



## **Migration Guide for Cisco ASR 9000 Series Routers**

**First Published:** 2016-08-31

**Last Modified:** 2017-02-14

### **Americas Headquarters**

Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134-1706  
USA  
<http://www.cisco.com>  
Tel: 408 526-4000  
800 553-NETS (6387)  
Fax: 408 527-0883

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

All printed copies and duplicate soft copies of this document are considered uncontrolled. See the current online version for the latest version.

Cisco has more than 200 offices worldwide. Addresses and phone numbers are listed on the Cisco website at [www.cisco.com/go/offices](http://www.cisco.com/go/offices).

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <https://www.cisco.com/c/en/us/about/legal/trademarks.html>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1721R)

© 2017 Cisco Systems, Inc. All rights reserved.

- To receive timely, relevant information from Cisco, sign up at [Cisco Profile Manager](#).
- To get the business impact you're looking for with the technologies that matter, visit [Cisco Services](#).
- To submit a service request, visit [Cisco Support](#).
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit [Cisco Marketplace](#).
- To obtain general networking, training, and certification titles, visit [Cisco Press](#).
- To find warranty information for a specific product or product family, access [Cisco Warranty Finder](#).

#### **Cisco Bug Search Tool**

[Cisco Bug Search Tool](#) (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.

© 2017 Cisco Systems, Inc. All rights reserved.





## CONTENTS

|                  |   |           |
|------------------|---|-----------|
| <b>CHAPTER 1</b> | <b>New and Changed Feature Description</b>          | <b>1</b>  |
|                  | New and Changed Feature Information                 | 1         |
| <b>CHAPTER 2</b> | <b>Migrating to IOS XR 64-bit OS</b>                | <b>3</b>  |
|                  | Why Migrate to IOS XR 64-Bit OS?                    | 3         |
|                  | Migration Methods                                   | 4         |
| <b>CHAPTER 3</b> | <b>Migrating using Cisco Software Manager</b>       | <b>5</b>  |
|                  | Cisco Software Manager                              | 5         |
|                  | Migration Process Using CSM                         | 5         |
| <b>CHAPTER 4</b> | <b>Migrating using Manual Method</b>                | <b>7</b>  |
|                  | Supported Hardware                                  | 7         |
|                  | Software Requirement                                | 10        |
|                  | Prepare System for Migration                        | 10        |
|                  | Migrate to IOS XR 64-Bit OS                         | 12        |
|                  | Migrate Using eUSB Boot                             | 13        |
|                  | Migrate Using TFTPBOOT                              | 14        |
|                  | Verify Migration                                    | 15        |
| <b>CHAPTER 5</b> | <b>Rolling Back from IOS XR 64-bit to IOS XR OS</b> | <b>19</b> |
|                  | Prepare System for Rollback                         | 19        |
|                  | Rollback to IOS XR OS                               | 20        |
|                  | Rollback Using Embedded USB                         | 20        |
|                  | Rollback Using ROMMON Settings                      | 21        |
|                  | Verify Rollback                                     | 23        |

---

**CHAPTER 6****Difference Between 32-bit and 64-bit OS 25**

Architectural Difference Between 32-bit and 64-bit OS 25

Understanding the IOS XR 64-bit Architecture 26

Operational Differences Between 32-bit and 64-bit OS on ASR 9000 Series Routers 28

CLI Differences Between 32-bit And 64-bit OS on ASR 9000 Series Routers 31



## CHAPTER 1

# New and Changed Feature Description

This section lists all the new and changed information for the Migration guide.

- [New and Changed Feature Information, on page 1](#)

## New and Changed Feature Information

| Release       | Feature Description   |
|---------------|---|
| All           | Gain an understanding of the basic differences between Cisco IOS XR 32-bit and 64-bit operating system on the ASR 9000 series routers.<br><a href="#">Difference Between 32-bit and 64-bit OS, on page 25</a> |
| Release 6.1.3 | A new parameter <code>-m</code> was added to specify the RSP boot slot. This parameter is used while rolling back from Cisco IOS XR 64-bit to IOS XR 32-bit operating system.                                 |
| Release 6.1.2 | The migration from Cisco IOS XR 32-bit to IOS XR 64-bit operating system was introduced.  |







## CHAPTER 2

# Migrating to IOS XR 64-bit OS

This document provides the procedure to migrate from Cisco IOS XR 32-bit to 64-bit operating system (OS) on the ASR9000 series routers.

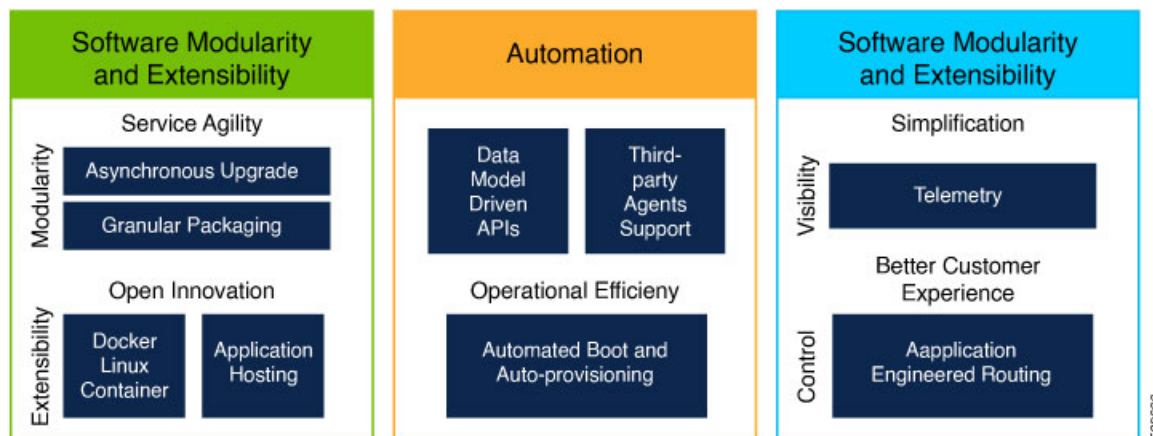
- [Why Migrate to IOS XR 64-Bit OS?, on page 3](#)
- [Migration Methods, on page 4](#)

## Why Migrate to IOS XR 64-Bit OS?

IOS XR 64-bit operating system (OS) is the next-generation IOS XR OS that runs on virtualized environment with underlying 64-bit Linux kernel. The Linux kernel distinctively separates the admin and the routing plane and their functions.

The key capabilities of IOS XR 64-bit OS include the following cloud-scale operational enhancements:

**Figure 1: Cloud-scale Operational Enhancements**



- Industry trends—Significantly improved ability to track technology, performance, scale and security trends with 64-bit processors, operating systems and third party applications.
- Software modularity—Redhat Packet Manager (RPM)-based software packaging and management with major features delivered as independent packages To explore easy routine upgrades and maintenance with modularized RPM packages, see the *System Setup and Software Installation Guide for Cisco ASR 9000 Series Routers*.

- **Telemetry**—push toward smarter visibility of the network by streaming data to a configured receiver for analysis and troubleshooting purposes. To get started with streaming telemetry data using model-driven telemetry, see the *Telemetry Configuration Guide for Cisco ASR 9000 Series Routers*.
- **Application Hosting**—leverage hosting of third-party applications in a container environment. To take advantage of containers and host applications, see the *Application Hosting Configuration Guide for Cisco ASR 9000 Series Routers*.
- **Data Models**—automate configurations that belong to multiple routers across the network. To automate configuration tasks across heterogeneous devices in a network, see the *Programmability Configuration Guide for Cisco ASR 9000 Series Routers*.

For more information, see the [Cisco Software Innovations for Cloud-Scale Networking ebook](#).

## Migration Methods

Migration from IOS XR to IOS XR 64-bit OS can be carried out in different methods using:

- **Cisco Software Manager (CSM):** Use this method to convert configuration, and schedule migration using CSM application.
- **Manual method:** Use this method to manually prepare the system, use a script to migrate, and verify that the migration was successful.

After migration, setup the system and install packages. For more information, see [System Setup and Software Installation Guide for Cisco ASR 9000 Series Routers](#).



## CHAPTER 3

# Migrating using Cisco Software Manager

This chapter helps to use Cisco Software Manager (CSM) application to migrate from Cisco IOS XR to Cisco IOS XR 64-bit operating system on the ASR9000 series routers.

This chapter covers information on:

- [Cisco Software Manager, on page 5](#)
- [Migration Process Using CSM, on page 5](#)

## Cisco Software Manager

Cisco Software Manager (CSM) is an application that can be installed on Mac OS or UNIX. CSM helps manage the process of Software Maintenance Upgrades (SMUs) and Service Packs (SPs) on devices that run the Cisco IOS XR Software. CSM also helps migrate from IOS XR to IOS XR 64 bit on the ASR9000 routers.

## Migration Process Using CSM

The migration from IOS XR to IOS XR 64 bit using CSM involves these phases:

- 1. Pre-migrate:** Prepares the device for migration through a series of automated tasks:
  - Checks hardware and software compatibility and operational state.
  - Removes content from `harddisk:/` and `harddiskb:/` location.
  - Copies the conversion, and existing operational configuration to be applied after successful migration.
  - Copies the 64-bit tar file to `harddisk:/` location.
  - Checks relevant FPD versions and performs FPD upgrades, if necessary.
- 2. Migrate:** Migrates the device to IOS XR 64 bit through a series of automated tasks:
  - Sets the boot mode to load the 64-bit image from `/harddiskb:/` location.
  - Takes a back-up of admin and IOS XR configurations.
  - Reloads the device to load the 64-bit image.
- 3. Post-migrate:** Verifies the migration through a series of automated tasks:

- Ensures all Route Switch Processors (RSP), Route Processors (RP) and Line Cards (LC) are in operational state.
- Loads the migrated and converted admin configurations.
- Loads either the migrated and converted IOS XR configuration or a custom IOS XR configuration based on the selection during scheduling migration.
- Checks FPD versions, upgrades FPDs, and reloads device, if necessary.

For more information about scheduling migration to IOS XR 64 bit, in the CSM application, click **Tools > ASR9K to ASR9K-64 Migration**.



## CHAPTER 4

# Migrating using Manual Method

This document provides the procedure to manually migrate from Cisco IOS XR to Cisco IOS XR 64-bit operating system on the ASR 9000 series routers.

- [Supported Hardware, on page 7](#)
- [Software Requirement, on page 10](#)
- [Prepare System for Migration, on page 10](#)
- [Migrate to IOS XR 64-Bit OS, on page 12](#)
- [Verify Migration, on page 15](#)

## Supported Hardware

The supported IOS XR 64-bit Product ID (PID) is listed in the table.

| Type       | Supported       | Release |
|------------|-----------------|---------|
| Fans PID   | ASR-9904-FAN    | -       |
|            | ASR-9006-FAN-V2 | -       |
|            | ASR-9010-FAN-V2 | -       |
|            | ASR-9912-FAN    | -       |
|            | ASR-9922-FAN-V2 | -       |
| PEMS PID   | PWR-2KW-DC-V2   | -       |
|            | PWR-3KW-AC-V2   | -       |
|            | PWR-6KW-AC-V3   | -       |
|            | PWR-4.4KW-DC-V3 | -       |
| Fabric PID | A99-SFC2        | 6.1.3   |
|            | A99-SFC-S       | 6.2.1   |
|            | A99-SFC-T       | 6.3.1   |

| Type    | Supported        | Release |
|---------|------------------|---------|
| RP, RSP | A99-RP2-SE       | 6.1.3   |
|         | A99-RP2-TR       |         |
|         | A9K-RSP880-SE    | 6.1.3   |
|         | A9K-RSP880-TR    |         |
|         | A99-RSP-TR       | 6.2.1   |
|         | A99-RSP-SE       |         |
|         | A9K-RSP880-LT-TR | 6.4.1   |
|         | A9K-RSP880-LT-SE |         |

| Type      | Supported         | Release |
|-----------|-------------------|---------|
| Line card | A9K-4X100GE-SE    | 6.1.3   |
|           | A9K-8X100GE-L-SE  |         |
|           | A9K-4X100GE-TR    |         |
|           | A9K-8X100GE-L-TR  |         |
|           | A9K-8X100GE-LB-TR |         |
|           | A9K-8X100GE-LB-SE |         |
|           | A9K-8X100GE-SE    |         |
|           | A99-8X100GE-SE    |         |
|           | A99-8X100GE-CM    |         |
|           | A90-8X100GE-CM    |         |
|           | A99-8X100GE-TR    |         |
|           | A9K-8X100GE-TR    |         |
|           | A99-12x100GE      | 6.1.3   |
|           | A99-12X100GE-CM   |         |
|           | A9K-400GE-DWDM-TR | 6.2.1   |
|           | A9K-MOD400-TR     | 6.2.1   |
|           | A9K-MOD400-SE     |         |
|           | A9K-MOD400-CM     |         |
|           | A9K-MOD200-TR     | 6.3.1   |
|           | A9K-MOD200-SE     |         |
|           | A9K-MOD200-CM     |         |
|           | A9K-24X10GE-1G-TR | 6.3.2   |
|           | A9K-24X10GE-1G-SE |         |
|           | A9K-48X10GE-1G-TR |         |
|           | A9K-48X10GE-1G-SE |         |
|           | A9K-4X100GE       | 6.4.1   |
|           | A9K-24X10GE-1G-CM | 6.4.2   |
|           | A9K-48X10GE-1G-CM |         |

# Software Requirement

A version of IOS XR release based on your requirement as outlined in the table in [Supported Hardware, on page 7](#) topic must run on the system before migrating to IOS XR 64 bit.

1. Upgrade the system to the minimum IOS XR release identified or higher.
2. Migrate from IOS XR release to any IOS XR 64 bit release.

## Prepare System for Migration

Prepare the system before migrating to IOS XR 64-bit to enable easy operation.

### Before you begin

Before you proceed, ensure that you have completed these pre-requisites:

- **Connect port:** connect console port to the terminal server. After migration, the console port will be connected the IOS XR 64-bit plane. If necessary, the AUX port can be used to connect to the management plane.
- **Backup data:** back up data on the router, System Admin plane, and XR plane configurations to an external server. All data drives except for harddiskb:/ drive are formatted during migration. The harddiskb:/ drive, also known as eusb:/ drive is resized. All available data drives can be viewed using the **show media** command.
- **Configure processor:** Configure RSP4/RP2 to reach the external server to download IOS XR 64-bit ISO image.

### Procedure

#### Step 1

Upgrade the ASR 9000 router to a minimum version as listed in table [Supported Hardware, on page 7](#):

- a) For every available line card in the system, identify the list of 64-bit releases from the [Supported Hardware, on page 7](#) table, and select the latest release.

#### Example:

In the following specification, the minimum required release is 6.3.2.

| RP/LC             | Release |
|-------------------|---------|
| A99-RP2-SE        | 6.1.3   |
| A9K-8X100GE-TR    | 6.1.3   |
| A99-SFC2          | 6.1.3   |
| A9K-400GE-DWDM-TR | 6.2.1   |
| A9K-24X10GE-1G-TR | 6.3.2   |



- b) Upgrade to IOS XR image as listed in table [Supported Hardware, on page 7](#).

```
RP/0/RSP0/CPU0:ios# admin install add source <path-to-image>/asr9k-mini-px.pie-6.1.3
asr9k-fpd-px-6.1.3 activate prompt-level none synchronous
```

For more information about upgrading the version, see *Upgrading and Managing Software on Cisco ASR 9000 Series Router* in the [Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide](#).

- c) Verify that the packages are active.

```
RP/0/RSP0/CPU0:ios# show install active summary
Sun Oct 30 09:05:05.333 UTC
Default Profile:
  SDRs:
    Owner
  Active Packages:
    disk0:asr9k-mini-px-6.1.3
    disk0:asr9k-fpd-px-6.1.3
```

- d) Commit the upgrade.

```
RP/0/RSP0/CPU0:ios# admin install commit
```

## Step 2 Upgrade FPD on RSP4, RP2, LC, and FC2 with unified FPDs:

**Important** FPD upgrade of new and supported hardware that will be used in IOS XR 64-bit after migration must be done in IOS XR.

```
RP/0/RSP0/CPU0:ios#admin upgrade hw-module fpd all location all
```

**Note** During the upgrade of FPDs:

- Do not reload the router or power cycle the router.
- Do not do an online insertion and removal (OIR) of RP2, RSP4, LC, and FC2 cards.
- Check the console logs or syslogs to monitor the progress of the FPD upgrade. If you observe a failure in the logs, stop the upgrade process and contact the Cisco Technical Assistance Center.

## Step 3 Setup a user with `root-lr` privileges only in the XR plane.

XR Plane:

```
username root
group root-lr
password <password>
!
```

**Note** In IOS XR 64-bit, the `root-system` group exists only in the System Admin plane, and not in the XR plane. Instead, `root-lr` group with equal privileges must be setup in the XR plane.

## Step 4 Run script `resize_eusb` to clean up `harddisk:/`, `harddiskb:/`, and back up System Admin and XR plane config to `harddiskb:/`.

**Note** When searching for file in XR shell using `ls -ltr` in `/pkg/bin` for `migrate_to_eXR` or `resize_eusb`, use the complete file name. For example, `ls -ltr pkg/bin/resize_eusb` or `ls -ltr pkg/bin/migrate_to_eXR`. Wild card search is not supported in shell.

```
RP/0/RSP0/CPU0:ios# run /pkg/bin/resize_eusb

Removing content of harddisk:/dumper
Removing content of harddisk:/showtech
Media cleanup operation completed.
Checking harddisk: size.
Sufficient disk space available in harddisk:/ to copy eXR image.
Success: Pre-Migration Operation Completed.
Removing content of harddiskb:/
Saving current configuration to /harddiskb:/cXR_xr_plane.cfg. It will be available in /eusbb/
after migration to IOS XR 64 bit.
Saving current admin configuration to /harddiskb:/cXR_admin_plane.cfg. It will be available
in /eusbb/ after migration to
IOS XR 64 bit.
#exit
```

---

### What to do next

Ensure all supported RSPs, RPs, FCs, and LCs are present so that the new OS takes effect on all of the cards post migration.

For the list of supported IOS XR 64-bit Product ID (PID), see [Supported Hardware, on page 7](#).

After the router is prepared for migration, run the migration script to migrate to IOS XR 64-bit OS.

## Migrate to IOS XR 64-Bit OS

Migration to IOS XR 64 bit is performed using a script `migrate_to_eXR` available in `/pkg/bin/`. The migration script performs these tasks:

- Copies GRUB files to `/harddiskb:/efi/boot/`
- Sets the boot mode on active RSP/RP to boot from `harddiskb:/`
- Sets the boot mode on standby RSP /RP to boot from active RSP/RP



### Note

- The IOS XR 32-bit to 64-bit conversion script does not support file names exceeding 48 characters.
- The IOS XR 32-bit operating system has a maximum file size limit of 2 GB. Ensure that GISO does not exceed that limit.
- When using the migration tar file, ensure that it is the only tar file on `harddisk:/` drive.

### Before you begin

- Ensure that you have completed [Prepare System for Migration, on page 10](#).
- Install the mandatory FPD PIE.
- While migrating, you might face migration abortion due to idle timeout. To avoid this, execute the command `line console exec-timeout 0` in config mode on the router:

```
RP/0/RP0/CPU0:router#config
Wed Apr 1 10:06:38.592 UTC
RP/0/RP0/CPU0:router(config)#line console exec-timeout 0
RP/0/RP0/CPU0:router(config)#commit
Wed Apr 1 10:06:51.281 UTC
RP/0/RP0/CPU0:router(config)#end
RP/0/RP0/CPU0:router#
```



**Note** From IOS XR release 6.1.3, the golden ISO (GISO) migration tar file must be built to migrate from IOS XR to IOS XR 64 bit. For more information about building the GISO migration tar file, see *Customize Installation using GISO* chapter in *System Setup and Software Installation Guide for Cisco ASR 9000 Series Routers*.

## Migrate Using eUSB Boot

To migrate using the 64-bit image stored in eUSB:

### Procedure

- Step 1** Copy the IOS XR 64-bit tar image to harddisk:/ drive. The tar image must be copied only to harddisk:/ drive. This tar image can be mini or GISO tar file. The following example shows a mini tar file copied to harddisk:/ drive. The mini tar file is posted on CCO, and GISO tar file must be created based on required RPMS/SMU.

```
RP/0/RSP0/CPU0:ios# copy <image-location>/asr9k-mini-x64-migrate_to_eXR.tar6.1.3
harddisk:/asr9k-mini-x64-migrate_to_eXR.tar-6.1.3
```

- Step 2** Run the migration script.

**Note** Running the script with `-r` parameter will reload the router. Remove this parameter to reload manually.

```
RP/0/RSP0/CPU0:ios#run /pkg/bin/migrate_to_eXR -m eusb -r
Executing the migration script on the standby node 0/RSP1/CPU0...
Assigning booting mode...
Updated booting mode successfully
Finished executing on the standby node.
Found tar file asr9k-mini-x64-migrate_to_eXR.tar-6.1.3 in /harddisk:/.
This tar file should contain the ASR9K IOS XR 64 Bit ISO and boot files.
Extracting boot/ EFI/ from tar file...
Tar: blocksize = 20
x boot/certs/Root_Certificate_Store.bin, 1047 bytes, 3 tape blocks
x boot/certs/CertFile, 795 bytes, 2 tape blocks
x boot/certs/crl.der, 438 bytes, 1 tape blocks
x boot/bzImage, 4475087 bytes, 8741 tape blocks
x boot/initrd.img, 144796121 bytes, 282805 tape blocks
x boot/signature.initrd.img, 256 bytes, 1 tape blocks
x EFI/boot/grub.efi, 914463 bytes, 1787 tape blocks
x EFI/boot/grub.cfg, 530 bytes, 2 tape blocks
Finished extracting tar file.
Updated the image filename in /harddiskb:/EFI/boot/grub.cfg to
asr9k-mini-x64migrate_to_eXR.tar-6.1.3
Assigning booting mode...
Updated booting mode successfully
Now reloading the system to migrate to ASR9K IOS XR 64 bit.
Proceed with reload? [confirm]
RP/0/RP0/CPU0::This node received reload command.
```

```

Reloading in 5 secs
  Reboot on ASR9912 RP2 (0x100326) in slot 0
By reload via REBOOT_CAUSE_RELOAD (4000001)
Current time: 2016-10-30 11:20:05.651, Up time: 4h 16m 3s
Release mastership on RP2
Normal reboot

```

```
# exit
```

Migration script parameters:

| Script parameter | Parameter description |
|------------------|-----------------------|
| -m               | media                 |
| -r               | reload router         |

**Step 3** Reload the router, if not reloaded in previous step using -r parameter.

```
Reload router (If not reloaded in previous step using -r
```

Preparing system for backup. This may take a few minutes especially for large configurations.

```

      Status report: node0_RSP0_CPU0: START TO BACKUP
      Status report: node0_RSP0_CPU0: BACKUP HAS COMPLETED SUCCESSFULLY
[Done]
Proceed with reload? [confirm]

```

## Migrate Using TFTPBOOT

To migrate using TFTPBOOT with management port connectivity:

### Procedure

Run the migration script `migrate_to_eXR` available in `/pkg/bin/`.

```
RP/0/RSP0/CPU0:ios#run /pkg/bin/migrate_to_eXR -s -p tftp -a 1.24.55.61 -n 255.255.255.0
-g 1.24.0.1 -u <image-location>/asr9k-mini-x64.iso
```

For help about the migration script, execute the command `run /pkg/bin/migrate_to_eXR -h`.

Migration script parameters:

| Script parameter | Parameter description |
|------------------|-----------------------|
| -a               | IP_ADDRESS            |
| -n               | IP_SUBNET_MASK        |
| -g               | DEFAULT_GATEWAY       |
| -u               | SERVER_URL            |
| -p               | Protocol              |

| Script parameter | Parameter description |
|------------------|-----------------------|
| -S               | Static Settings       |

System will boot with IOS XR 64-bit followed by automatic reload, and will boot from disk. The standby RSP and RP, if present, will boot from active RSP and RP.

### What to do next

Set username and password when the system prompts on the XR console. The user is also created on System Admin plane.

## Verify Migration

After running the migration script, verify that the system migrated to IOS XR 64 bit successfully.

### Before you begin

Ensure that you have completed [Prepare System for Migration, on page 10](#) and [Migrate to IOS XR 64-Bit OS, on page 12](#).

### Procedure

#### Step 1

Run the **show platform** command to verify that RSP4, RP2, LC, and FC2 are in `IOS XR RUN` or `OPERATIONAL` state.

An `IOS XR RUN` or `OPERATIONAL` state indicates that the System Admin and XR planes are booted up. The system is ready for IOS XR 64-bit FPD upgrades and configuration. If an RSP4, RP2, FC2, or LC is not displayed, contact Cisco Technical assistance Center.

An example of **show platform** output from RSP0:

```
RP/0/RSP0/CPU0:ios#show platform
Sun Oct 30 11:25:04.315 UTC
```

| Node        | Type                    | State       | Config state |
|-------------|-------------------------|-------------|--------------|
| 0/RSP0/CPU0 | A9K-RSP880-SE (Active)  | IOS XR RUN  | NSHUT        |
| 0/RSP1/CPU0 | A9K-RSP880-SE (Standby) | IOS XR RUN  | NSHUT        |
| 0/FT0       | ASR-9904-FAN            | OPERATIONAL | NSHUT        |
| 0/0/CPU0    | A9K-8X100GE-L-SE        | IOS XR RUN  | NSHUT        |
| 0/1/CPU0    | A9K-8X100GE-L-SE        | IOS XR RUN  | NSHUT        |
| 0/PT0       | A9K-AC-PEM-V3           | OPERATIONAL | NSHUT        |

An example of **show platform** output from RP0:

```
RP/0/RP0/CPU0:ios#show platform
Sun Oct 30 11:30:01.907 UTC
```

| Node       | Type                 | State       | Config state |
|------------|----------------------|-------------|--------------|
| 0/RP0/CPU0 | A99-RP2-TR (Active)  | IOS XR RUN  | NSHUT        |
| 0/RP1/CPU0 | A99-RP2-TR (Standby) | IOS XR RUN  | NSHUT        |
| 0/FT0      | ASR-9912-FAN         | OPERATIONAL | NSHUT        |
| 0/FT1      | ASR-9912-FAN         | OPERATIONAL | NSHUT        |
| 0/0/CPU0   | A9K-8X100GE-L-SE     | IOS XR RUN  | NSHUT        |

```

0/1/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/2/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/3/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/4/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/5/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/6/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/7/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/8/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/9/CPU0      A9K-8X100GE-L-SE      IOS XR RUN      NSHUT
0/FC0         A99-SFC2               OPERATIONAL     NSHUT
0/FC1         A99-SFC2               OPERATIONAL     NSHUT
0/FC2         A99-SFC2               OPERATIONAL     NSHUT
0/FC3         A99-SFC2               OPERATIONAL     NSHUT
0/FC4         A99-SFC2               OPERATIONAL     NSHUT
0/FC6         A99-SFC2               OPERATIONAL     NSHUT
0/PT0         A9K-AC-PEM-V2          OPERATIONAL     NSHUT
0/PT1         A9K-AC-PEM-V2          OPERATIONAL     NSHUT
0/PT2         A9K-AC-PEM-V2          OPERATIONAL     NSHUT

```

An example of **show platform** output from System Admin:

```

sysadmin-vm:0_RP0# show platform
Sun Oct 30 11:37:04.862 UTC

```

| Location | Card Type        | HW State    | SW State    | Config State |
|----------|------------------|-------------|-------------|--------------|
| 0/0      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/1      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/2      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/3      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/4      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/5      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/6      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/7      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/8      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/9      | A9K-8X100GE-L-SE | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/RP0    | A99-RP2-TR       | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/RP1    | A99-RP2-TR       | OPERATIONAL | OPERATIONAL | NSHUT        |
| 0/FC0    | A99-SFC2         | OPERATIONAL | N/A         | NSHUT        |
| 0/FC1    | A99-SFC2         | OPERATIONAL | N/A         | NSHUT        |
| 0/FC2    | A99-SFC2         | OPERATIONAL | N/A         | NSHUT        |
| 0/FC3    | A99-SFC2         | OPERATIONAL | N/A         | NSHUT        |
| 0/FC4    | A99-SFC2         | OPERATIONAL | N/A         | NSHUT        |
| 0/FC6    | A99-SFC2         | OPERATIONAL | N/A         | NSHUT        |
| 0/FT0    | ASR-9912-FAN     | OPERATIONAL | N/A         | NSHUT        |
| 0/FT1    | ASR-9912-FAN     | OPERATIONAL | N/A         | NSHUT        |
| 0/PT0    | A9K-AC-PEM-V2    | OPERATIONAL | N/A         | NSHUT        |
| 0/PT1    | A9K-AC-PEM-V2    | OPERATIONAL | N/A         | NSHUT        |
| 0/PT2    | A9K-AC-PEM-V2    | OPERATIONAL | N/A         | NSHUT        |

## Step 2

Run the **show hw-module fpd** command from XR or System Admin mode to check if an FPD upgrade is required. If an upgrade is required, perform step 3, else go to step 4.

The FPD pie is bundled with the ISO image installed on the router.

```

RP/0/RSP0/CPU0:ios#show hw-module fpd
Sun Oct 30 12:05:00.674 UTC

```

| Location | Card type     | HWver | FPD device | ATR Status | FPD Versions |          |
|----------|---------------|-------|------------|------------|--------------|----------|
|          |               |       |            |            | Running      | Programd |
| 0/RSP0   | A9K-RSP880-SE | 1.0   | Alpha-FPGA | NEED UPGD  | 0.10         | 0.10     |
| 0/RSP0   | A9K-RSP880-SE | 1.0   | CBC        | CURRENT    | 34.38        | 34.38    |
| 0/RSP0   | A9K-RSP880-SE | 1.0   | Cha-FPGA   | CURRENT    | 0.04         | 0.04     |
| 0/RSP0   | A9K-RSP880-SE | 1.0   | IPU-FPGA   | NEED UPGD  | 0.40         | 0.40     |
| 0/RSP0   | A9K-RSP880-SE | 1.0   | IPU-FSBL   | CURRENT    | 1.80         | 1.80     |

```

0/RSP0    A9K-RSP880-SE    1.0    IPU-Linux                CURRENT    1.80    1.80
0/RSP0    A9K-RSP880-SE    1.0    Omega-FPGA               CURRENT    0.11    0.11
0/RSP0    A9K-RSP880-SE    1.0    Optimus-FPGA             NEED UPGD  0.08    0.08
0/RSP0    A9K-RSP880-SE    1.0    Rommon                   CURRENT    10.48   10.48

```

-----Truncated-----

```
RP/0/RSP0/CPU0:ios#
```

A NEED UPGD status indicates that an FPD upgrade of the card is required.

**Step 3** Run the **upgrade hw-module location all fpd all** command to upgrade the FPD from XR or System Admin plane.

```
RP/0/RSP0/CPU0:ios#upgrade hw-module location all fpd all
```

**Note** During the upgrade of FPDs:

- Do not reload the router or power cycle the router.
- Do not do an online insertion and removal (OIR) of RP2, RSP4, LC, and FC2 cards.
- Check the console logs or syslogs to monitor the progress of the FPD upgrade. If you observe a failure in the logs, stop the upgrade process and contact the Cisco Technical Assistance Center.

**Step 4** Reload the router to upgrade with IOS XR 64-bit FPD.

```

sysadmin-vm:0_RSP0# hw-module location all reload
Sun Oct 30 13:05:56.202 UTC
Reload hardware module ? [no,yes] yes

```

**Step 5** Verify that the status of all FPDs is CURRENT.

```
RP/0/RSP0/CPU0:ios#show hw-module fpd
```

```

RP/0/RSP0/CPU0:ios#show hw-module fpd
Sun Oct 30 13:48:42.178 UTC

```

| Location | Card type        | HWver | FPD device   | ATR Status | FPD Versions |          |
|----------|------------------|-------|--------------|------------|--------------|----------|
|          |                  |       |              |            | Running      | Programd |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | Alpha-FPGA   | CURRENT    | 0.14         | 0.14     |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | CBC          | CURRENT    | 34.38        | 34.38    |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | Cha-FPGA     | CURRENT    | 0.04         | 0.04     |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | IPU-FPGA     | CURRENT    | 0.42         | 0.42     |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | IPU-FSBL     | CURRENT    | 1.80         | 1.80     |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | IPU-Linux    | CURRENT    | 1.80         | 1.80     |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | Omega-FPGA   | CURRENT    | 0.11         | 0.11     |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | Optimus-FPGA | CURRENT    | 0.12         | 0.12     |
| 0/RSP0   | A9K-RSP880-SE    | 1.0   | Rommon       | CURRENT    | 10.48        | 10.48    |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | Alpha-FPGA   | CURRENT    | 0.14         | 0.14     |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | CBC          | CURRENT    | 34.38        | 34.38    |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | Cha-FPGA     | CURRENT    | 0.04         | 0.04     |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | IPU-FPGA     | CURRENT    | 0.42         | 0.42     |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | IPU-FSBL     | CURRENT    | 1.80         | 1.80     |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | IPU-Linux    | CURRENT    | 1.80         | 1.80     |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | Omega-FPGA   | CURRENT    | 0.11         | 0.11     |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | Optimus-FPGA | CURRENT    | 0.12         | 0.12     |
| 0/RSP1   | A9K-RSP880-SE    | 1.0   | Rommon       | CURRENT    | 10.48        | 10.48    |
| 0/FT0    | ASR-9904-FAN     | 1.0   | CBC          | CURRENT    | 31.05        | 31.05    |
| 0/O      | A9K-8X100GE-L-SE | 0.24  | CBC          | CURRENT    | 38.23        | 38.23    |

```

0/0      A9K-8X100GE-L-SE  0.24  Dalla                CURRENT  1.06    1.06
0/0      A9K-8X100GE-L-SE  0.24  IPU-FPGA             CURRENT  1.76    1.76
0/0      A9K-8X100GE-L-SE  0.24  IPU-FSBL             CURRENT  1.78    1.78
0/0      A9K-8X100GE-L-SE  0.24  IPU-Linux            CURRENT  1.78    1.78

```

```

-----Truncated-----
RP/0/RSP0/CPU0:ios#

```

**Step 6** Install required RPMs if mini.iso is installed on the router. If full.iso is installed, only k9 sec package is required to be installed on the router.

Configure RSP4/RP2 to reach the external server to install the required RPMs.

In the following sample output, with mini.iso installed on the router, all the RPMs are installed.

```

RP/0/RSP0/CPU0:ios# install add source <image-location>/asr9k-mcast-x64-2.0.0.0r613.x86_64.rpm

asr9k-eigrp-x64-1.0.0.0-r613.x86_64.rpm  asr9k-mgbl-x642.0.0.0-r613.x86_64.rpm
asr9k-isis-x64-1.0.0.0-r613.x86_64.rpm
asr9k-mppls-tersvp-x64-1.0.0.0-r613.x86_64.rpm  asr9k-k9sec-x64-1.1.0.0r613.x86_64.rpm
asr9k-mppls-x64-2.0.0.0-r613.x86_64.rpm  asr9k-li-x64-1.1.0.0r613.x86_64.rpm
asr9k-optic-x64-1.0.0.0-r613.x86_64.rpm
asr9k-m2m-x64-2.0.0.0r613.x86_64.rpm  asr9k-ospf-x64-1.0.0.0-r613.x86_64.rpm

RP/0/RSP0/CPU0:ios# install activate id 1 << (Pick ID from install add step)
Or
RP/0/RSP0/CPU0:ios# install activate <rpm 1> <rpm 2> <rpm 3> <rpm n>
RP/0/RSP0/CPU0:Oct 30 14:44:03.316 : sdr_instmgr[1139]: %INSTALL-INSTMGR-6OPERATION_SUCCESS
:
Install operation 2 finished successfully

RP/0/RSP0/CPU0:ios# install commit
Wed Oct 30 13:56:29.705 UTC
Oct 30 14:46:30 Install operation 3 started by root:   install commit

```

**Step 7** Verify that the RPMs are successfully installed.

```

RP/0/RSP0/CPU0:ios#show install committed
Sun Oct 30 15:06:15.991 UTC
Node 0/RSP0/CPU0 [RP]
  Boot Partition: xr_lv0
  Committed Packages: 12
    asr9k-xr-6.1.1 version=6.1.3 [Boot image]
    asr9k-eigrp-x64-1.0.0.0-r613
    asr9k-isis-x64-1.0.0.0-r613
    asr9k-mcast-x64-2.0.0.0-r613
    asr9k-mgbl-x64-2.0.0.0-r613
    asr9k-mppls-te-rsvp-x64-1.0.0.0-r613
    asr9k-k9sec-x64-1.1.0.0-r613
    asr9k-li-x64-1.1.0.0-r613
    asr9k-m2m-x64-2.0.0.0-r613
    asr9k-mppls-x64-2.0.0.0-r613
    asr9k-optic-x64-1.0.0.0-r613
    asr9k-ospf-x64-1.0.0.0-r613

```

The router is migrated to IOS XR 64 bit successfully.





## CHAPTER 5

# Rolling Back from IOS XR 64-bit to IOS XR OS

This section provides the procedure to rollback from Cisco IOS XR 64-bit to Cisco IOS XR operating system on the ASR 9000 series routers.

This chapter covers information on these procedures:

- [Prepare System for Rollback, on page 19](#)
- [Rollback to IOS XR OS, on page 20](#)
- [Verify Rollback, on page 23](#)

## Prepare System for Rollback

### Before you begin

Before you proceed, ensure that you have completed these pre-requisites:

- **Connect port:** Connect console port to terminal server. After the rollback to Cisco IOS XR, the console port will be connected the IOS XR plane. If necessary, the AUX port can be used to connect to XR plane.
- **Insert card:** ensure all supported RSP, RP, FC, and LCs are inserted. Perform rollback using RSP/RP in slot 0.
- **Backup data:** back up data on the router, the system admin plane, and the XR plane configurations to an external server. All data drives including harddiskb:/ (also known as eusb:/) drive are formatted during migration. All available data drives can be viewed using the **show media location <location id>** command.
- **Configure processor:** ensure RSP4 and RP2 are configured to reach the external server to download the IOS XR ISO image.

### What to do next

The router is prepared for migration. Roll back the system from IOS XR 64-bit to IOS XR OS.



```

Updated boot mode to turbo boot IOS XR 32 Bit
Updated Turbo boot flag in IOS XR 32 Bit
Updated boot filename to asr9k-mini-px.vm-6.1.3
Executing the migration script on RSP1/RP1...
Updated MIGRATE flag.
Updated boot mode to turbo boot IOS XR 32 Bit
Updated Turbo boot flag in IOS XR 32 Bit
No ASR9K 32 Bit IOS XR image in harddiskb:/. Take as standby node.
Reload to boot IOS XR 32 Bit image.
*** IMPORTANT *** Please back up your admin and XR configurations before reloading.
sysadmin-vm:0_RP0# run /etc/rc.d/init.d/migrate_to_cXR -b eusb -r
Mon Oct 31 09:53:33.570 UTC

```

```

Executing the migration script on RSP0/RP0...
Updated MIGRATE flag.
Updated boot mode to turbo boot IOS XR 32 Bit
Updated Turbo boot flag in IOS XR 32 Bit
Updated boot filename to asr9k-mini-px.vm-6.1.3
Rebooting Automatically
Setting up the reload option
Successfully connected to SM service

```

Migration script parameters:

| Script Parameter | Parameter Description  |
|------------------|--|
| -b               | Boot mode  |
| -r               | Reload router  |
| -m               | RSP boot slot<br><b>Note</b> The parameter <code>-m</code> is supported from release 6.1.3 and later. The accepted values are <code>-m RSP0/RSP1</code> or <code>-m RP0/RP1</code> . |

**Step 3** Reload the router if not reloaded in previous step using `-r` parameter.

```

sysadmin-vm:0_RP0# hw-module location all reload
Mon Oct 31 10:00:53.339 UTC
Reload hardware module ? [no,yes]

```

System boots with IOS XR followed by reload, and will boot from the disk. The standby RP, if present, will boot from active RP.

### What to do next

Verify that the rollback from IOS XR 64-bit to IOS XR OS is successful.

## Rollback Using ROMMON Settings

This option uses management port on active RP or RSP to rollback.

## Procedure

### Step 1 Log in to System Admin plane and execute the script.

```
sysadmin-vm:0_RP0# run /etc/rc.d/init.d/migrate_to_cXR -b tftp -a <ip-address> -n
<ip-subnet-mask> -g <default-gateway> -s <tftp-server> -p </image-path>/asr9k-mini-px.vm
-m <rsp-boot-slot>
Mon Oct 31 10:05:06.630 UTC
```

```
Executing the migration script on RSP0/RP0...
Updated the Migration Flag
Updated the BOOT Parameter Flag
Updated IP_ADDRESS to <ip-address>
Updated DEFAULT_GATEWAY to <default-gateway>
Updated IP_SUBNET_MASK to <ip-subnet-mask>
Updated TFTP_SERVER to <tftp-server>
Updated TFTP_FILE to </image-path>/asr9k-mini-px.vm
Updated boot mode to turbo boot IOS XR 32 Bit
Updated Turbo boot flag in IOS XR 32 Bit
Executing the migration script on RSP1/RP1...
Updated the Migration Flag
Updated the BOOT Parameter Flag
Updated IP_ADDRESS to <ip-address>
Updated DEFAULT_GATEWAY to <default-gateway>
Updated IP_SUBNET_MASK to <ip-subnet-mask>
Updated TFTP_SERVER to <tftp-server>
Updated TFTP_FILE to </image-path>/asr9k-mini-px.vm
Updated boot mode to turbo boot IOS XR 32 Bit
Updated Turbo boot flag in IOS XR 32 Bit
Reload to boot IOS XR 32 Bit image.
*** IMPORTANT *** Please back up your admin and XR configurations before reloading.
```

Migration script parameters:

| Script Parameter | Parameter Description  |
|------------------|--|
| -a               | IP_ADDRESS   |
| -n               | IP_SUBNET_MASK   |
| -g               | DEFAULT_GATEWAY  |
| -p               | Path to vm image   |
| -s               | Server IP  |
| -b               | Boot mode  |
| -r               | Reload router  |
| -m               | RSP boot slot<br><br><b>Note</b> The parameter -m is supported from release 6.1.3 and later. The accepted values are -m RSP0/RSP1 or -m RP0/RP1. |

### Step 2 Reload the router if not reloaded in previous step using -r parameter.

```
sysadmin-vm:0_RP0# hw-module location all reload
Mon Oct 31 10:37:53.339 UTC
Reload hardware module ? [no,yes]
```

System boots with IOS XR OS followed by reload, and will boot from the disk. The standby RP, if present, will boot from active RP.

---

### What to do next

Verify that the rollback from IOS XR 64 bit to IOS XR is successful.

## Verify Rollback

After the rollback to IOS XR from IOS XR 64 bit, verify that the operation was successful.

### Procedure

---

- Step 1** Load required software packages using install CLIs.
- For more information about upgrading the software packages, see *Upgrading and Managing Software on Cisco ASR 9000 Series Router* in the [Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide](#).
- Step 2** Load the saved configuration from external server and commit the configuration.
- 

The router is rolled back to IOS XR successfully.





## CHAPTER 6

# Difference Between 32-bit and 64-bit OS

---

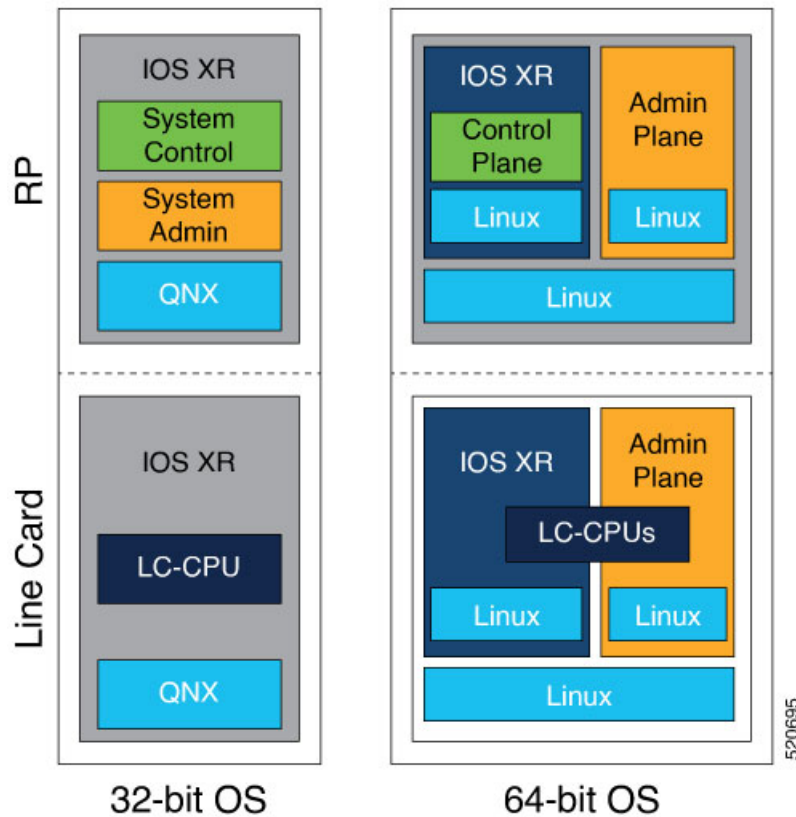
This section provides the differences between Cisco IOS XR 32-bit and 64-bit operating system on the ASR 9000 series routers.

- [Architectural Difference Between 32-bit and 64-bit OS, on page 25](#)
- [Understanding the IOS XR 64-bit Architecture, on page 26](#)
- [Operational Differences Between 32-bit and 64-bit OS on ASR 9000 Series Routers, on page 28](#)
- [CLI Differences Between 32-bit And 64-bit OS on ASR 9000 Series Routers, on page 31](#)

## Architectural Difference Between 32-bit and 64-bit OS

The following image shows the architectural difference between 32-bit and 64-bit OS.

Figure 2: Architectural Difference Between 32-bit and 64-bit OS

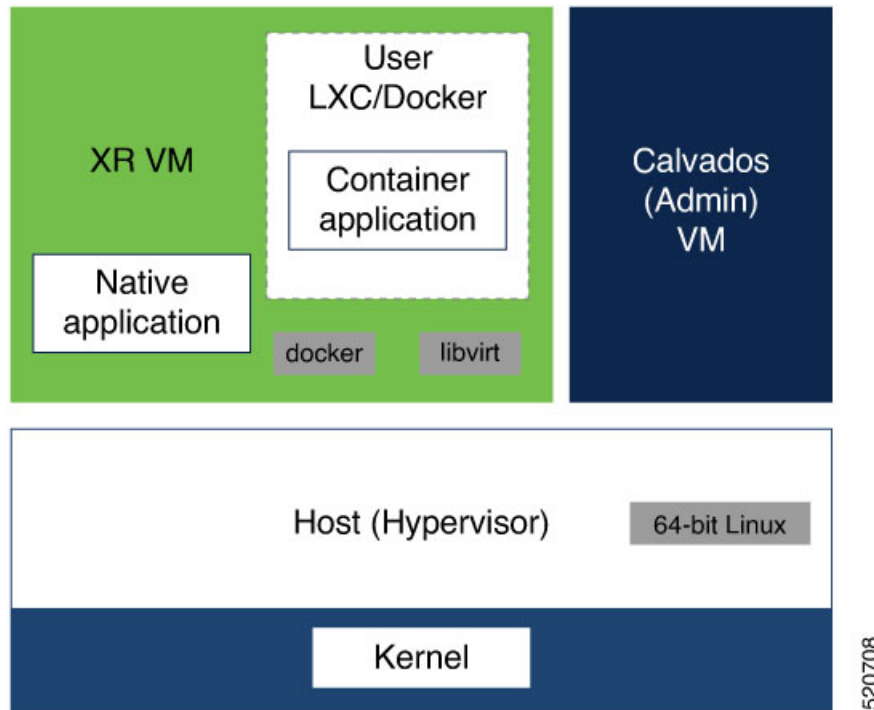


## Understanding the IOS XR 64-bit Architecture

IOS XR 64-bit OS runs in two variants:

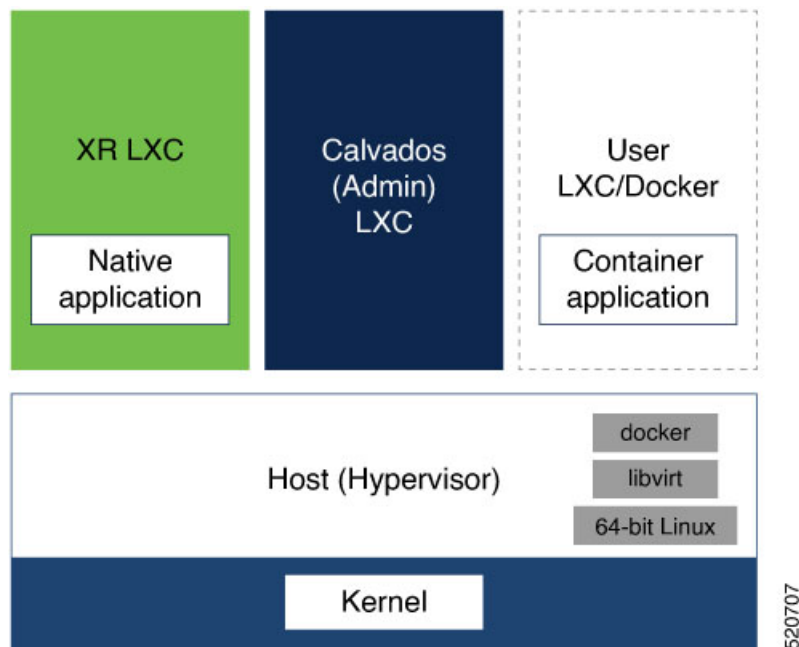
- VM-based 64-bit software:
  - Supported platforms: ASR 9000, NCS 6000
  - VM OS is separate from Host OS.



*Figure 3: VM-based 64-bit OS Architecture*

- Container-based 64-bit software:
  - Supported platforms: NCS 5500, NCS 5000
  - Container (LXC) OS shares the same kernel as the Host OS
  - Light-weight architecture

Figure 4: LXC-based 64-bit OS Architecture



The architecture includes the following common components:

- **Host (Hypervisor):** The host is the underlying 64-bit operating system that acts as the hypervisor. The XR VM/LXC and the Admin VM/LXC spawn on the hypervisor. It also runs the container/VM daemons like `libvirt` and `docker` to spawn the XR and Calvados instances.
- **XR VM:** The IOS XR control plane processes run within an isolated VM/LXC. This VM/LXC contains the IOS XR control plane processes (protocol stacks such as BGP, ISIS, OSPF, internal database, APIs, and so on). The XR VM brings its own kernel and runs the `libvirt` daemon and the `docker` daemon inside the XR VM. The `User LXC/Docker` containers are spawned inside XR VM unlike LXC-based platforms where the user containers are spawned on the Host kernel.
- **Admin VM:** Admin VM/LXC, called Calvados, is the first instance that comes up once the Host layer is up. The admin VM/LXC therefore helps handle the lifecycle of the XR VM/LXC. The primary purpose of Calvados is to enable multi-tenancy on the same router by spawning multiple IOS XR instances. These instances act as separate logical routers (secure domain routers (SDRs)).

For more information, see the [Data Sheet](#). For blogs and tutorials, see [xrdocs.io](#).

## Operational Differences Between 32-bit and 64-bit OS on ASR 9000 Series Routers

This section outlines the architectural and operational differences between 32-bit and 64-bit routers at a high level.

| Category | IOS XR 32-bit OS | IOS XR 64-bit OS |
|----------|------------------|------------------|
| Kernel   | QNX              | Linux            |

| Category              | IOS XR 32-bit OS  | IOS XR 64-bit OS  |
|-----------------------|---|---|
| Control plane         | The IOS XR control plane and feature configurations are unchanged.  |   |
| Virtualization        | No virtualization<br>All applications run as different processes.   | Two VMs:<br>Sysadmin VM and XR VM on isolated RP/LC CPU.  |
| Management LAN0       | Visible in XR plane to perform management services.   | Visible in XR VM to perform management services.  |
| Management LAN1       |   | Visible in Sysadmin VM to perform file transfer (install and file copy).  |
| Console and Aux ports | -   | Console port directs to the XR VM.<br>Aux port directs to the Sysadmin VM.  |
| Software packaging    | <ul style="list-style-type: none"> <li>• PIE-based packages.</li> <li>• Special VM image for fresh installation (Turboboot).</li> </ul> | <ul style="list-style-type: none"> <li>• ISO/RPM based packages.</li> <li>• ISO image for bootup and fresh installation.</li> <li>• Flexible Golden ISO (GISO) image.</li> <li>• Offline RPM-based package management.</li> </ul>                                 |
| Boot facility         | <ul style="list-style-type: none"> <li>• Install CLI-based boot</li> <li>• ROMMON: TFTP network boot</li> <li>• USB boot</li> </ul>     | <ul style="list-style-type: none"> <li>• Boot directly from ISO using: <ul style="list-style-type: none"> <li>• Local settings</li> <li>• DHCP</li> <li>• USB</li> </ul> </li> <li>• Install CLI using TFTP/FTP/SFTP/HTTP/HTTPS</li> <li>• ZTP support</li> </ul> |
| File check system     | Run the <b>fsck</b> command to check the status of the file system.   | The file system is checked automatically during the bootup process, eliminating the need to run the command manually.   |

| Category       | IOS XR 32-bit OS   | IOS XR 64-bit OS   |
|----------------|--|--|
| Chassis reload | <p>No VMs. The reload happens at hardware module (each RSP/RP/LC) or at entire chassis level.</p> <ul style="list-style-type: none"> <li>Run the <b>reload</b> command from XR mode to reload the corresponding RSP/RP node.</li> <li>Run the <b>reload</b> command from admin mode to reload the the specified hardware module.</li> <li>Run the <b>reload location all</b> command from admin Exec prompt to reload the entire chassis.</li> <li>Run the <b>hw-module location &lt;location&gt; reload</b> command from admin mode to reload a specific module.</li> </ul> | <p>2 VMs on each of the RSP/RP/LC CPU. The reload happens at VM (admin/XR), hardware module or at entire chassis level.</p> <ul style="list-style-type: none"> <li>Run the <b>reload</b> command from XR mode to reload the XR VM.</li> <li>Run the <b>reload</b> command from admin mode to reload the the VMs (admin VM, XR VM or all VMs).</li> <li>Run the <b>hw-module location all reload</b> command or <b>reload rack 0</b> command from admin Exec prompt to reload the entire chassis. The <b>reload location all</b> command reloads only the VMs.</li> <li>Run the <b>hw-module location &lt;location&gt; reload</b> command from admin mode to reload a specific module or the entire chassis.</li> </ul> |
| Applications   | NA   | Third-party applications can be hosted on XR VM, which use the kernel stack for northbound communication.  |
| FPD            | <p>FPD upgrade performed in Sysadmin plane.</p> <p>Run <b>fpd auto-upgrade</b> command and <b>fpd auto-reload</b> command from Sysadmin plane.</p>   | <p>FPD upgrade performed in XR VM.</p> <p>Run <b>fpd auto-upgrade enable</b> command and <b>fpd auto-reload enable</b> command from XR VM.</p> <p>To disable the FPD upgrade, use <b>disable</b> keyword in these commands.</p>  |
| Clock          | Daylight saving (DST) must be configured explicitly.   | DST changes are embeded into a timezone file, and is adjusted automatically.   |
| Fabric mode    | Default (1024 VQIs)  | High-bandwidth (2048 VQIs)   |

| Category             | IOS XR 32-bit OS  | IOS XR 64-bit OS   |
|----------------------|---|--|
| Attach to LC console | Run <b>run attachCon &lt;lc_node&gt;</b> from XR plane.   | Login to Sysadmin VM on RP/RSP where XR is active.<br><br>Run <b>run chvrf 0 attachCon 0/1</b> from Sysadmin VM.   |
| Internal copy        | Storage device is common between the admin and xr plane. No copy commands are required.   | Login to LC XR or Sysadmin VM and copy using scp command.<br><br>copy from LC to RSP:run scp lc0_xr:/filename /harddisk:/<br><br>Copy from Sysadmin to XR VM:copy harddisk:/ location 0/RSP0 harddisk:/ location 0/RSP0/CPU0/VM1 |
| Reboot history       | Both XR and admin planes provide reboot history of nodes.   | XR VM provides details about VM reboot history. Sysadmin VM provides details about both the VM and the card-level reboot history.  |
| CLI changes          | Admin CLI changes: Configuration, Exec and Show commands<br><br>XR Exec and Show command CLI changes: No major changes in configuration CLIs. |  |

## CLI Differences Between 32-bit And 64-bit OS on ASR 9000 Series Routers

The following table shows the CLI usage for few commonly used commands and differences between 32-bit and 64-bit OS:

| IOS XR 32-bit OS                                   | IOS XR 64-bit OS   |
|--|--|
| show platform                                      | show platform—sysadmin<br>show platform vm—XR<br>show sdr—Sysadmin provides information about VMs<br>show vm—Sysadmin provides health of the VMs |
| show hw-module fpd location all                    | show hw-module fpd   |
| N/A  | show hw-module location <slot> fpd <fpd name>  |
| admin upgrade hw-module fpd all force location all | upgrade hw-module location all fpd all force<br>admin upgrade hw-module location all fpd all force   |

| IOS XR 32-bit OS                   | IOS XR 64-bit OS   |
|------------------------------------|--|
| show version<br>show version brief | show version   |
| admin show diag <slot> eeprom-info | admin show diag detail location <slot>   |
| show inventory                     | show inventory   |
| admin show inventory               | admin show inventory   |
| admin show fpd package             | admin show fpd package in Sysadmin mode<br>show fpd package in XR mode   |
| admin show led                     | admin show led   |
| admin show environment alarms      | admin show alarm   |
| show environment table             | show environment temperatures  |
| show install summary               | N/A  |
| admin show environment fan         | admin show environment fans  |
| admin show environment voltages    | admin show environment voltages  |
| admin show environment altitude    | admin show environment altitude  |
| admin show environment power       | admin show env power-supply  |
| show environment all               | show environment all   |
| admin show dsc                     | NA   |
| admin reload location all          | admin hw-module location all reload  |
| show redundancy in admin mode      | NA   |
| fsck filesystem:                   | NA   |
| show process cpu<br>run top_procs  | show process cpu<br>run top  |
| show pfm location <location-id>    | show alarms brief card/system<br>active/suppressed/history<br>show pfm location <location-id><br>admin show alarms |

The following section shows the difference in output for few commands in 32-bit and 64-bit OS:

### show platform

#### 32-bit:

```
Router#show platform
Node           Type                               State           Config State
-----
0/RSP1/CPU0    A9K-RSP880-SE (Active)   IOS XR RUN      PWR, NSHUT, MON
0/0/CPU0       A9K-400G-DWDM-TR        IOS XR RUN      PWR, NSHUT, MON
0/1/CPU0       A9K-8X100GE-L-SE        UNPOWERED       PWR, NSHUT, MON
```

**64-bit:**

```
Router#show platform
Node           Type                               State           Config state
-----
0/RSP0/CPU0    A9K-RSP880-SE (Active)   IOS XR RUN      NSHUT
0/RSP1/CPU0    A9K-RSP880-SE (Standby) IOS XR RUN      NSHUT
0/FT0          ASR-9904-FAN             OPERATIONAL     NSHUT
0/0/CPU0       A99-8X100GE-SE           IOS XR RUN      NSHUT
0/1/CPU0       A99-8X100GE-SE           IOS XR RUN      NSHUT
0/PT0          A9K-AC-PEM-V2            OPERATIONAL     NSHUT
```

**admin show platform****32-bit:**

```
Router#show platform
Node           Type                               State           Config State
-----
0/RSP1/CPU0    A9K-RSP880-SE (Active)   IOS XR RUN      PWR, NSHUT, MON
0/FT0/SP       ASR-9904-FAN             READY
0/0/CPU0       A9K-400G-DWDM-TR        IOS XR RUN      PWR, NSHUT, MON
0/1/CPU0       A9K-8X100GE-L-SE        UNPOWERED       PWR, NSHUT, MON
0/PS0/M0/SP    PWR-3KW-AC-V2           FAILED          PWR, NSHUT, MON
0/PS0/M1/SP    PWR-3KW-AC-V2           READY           PWR, NSHUT, MON
```

**64-bit:**

```
Router#admin show platform
Location  Card Type           HW State           SW State           Config State
-----
0/0       A99-8X100GE-SE      OPERATIONAL        OPERATIONAL        NSHUT
0/1       A99-8X100GE-SE      OPERATIONAL        OPERATIONAL        NSHUT
0/RSP0    A9K-RSP880-SE       OPERATIONAL        OPERATIONAL        NSHUT
0/RSP1    A9K-RSP880-SE       OPERATIONAL        OPERATIONAL        NSHUT
0/FT0     ASR-9904-FAN        OPERATIONAL        N/A                NSHUT
0/PT0     A9K-AC-PEM-V2       OPERATIONAL        N/A                NSHUT
```

**show install****32-bit:**

**Note** The command **show install summary** is supported only in 32-bit OS.

```
Router#show install ?
  active           Show the active package information
  audit            Audit installed packages
  auto-abort-timer Show auto-abort-timer value
  boot-options     Show boot options
  committed        Show the committed package information
  compression      Show Install File Compression information(cisco-support)
  events           Show key events from the install history
  inactive         Show inactive package information
```

|            |  |
|------------|--|
| log        | Show log file  |
| package    | Name of the package                                      |
| pie-info   | Show information in a PIE file                           |
| request    | Show current request                                     |
| rollback   | Show package information for a rollback point            |
| sp-desc    | Show description of the Service Pack                     |
| summary    | Show summary information                                 |
| superseded | Show superseded packages                                 |
| which      | Show the origin of a named process, component or package |

**64-bit:**

```
Router#show install ?
  active          Show active package(s) installed(cisco-support)
  committed       Show committed package(s) information(cisco-support)
  inactive        Show inactive package(s) information(cisco-support)
  issu            Show ISSU information(cisco-support)
  log             Show log file(cisco-support)
  package         Show information for package(s) in repository(cisco-support)
  prepare         Show prepared package(s) ready for activation(cisco-support)
  repository      Show SDR software repository(cisco-support)
  request         Show current request(cisco-support)
  superseded      Show superseded package(s) (cisco-support)
  which          Show information about an installed file(cisco-support)
```

**show install active/inactive/committed****32-bit:**

```
Router#show install active summary
Default Profile:
SDRs:
Owner
Active Packages:
  disk0:asr9k-mini-px-<version>
  disk0:asr9k-mpls-px-<version>
  disk0:asr9k-mcast-px-<version>
  disk0:asr9k-mgbl-px-<version>
  disk0:asr9k-fpd-px-<version>
  disk0:asr9k-optic-px-<version>
  disk0:asr9k-k9sec-px-<version>
```

**64-bit:**

```
Router#show install active summary
Active Packages: 8
  asr9k-xr-<version> version=x.x.xx [Boot image]
  asr9k-m2m-x64-<version>
  asr9k-optic-x64-<version>
  asr9k-mcast-x64-<version>
  asr9k-9000v-nV-x64-<version>
  asr9k-mpls-x64-<version>
  asr9k-mpls-te-rsvp-x64-<version>
  asr9k-eigrp-x64-<version>
```

**admin show install active/inactive/committed****32-bit:**

```
Router#admin show install active summary
Default Profile:
```



```

SDRs:
Owner
Active Packages:
  disk0:asr9k-mini-px-<version>
  disk0:asr9k-mpls-px-<version>
  disk0:asr9k-mcast-px-<version>
  disk0:asr9k-mgbl-px-<version>
  disk0:asr9k-fpd-px-<version>
  disk0:asr9k-optic-px-<version>
  disk0:asr9k-k9sec-px-<version>

```

**64-bit:**

```

Router#admin show install active summary
  Active Packages: 1
  asr9k-sysadmin-<version> version=x.x.xx [Boot image]

```

**fsck****32-bit:**

```

Router#fsck ?
  disk0:      Name of the flash device
  disk0a:     Name of the flash device
  disk1:      Name of the flash device
  disk1a:     Name of the flash device
  harddisk:   Name of the flash device
  harddiska:  Name of the flash device
  harddiskb:  Name of the flash device
  lcdisk0:    Name of the flash device
  lcdisk0a:   Name of the flash device

```

```

Router#fsck disk0:
FSCK results for partition /disk0: on node 0/RSP0/CPU0.
=====

```

**64-bit:**

In the 32-bit OS, all activities pertain to either `/disk0:` or `/harddisk:` partitions. On the contrary, the 64-bit OS uses the Linux volume management to carve physical devices into logical volumes. This is needed to create dedicated and protected storage volumes for host OS, admin and XR VMs. The logical volumes also provide for more compartmentalized system and ISSU upgrades.

**Note**

It is not recommended to run `fsck` command on Linux-based 64-bit OS. The `fsck` activities are performed automatically during bootup, and does not require manual inspection using **fsck** command in 64-bit OS.

