 09:26:25.156 R0/0: %PMAN-5-EXITACTION: Process manager is exiting:
process exit with reload chassis code

```

```

Initializing Hardware ...

```

```

System integrity status: 00000610
Rom image verified correctly
System Bootstrap, Version 15.3(3r)S1, RELEASE SOFTWARE
Copyright (c) 1994-2013 by cisco Systems, Inc.

```

```

Current image running: Boot ROM0

```

```

Last reset cause: LocalSoft
Cisco ISR4451-X/K9 platform with 4194304 Kbytes of main memory

```

```

rommon 1 boot bootflash:mydir/packages.conf

```

```

File size is 0x000028f1
Located mydir/packages.conf
Image size
10481 inode num 632741, bks cnt 3 blk size 8*512

```

```

#
File size is 0x150ae3cc
Located mydir/isr4400-mono-universalk9.03.14.00.S.155-1.S-std.SPA.pkg
Image size 353035212 inode num 356929, bks cnt 86191 blk size 8*512
#####
#####
Boot image size = 353035212 (0x150ae3cc) bytes

```

```

Package header rev 1 structure detected
Calculating SHA-1 hash...done
validate_package: SHA-1 hash:
calculated 8e966678:8afb08f4:8a88bb8f:fe591121:8bddf4b3
expected 8e966678:8afb08f4:8a88bb8f:fe591121:8bddf4b3

```

```

RSA Signed RELEASE Image Signature Verification Successful.
Package Load Test Latency : 3799 msec
Image validated
Dec 12 09:28:50.338 R0/0: %FLASH_CHECK-3-DISK_QUOTA: Flash disk quota exceeded
[free space is 61864 kB] - Please clean up files on bootflash.

```

Restricted Rights Legend

```

Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

```

```

cisco Systems, Inc.
170 West Tasman Drive

```

San Jose, California 95134-1706

Cisco IOS Software, ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 15.5(1)S,
RELEASE SOFTWARE (fc5)
Technical Support: <http://www.cisco.com/techsupport>
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Thu 20-Nov-14 18:28 by mcpre

Cisco IOS-XE software, Copyright (c) 2005-2014 by cisco Systems, Inc.
All rights reserved. Certain components of Cisco IOS-XE software are
licensed under the GNU General Public License ("GPL") Version 2.0. The
software code licensed under GPL Version 2.0 is free software that comes
with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such
GPL code under the terms of GPL Version 2.0. For more details, see the
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
<http://www.cisco.com/wvl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to
export@cisco.com.

cisco ISR4451-X/K9 (2RU) processor with 1681388K/6147K bytes of memory.
Processor board ID FTX1736AJUT
2 Ethernet interfaces
4 Gigabit Ethernet interfaces
2 ATM interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of flash memory at bootflash:.

Press RETURN to get started!

```
*Dec 12 09:28:58.922:
%IOS_LICENSE_IMAGE_APPLICATION-6-LICENSE_LEVEL:
Module name = esg Next reboot level = appxk9 and License = appxk9
*Dec 12 09:28:58.943:
%IOS_LICENSE_IMAGE_APPLICATION-6-LICENSE_LEVEL:
Module name = esg Next reboot level = ipbasek9 and License = ipbasek9
*Dec 12 09:28:58.981:
%ISR_THROUGHPUT-6-LEVEL: Throughput level has been set to 1000000 kbps
*Dec 12 09:29:13.302: %SPANTREE-5-EXTENDED_SYSID: Extended SysId enabled for type vlan
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface Lsmpi0, changed state to up
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface EOBC0, changed state to up
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface GigabitEthernet0, changed state to down
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface LIIN0, changed state to up
*Dec 12 09:28:51.438: %CMRP-3-PFU_MISSING:cmand: The platform does not detect a power
```

```

supply in slot 1
*Dec 12 09:29:01.256: %CMLIB-6-THROUGHPUT_VALUE:cmand: Throughput license found, throughput
  set to 1000000 kbps
*Dec 12 09:29:03.223: %CPPHA-7-START:cpp_ha: CPP 0 preparing ucode
*Dec 12 09:29:03.238: %CPPHA-7-START:cpp_ha: CPP 0 startup init
*Dec 12 09:29:11.335: %CPPHA-7-START:cpp_ha: CPP 0 running init
*Dec 12 09:29:11.645: %CPPHA-7-READY:cpp_ha: CPP 0 loading and initialization complete
*Dec 12 09:29:11.711: %IOSXE-6-PLATFORM:cpp_cp:
Process CPP_PFILTER_EA_EVENT_API_CALL_REGISTER
*Dec 12 09:29:16.280:
%IOSXE_MGMTVRF-6-CREATE_SUCCESS_INFO:
Management vrf Mgmt-intf created with ID 1, ipv4 table-id 0x1, ipv6 table-id 0x1E000001
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface Lsmpi0, changed state to up
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface EOBC0, changed state to up
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0, changed state to down
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface LIIN0, changed state to up
*Dec 12 09:29:17.521: %SYS-5-LOG_CONFIG_CHANGE: Buffer logging disabled
*Dec 12 09:29:18.867: %SYS-5-CONFIG_I: Configured from memory by console
*Dec 12 09:29:18.870:
%IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/0, interfaces disabled
*Dec 12 09:29:18.870:
%IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/1, interfaces disabled
*Dec 12 09:29:18.871:
%IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/2, interfaces disabled
*Dec 12 09:29:18.873:
%SPA_OIR-6-OFFLINECARD: SPA (ISR4451-X-4x1GE) offline in subslot 0/0
*Dec 12 09:29:18.874: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VA-B) offline in subslot 0/1
*Dec 12 09:29:18.874: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
*Dec 12 09:29:18.876: %IOSXE_OIR-6-INSCARD: Card (fp) inserted in slot F0
*Dec 12 09:29:18.876: %IOSXE_OIR-6-ONLINECARD: Card (fp) online in slot F0
*Dec 12 09:29:18.882: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/0
*Dec 12 09:29:18.884: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/1
*Dec 12 09:29:18.884: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/2
*Dec 12 09:29:18.935: %SYS-5-RESTART: System restarted --
Cisco IOS Software, ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 15.5(1)S,
RELEASE SOFTWARE (fc5)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Thu 20-Nov-14 18:28 by mcpre
*Dec 12 09:29:18.895: %SPA-3-ENVMON_NOT_MONITORED:iomd: Environmental monitoring
is not enabled for ISR4451-X-4x1GE[0/0]
*Dec 12 09:29:19.878: %LINK-5-CHANGED: Interface GigabitEthernet0,

changed state to administratively down
*Dec 12 09:29:22.419: %SPA_OIR-6-ONLINECARD: SPA (ISR4451-X-4x1GE) online in subslot 0/0
*Dec 12 09:29:22.610: %SYS-6-BOOTTIME: Time taken to reboot after reload = 194 seconds
*Dec 12 09:29:24.354: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0,
changed state to down
*Dec 12 09:29:24.415: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/2,
changed state to down
*Dec 12 09:29:24.417: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/3,
changed state to down
*Dec 12 09:29:30.919: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0,
changed state to up
*Dec 12 09:29:30.925: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/2,
changed state to up
*Dec 12 09:29:30.936: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/3,
changed state to up
*Dec 12 09:29:31.919: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/0, changed state to up

```

```

*Dec 12 09:29:31.930: %LINEPROTO-5-UPDOWN: Line protocol on
  Interface GigabitEthernet0/0/2, changed state to up
*Dec 12 09:29:31.936: %LINEPROTO-5-UPDOWN: Line protocol on
  Interface GigabitEthernet0/0/3, changed state to up
*Dec 12 09:29:34.147: %SSH-5-ENABLED: SSH 1.99 has been enabled
*Dec 12 09:30:29.152: %SPA_OIR-6-ONLINECARD: SPA (NIM-VA-B) online in subslot 0/1
*Dec 12 09:30:29.470: %SPA_OIR-6-ONLINECARD: SPA (NIM-VAB-A) online in subslot 0/2
*Dec 12 09:30:31.152: %LINK-3-UPDOWN: Interface Ethernet0/1/0, changed state to down
*Dec 12 09:30:31.152: %LINK-3-UPDOWN: Interface ATM0/1/0, changed state to down
*Dec 12 09:30:31.470: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to down
*Dec 12 09:30:31.470: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
*Dec 12 09:31:03.074: %CONTROLLER-5-UPDOWN: Controller VDSL 0/2/0, changed state to up
*Dec 12 09:31:05.075: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to up
*Dec 12 09:31:06.076: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2/0,
changed state to up
*Dec 12 09:31:12.559: %CONTROLLER-5-UPDOWN: Controller VDSL 0/1/0, changed state to up
*Dec 12 09:31:20.188: %LINK-3-UPDOWN: Interface ATM0/1/0, changed state to up
*Dec 12 09:31:21.188: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/1/0,
changed state to up
Router>
Router>en
Password:
Router#
Router#show controller vdsl 0/2/0
Controller VDSL 0/2/0 is UP

Daemon Status:  UP

      XTU-R (DS)  XTU-C (US)
Chip Vendor ID:  'BDCM'      'BDCM'
Chip Vendor Specific:  0x0000      0xA41B
Chip Vendor Country:  0xB500      0xB500
Modem Vendor ID:  'CSCO'      ' '
Modem Vendor Specific:  0x4602      0x0000
Modem Vendor Country:  0xB500      0x0000
Serial Number Near:      FOC18426DQ8 4451-X/K15.5(1)S
Serial Number Far:
Modem Version Near:      15.5(1)S
Modem Version Far:      0xa41b

Modem Status(L1): TC Sync (Showtime!)
DSL Config Mode: VDSL2
Trained Mode(L1): G.993.2 (VDSL2) Profile 30a

TC Mode:  PTM
Selftest Result: 0x00
DELT configuration: disabled
DELT state:  not running

Failed full inits: 0
Short inits: 0
Failed short inits: 0

Modem FW  Version: 4.14L.04
Modem PHY Version: A2pv6F039h.d24o_rc1

Line 1:

      XTU-R (DS)  XTU-C (US)
Trellis:  ON      ON
SRA:      disabled  disabled
SRA count:  0      0
Bit swap:  enabled  enabled
Bit swap count:  9      0

```

```

Profile 30a:      enabled
Line Attenuation:  3.5 dB    0.0 dB
Signal Attenuation:  0.0 dB    0.0 dB
Noise Margin:     30.9 dB   12.4 dB
Attainable Rate:  200000 kbits/s   121186 kbits/s
Actual Power:    13.3 dBm   7.2 dBm
Per Band Status:      D1  D2  D3  U0  U1  U2  U3
Line Attenuation(dB):  0.9  1.5  5.5  N/A  0.1  0.9  3.8
Signal Attenuation(dB): 0.8  1.5  5.5  N/A  0.0  0.2  3.2
Noise Margin(dB):     31.1 31.0 30.9 N/A 12.3 12.4 12.5
Total FECC:         0    0
Total ES:           0    0
Total SES:          0    0
Total LOSS:         0    0
Total UAS:          51   51
Total LPRS:         0    0
Total LOFS:         0    0
Total LOLS:         0    0

```

```

          DS Channel11  DS Channel10  US Channel11  US Channel10
Speed (kbps):      NA          100014  NA          100014
SRA Previous Speed: NA          0  NA          0
Previous Speed:    NA          0  NA          0
Reed-Solomon EC:   NA          0  NA          0
CRC Errors:        NA          0  NA          0
Header Errors:     NA          0  NA          0
Interleave (ms):   NA          9.00  NA          0.00
Actual INP:        NA          4.00  NA          0.00

```

```

Training Log : Stopped
Training Log Filename : flash:vdslllog.bin

```

```

Router#
Router#

```

```

Router#copy bootflash:isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
bootflash:mydir/

```

```

Destination filename [mydir/isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg]?
Copy in progress...CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
6640604 bytes copied in 1.365 secs (4864911 bytes/sec)
Router#

```

```

Router#request platform software package install rp 0 file
bootflash:mydir/isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
--- Starting local lock acquisition on R0 ---
Finished local lock acquisition on R0

```

```

--- Starting file path checking ---
Finished file path checking

```

```

--- Starting image file verification ---
Checking image file names
Locating image files and validating name syntax
  Found isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
Verifying image file locations
Inspecting image file types
Processing image file constraints
Creating candidate provisioning file
Finished image file verification

```

```

--- Starting candidate package set construction ---
Verifying existing software set

```

```

Processing candidate provisioning file
Constructing working set for candidate package set
Constructing working set for running package set
Checking command output
Constructing merge of running and candidate packages
Checking if resulting candidate package set would be complete
Finished candidate package set construction

--- Starting ISSU compatibility verification ---
Verifying image type compatibility
Checking IPC compatibility with running software
Checking candidate package set infrastructure compatibility
Checking infrastructure compatibility with running software
Checking package specific compatibility
Finished ISSU compatibility verification

--- Starting impact testing ---
Checking operational impact of change
Finished impact testing

--- Starting list of software package changes ---
Old files list:
  Removed isr4400-firmware_nim_xdsl.03.14.00.S.155-1.S-std.SPA.pkg
New files list:
  Added isr4400-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
Finished list of software package changes

--- Starting commit of software changes ---
Updating provisioning rollback files
Creating pending provisioning file
Committing provisioning file
Finished commit of software changes

--- Starting analysis of software changes ---
Finished analysis of software changes

--- Starting update running software ---
Blocking peer synchronization of operating information
Creating the command set placeholder directory
  Finding latest command set
  Finding latest command shortlist lookup file
  Finding latest command shortlist file
  Assembling CLI output libraries
  Assembling CLI input libraries
Skipping soft links for firmware upgrade
Skipping soft links for firmware upgrade
  Assembling Dynamic configuration files
  Applying interim IPC and database definitions
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19/
release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19/
release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19
/release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]
  Replacing running software
  Replacing CLI software
  Restarting software
  Applying final IPC and database definitions
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19/
release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]

```

```

Generating software version information
Notifying running software of updates
Unblocking peer synchronization of operating information
Unmounting old packages
Cleaning temporary installation files
Finished update running software

SUCCESS: Finished installing software.
Router#
Router#show platform software subslot 0/2 module firmware
Avg Load info
-----
1.83 1.78 1.44 3/45 607

Kernel distribution info
-----
Linux version 3.4.11-rt19 (sapanwar@blr-atg-001) (gcc version 4.6.2
(Buildroot 2011.11) ) #3 SMP PREEMPT Fri Nov 7 09:26:19 IST 2014

Module firmware versions
-----
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039h.d24o_rcl

Boot Loader: Secondary
-----
Version: 1.1

Modem Up time
-----
0D 0H 25M 38S

Router#

Router#hw-module subslot 0/2 reload
Proceed with reload of module? [confirm]
Router#
*Dec 12 09:55:59.645: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(NIM-VAB-A)
reloaded on subslot 0/2
*Dec 12 09:55:59.646: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
*Dec 12 09:55:59.647: %CONTROLLER-5-UPDOWN: Controller VDSL 0/2/0, changed state to down
*Dec 12 09:57:22.514: new extended attributes received from iomd(slot 0 bay 2 board 0)
*Dec 12 09:57:22.514: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(NIM-VAB-A)
reloaded on subslot 0/2
*Dec 12 09:57:22.515: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
Router#
Router#
*Dec 12 09:58:35.471: %SPA_OIR-6-ONLINECARD: SPA (NIM-VAB-A) online in subslot 0/2
*Dec 12 09:58:37.470: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to down
*Dec 12 09:58:37.470: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
Router#

Router#show platform software subslot 0/2 module firmware
Avg Load info
-----
0.84 0.23 0.08 1/45 598

Kernel distribution info
-----
Linux version 3.4.11-rt19 (sapanwar@blr-atg-001) (gcc version 4.6.2 (Buildroot 2011.11) )
#6 SMP PREEMPT Mon Nov 17 10:51:41 IST 2014

Module firmware versions
-----

```

```
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039n.d24o_rc1
```

```
Boot Loader: Secondary
```

```
-----
Version: 1.1
```

```
Modem Up time
```

```
-----
0D 0H 0M 42S
```

```
Router#
```