Migration Guide for Cisco ASR 9000 Series Routers

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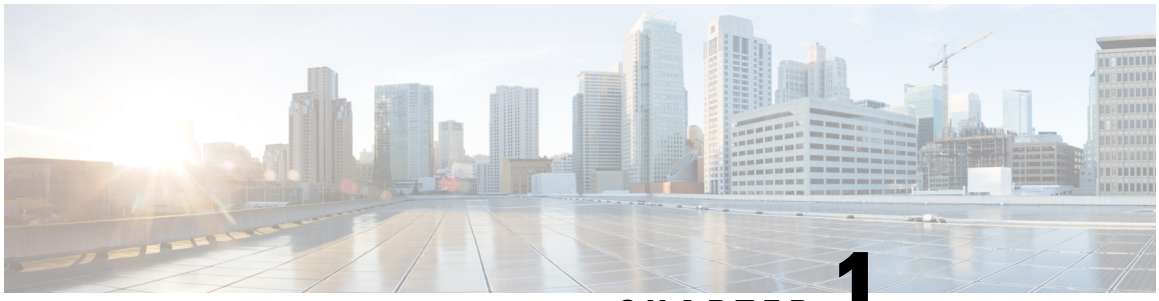


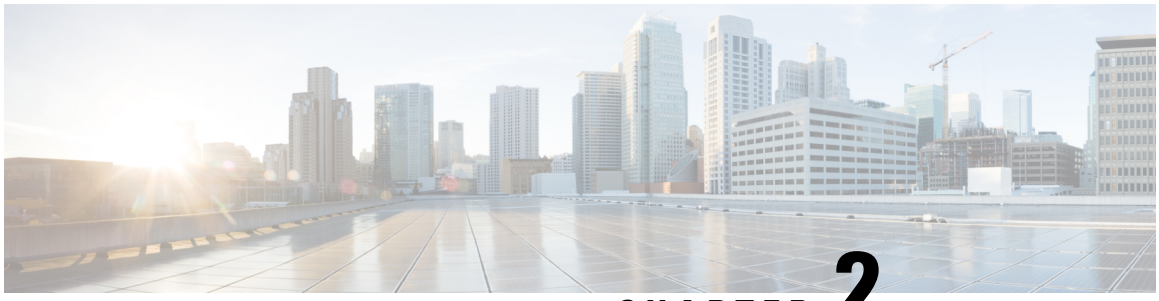
CHAPTER 1

New and Changed Feature Description

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

New and Changed Feature Information

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. Difference Between Cisco IOS XR 32-bit and 64-bit OS, on page 23
Release 6.1.3	A new parameter `-m` 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 from Cisco IOS XR 32-bit to 64-bit OS

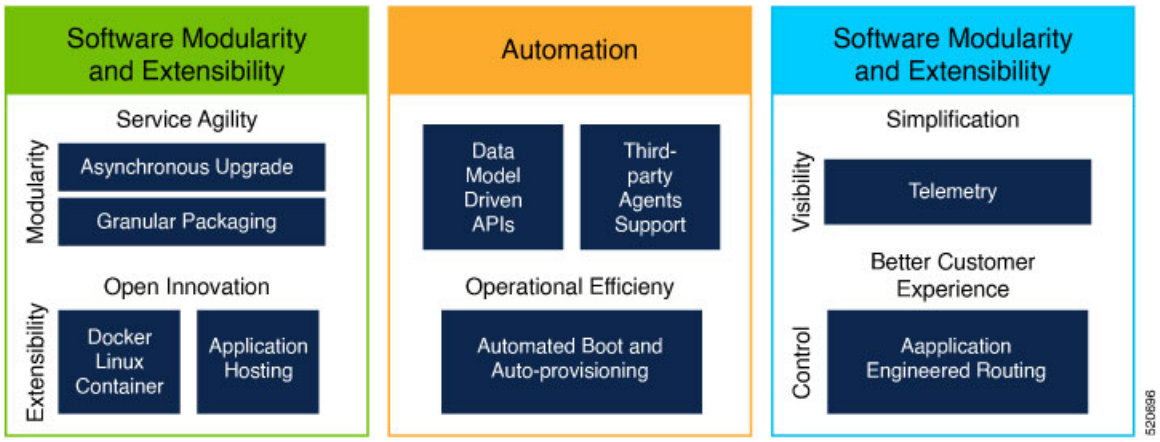
This document provides the procedure to migrate from Cisco IOS XR 32-bit to 64-bit operating system (OS) on the ASR9000 series routers.

Why Migrate to IOS XR 64-Bit OS?

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.

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 A99-RP2-TR	6.1.3
	A9K-RSP880-SE A9K-RSP880-TR	6.1.3
	A99-RSP-TR A99-RSP-SE	6.2.1
	A9K-RSP880-LT-TR A9K-RSP880-LT-SE	6.4.1

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

Software Requirement

A version of IOS XR release based on your requirement as outlined in the table in Supported Hardware, on page 4 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 4:

a) For every available line card in the system, identify the list of 64-bit releases from the Supported Hardware, on page 4 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 4.

```
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 4.

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 7.
- 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:

```
Router# config
Router(config)# line console exec-timeout 0
Router(config)# commit
Router(config)# end
```

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.

```
Router# 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.

```
Router# 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/`.

Example:

```
Router# 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
-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.

Note Files related to 32-bit installation are deleted after the software is migrated to 64-bit OS.

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 7 and Migrate to IOS XR 64-Bit OS, on page 9.

Procedure

Step 1 Run the **show platform** command to verify that RSP4, RP2, LC, and FC2 are in `IOS XR RUN` or `OPERATIONAL` state.

Example:

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
```

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.

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.

Example:

```
Router# show hw-module fpd
Sun Oct 30 12:05:00.674 UTC
                                                                    FPD Versions
                                                                    ================
Location   Card type        HWver FPD device       ATR Status   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-------------------------------------
```

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

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.

Example:

```
Router# 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.

Example:

```
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`.

Example:

```
Router# show hw-module fpd
Sun Oct 30 13:48:42.178 UTC
                                                                    FPD Versions
                                                                    ================
Location   Card type        HWver FPD device       ATR Status   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
0/0        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---------------------------------
```

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.

Example:

```
Router# 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-mpls-tersvp-x64-1.0.0.0-r613.x86_64.rpm asr9k-k9sec-x64-1.1.0.0r613.x86_64.rpm
asr9k-mpls-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
```

Step 7 Activate the RPMs.

Example:

```
Router# install activate id 1
```

or

```
Router# 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
```

Step 8 Commit the operation.

Example:

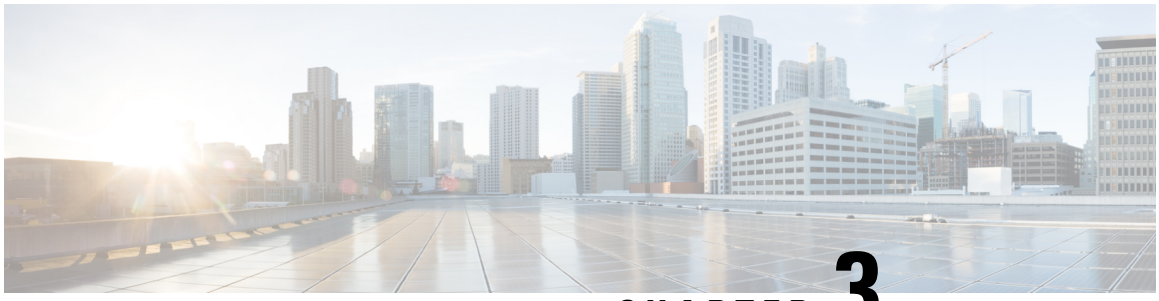
```
Router# install commit
Wed Oct 30 13:56:29.705 UTC
Oct 30 14:46:30 Install operation 3 started by root:   install commit
```

Step 9 Verify that the RPMs are successfully installed.

Example:

```
Router# 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-mpls-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-mpls-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 3

Rolling Back from Cisco IOS XR 64-bit to 32-bit OS

This section provides the procedure to rollback from Cisco IOS XR 64-bit to 32-bit operating system on the ASR 9000 series routers.

This chapter covers information on these procedures:

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.
- **Download software:** Ensure `ASR9K-iosxr-px-<version>-turboboot.tar` file is downloaded from the Cisco Software Download page for the specific release to be downgraded. This tarball contains the `asr9k-mini-px.vm-<version>` pie file that is needed to rollback to IOS XR 32-bit software.

What to do next

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

Rollback to IOS XR OS

Before you begin

Ensure that you have completed Prepare System for Rollback, on page 17.

Back up configuration in XR and admin plane to an external server.

Rollback Using Embedded USB

Use the following procedure to rollback from 64-bit to 32-bit OS. This option does not rely on the management port on RP/RSP.

Procedure

Step 1 Copy target VM image to harddiskb:/ location.

For releases 6.1.2, 6.1.3 and 6.1.4, copy the image to harddiskb: directly.

```
Router# copy <image-path>/asr9k-mini-px.vm-6.1.3 harddiskb:
```

For releases 6.2.1 and later, perform these steps:

a. Copy image from external server to harddisk:/ of XR VM mode.

```
Router# copy <image-path>/asr9k-mini-px.vm-5.3.3 harddisk:
Wed Nov 16 01:30:04.681 PST
Destination filename [/harddisk:/asr9k-mini-px.vm-5.3.3]?
Accessing tftp://223.255.254.245/auto/tftp-platform-reg/533/asr9k-mini-px.vm-5.3.3
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
543436327 bytes copied in    646 sec (   840094)bytes/sec
```

b. Login to System Admin mode.

```
Router# admin
```

c. Copy from harddisk:/ of XR VM to harddiskb:/ in System Admin mode.

```
sysadmin-vm:# copy harddisk:/asr9k-mini-px.vm-5.3.3 location 0/RP0/CPU0/VM1 harddiskb:/
Copying harddisk:/asr9k-mini-px.vm-5.3.3 to harddiskb:/
asr9k-mini-px.vm-5.3.3 100% 518MB 129.6MB/s 00:04

543436327 bytes copied in 877 sec ( 619136)bytes/sec
```

Note Any ASR 9000 32-bit image can be used. In the above example, image from releases 6.1.3 and 5.3.3 is used.

Step 2 Log in to System Admin plane and run the script.

```
sysadmin-vm:0_RP0# run /etc/rc.d/init.d/migrate_to_cXR -b eusb -m <RSP-boot-slot> -r
Mon Oct 31 09:05:05.664 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
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 **Note** The parameter `-m` is supported from release 6.1.3 and later. The accepted values are `-m RSP0/RSP1` or `-m RP0/RP1`.

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 **Note** 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 32-bit OS is successful.

Verify Rollback

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

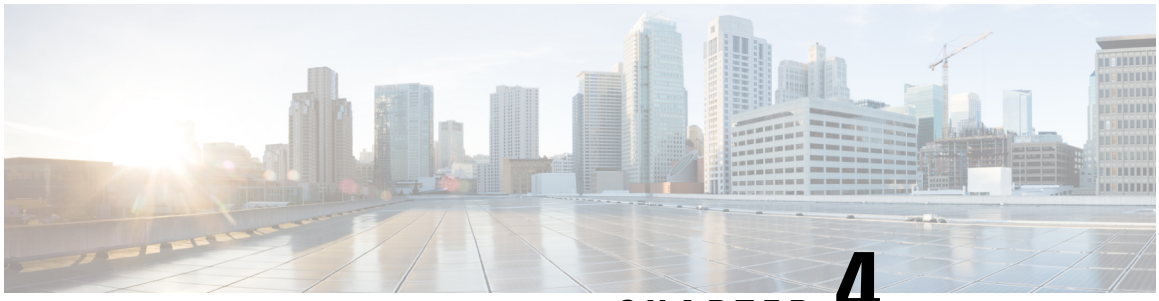
Procedure

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 4

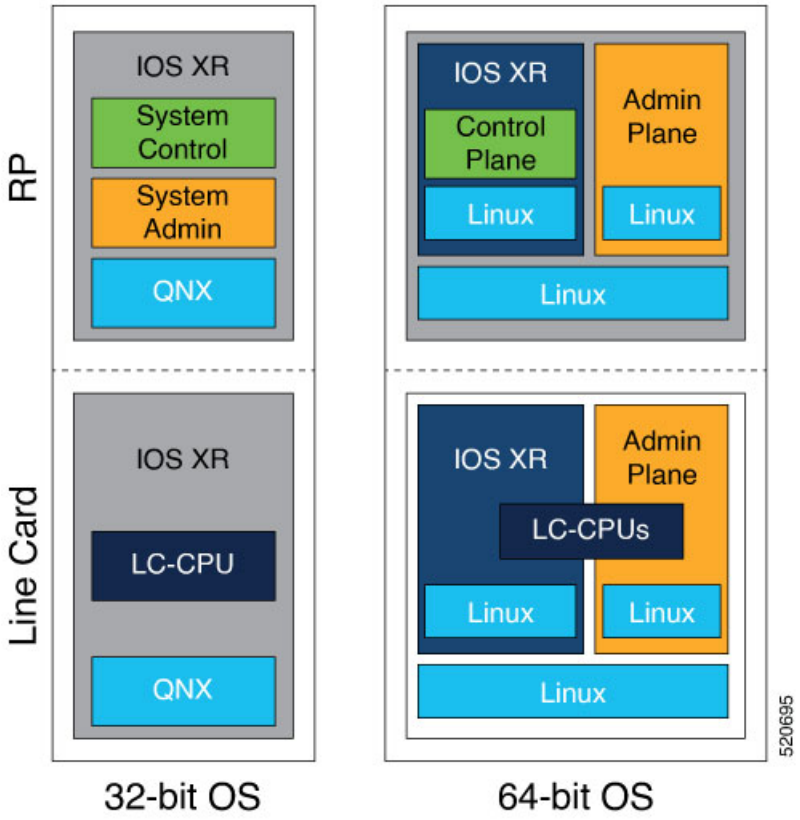
Difference Between Cisco IOS XR 32-bit and 64-bit OS

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

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

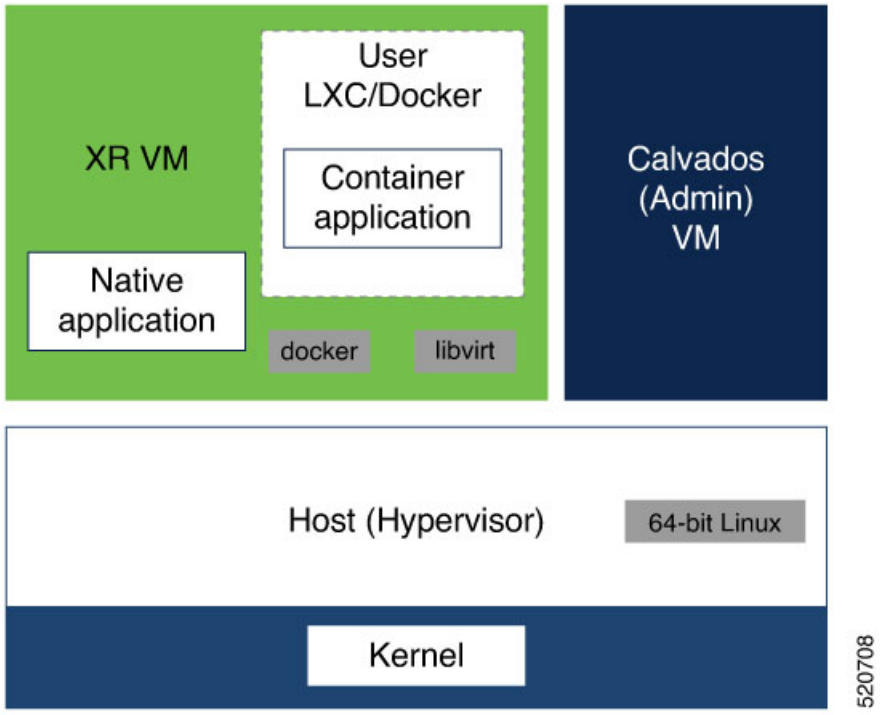


Understanding the IOS XR 64-bit Architecture

IOS XR 64-bit OS runs in two variants:

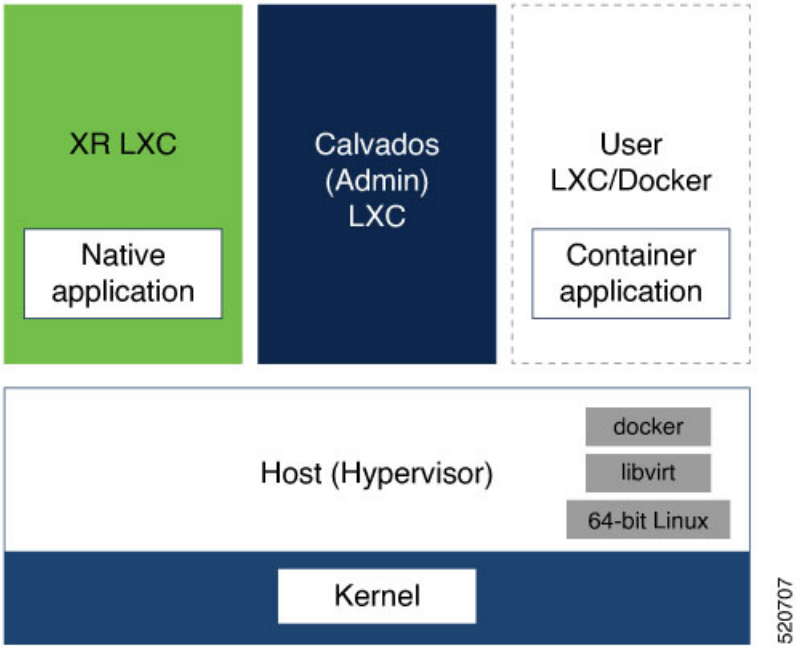
- VM-based 64-bit software:
  - Supported platforms: ASR 9000, NCS 6000
  - VM OS is separate from Host OS.

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 All applications run as different processes.	Two VMs: 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. Aux port directs to the Sysadmin VM.
Software packaging	• PIE-based packages. • Special VM image for fresh installation (Turboboot).	• ISO/RPM based packages. • ISO image for bootup and fresh installation. • Flexible Golden ISO (GISO) image. • Offline RPM-based package management.

Boot facility	• Install CLI-based boot
	• ROMMON: TFTP network boot
	• USB boot
		• Boot directly from ISO using:
		  • Local settings
		  • DHCP
		  • USB
		• Install CLI using TFTP/FTP/SFTP/HTTP/HTTPs
		• ZTP support

File check system	Run the **fsck** command to checkthe 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	No VMs. The reload happens at hardware module (each RSP/RP/LC) or at entire chassis level. • Run the **reload** command from XR mode to reload the corresponding RSP/RP node. • Run the **reload** command from admin mode to reload the the specified hardware module. • Run the **reload location all** command from admin Exec prompt to reload the entire chassis. • Run the **hw-module location <location> reload** command from admin mode to reload a specific module.	2 VMs on each of the RSP/RP/LC CPU. The reload happens at VM (admin/XR), hardware module or at entire chassis level. • Run the **reload** command from XR mode to reload the XR VM. • Run the **reload** command from admin mode to reload the the VMs (admin VM, XR VM or all VMs). • Run the **hw-module location all reload** command or **reload rack 0** command from admin Exec prompt to reload the entire chassis. The **reload location all** command reloads only the VMs. • Run the **hw-module location <location> reload** command from admin mode to reload a specific module or the entire chassis.
Applications	NA	Third-party applications can be hosted on XR VM, which use the kernel stack for northbound communication.
FPD	FPD upgrade performed in Sysadmin plane. Run **fpd auto-upgrade** command and **fpd auto-reload** command from Sysadmin plane.	FPD upgrade performed in XR VM. Run **fpd auto-upgrade enable** command and **fpd auto-reload enable** command from XR VM. To disable the FPD upgrade, use **diasble** keyword in these commands.
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 **run attachCon <lc_node>** from XR plane.	Login to Sysadmin VM on RP/RSP where XR is active. Run **run chvrf 0 attachCon 0/1** 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. copy from LC to RSP:`run scp lc0_xr:/filename /harddisk:/` 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.
Default console settings	• 9600 bps • 8 data bits • No parity • 2 stop bits	• 9600 bps • 8 data bits • No parity • 1 stop bits
CLI changes	Admin CLI changes: Configuration, Exec and Show commands 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 show platform vm—XR show sdr—Sysadmin provides information about VMs show vm—Sysadmin provides health of the VMs
show hw-module fpd location all	show hw-module fpd

IOS XR 32-bit OS	IOS XR 64-bit OS
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 admin upgrade hw-module location all fpd all force
show version 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 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 run top_procs	show process cpu run top
show pfm location <location-id>	show alarms brief card/system active/suppressed/history show pfm location <location-id> 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
   superceded         Show superceded 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.