Release Notes for
Cisco ASR 9000 Series Aggregation Services Routers for Cisco IOS XR Software Release 4.1

November 14, 2013

Cisco ASR 9000 Series Router Software Release 4.1

Text Part Number OL-24744-02

Note For information on Cisco ASR 9000 Series Router running Cisco IOS XR Software Release 4.1, see the "Features Supported on the Cisco ASR 9000 Series Router" section on page 20.

These release notes describe the features provided on the Cisco ASR 9000 Series Router running Cisco IOS XR Software Release 4.1 and are updated as needed.

For a list of software caveats that apply to the Cisco ASR 9000 Series Router running Cisco IOS XR Software Release 4.1, see the "Caveats" section on page 52. The caveats are updated for every release and are described on the World Wide Web at www.cisco.com.

Contents

These release notes contain the following sections:

Introduction

Cisco IOS XR software is a distributed operating system designed for continuous system operation combined with service flexibility and high performance.

Cisco IOS XR software running on the Cisco ASR 9000 Series Router provides the following features and benefits:

- **IP and Routing**—Supports a wide range of IPv4 and IPv6 services and routing protocols; such as Border Gateway Protocol (BGP), Routing Information Protocol (RIPv2), Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), IP Multicast, Routing Policy Language (RPL), Hot Standby Router Protocol (HSRP), and Virtual Router Redundancy Protocol features (VRRP).

- **Ethernet Services**—The Cisco IOS XR software Release 4.1 running on the Cisco ASR 9000 Series Router supports the following Ethernet features:

    – Ethernet Virtual Connections (EVCs)

    – Flexible VLAN classification

    – Flexible VLAN translation

    – IEEE bridging

    – IEEE 802.1s Multiple Spanning Tree (MST)

    – MST Access Gateway

    – L2VPN

    – Virtual Private LAN Services (VPLS), Hierarchical VPLS (H-VPLS), Virtual Private Wire Service (VPWS), Ethernet over MPLS (EoMPLS), pseudo wire redundancy, and multi segment pseudo wire stitching

- **BGP Prefix Independent Convergence**—Provides the ability to converge BGP routes within sub seconds instead of multiple seconds. The Forwarding Information Base (FIB) is updated, independent of a prefix, to converge multiple 100K BGP routes with the occurrence of a single failure. This convergence is applicable to both core and edge failures and with or with out MPLS. This fast convergence innovation is unique to Cisco IOS XR software.

- **Multiprotocol Label Switching (MPLS)**—Supports MPLS protocols, including Traffic Engineering (TE) [including TE-FRR and TE Preferred Path], Resource Reservation Protocol (RSVP), Label Distribution Protocol (LDP), Targeted LDP (T-LDP), Differentiated Services (DiffServ)-aware traffic engineering, and Layer 3 Virtual Private Network (L3VPN).

- **Multicast—**Provides comprehensive IP Multicast software including Source Specific Multicast (SSM) and Protocol Independent Multicast (PIM) in Sparse Mode only. The Cisco ASR 9000 Series Router also supports Auto-Rendezvous Point (AutoRP), Multiprotocol BGP (MBGP), Multicast Source Discovery Protocol (MSDP), Internet Group Management Protocol Versions 2 and 3 (IGMPv2 and v3), and IGMPv2 and v3 snooping.

- **Quality of Service (QoS)—**Supports QoS mechanisms including policing, marking, queuing, random and hard traffic dropping, and shaping. Additionally, Cisco IOS XR supports modular QoS command-line interface (MQC). MQC is used to configure various QoS features on various Cisco platforms, including the Cisco ASR 9000 Series Router. Supports the following:

    – Class-Based Weighted Fair Queuing (CBWFQ)

    – Weighted Random Early Detection (WRED)

    – Priority Queuing with propagation

- 2-rate 3-color (2R3C) Policing

- Modular QoS CLI (MQC)

- 4-level Hierarchical-QoS

- Shared Policy Instances

- **Manageability**—Provides industry-standard management interfaces including modular command-line interface (CLI), Simple Network Management Protocol (SNMP), and native Extensible Markup Language (XML) interfaces. Includes a comprehensive set of Syslog messaging.

- **Security**—Provides comprehensive network security features including Layer 2 and Layer 3access control lists (ACLs); routing authentications; Authentication, Authorization, and Accounting (AAA)/Terminal Access Controller Access Control System (TACACS+); Secure Shell (SSH); Management Plane Protection (MPP) for control plan security; and Simple Network Management Protocol version3 (SNMPv3). Control plane protections integrated into line card Application-Specific Integrated Circuits (ASICs) include Generalized TTL Security Mechanism (GTSM), RFC 3682, and Dynamic Control Plane Protection (DCPP).

- **Availability**—Supports rich availability features such as fault containment, fault tolerance, fast switchover, link aggregation, nonstop routing for ISIS, LDP and OSPF, and nonstop forwarding (NSF).

- **Enhanced core competencies:**

    - IP fast convergence with Fast Reroute (FRR) support for Intermediate System-to-Intermediate System (IS-IS)

    - Path Computation Element (PCE) capability for traffic engineering

For more information about new features provided on the Cisco ASR 9000 Series Router platform for Cisco IOS XR Software Release 4.0.3, see the "Features Introduced in Cisco IOS XR Software Release 4.0.1" section on page 23 in this document.

System Requirements

This section describes the system requirements for Cisco ASR 9000 Series Router Software Release 4.1. The system requirements include the following information:

Feature Set Table

The Cisco ASR 9000 Series Router software is packaged in *feature sets* (also called *software images*). Each feature set contains a specific set of Cisco ASR 9000 Series Router Software Release 4.1 features.

Table 1 lists the Cisco ASR 9000 Series Router software feature set matrix (PIE files) and associated filenames available for the Release 4.1 supported on the Cisco ASR 9000 Series Router.

Table 1 ***Cisco ASR 9000 Series Router Supported Feature Sets***
(Cisco IOS XR Software Release 4.1 PIE Files)

Feature Set	Filename	Description
Composite Package		
Cisco IOS XR IP Unicast Routing Core Bundle	asr9k-mini-p.pie-4.1.0	Contains the required core packages, including OS, Admin, Base, Forwarding, Forwarding Processor Card 40G, FPD, Routing, SNMP Agent, Diagnostic Utilities, and Alarm Correlation.
Cisco IOS XR IP Unicast Routing Core Bundle	asr9k-mini-p.vm-4.1.0	Contains the required core packages including OS, Admin, Base, Forwarding, Forwarding Processor Card 40G, FPD, Routing, SNMP Agent, Diagnostic Utilities, and Alarm Correlation.
Optional Individual Packages[1]		
Cisco IOS XR Manageability Package	asr9k-mgbl.pie-4.1.0	CORBA[2] agent, XML[3] Parser, and HTTP server packages. This PIE also contains some SNMP MIB infrastructure. Certain MIBs won't work if this PIE is not installed.
Cisco IOS XR MPLS Package	asr9k-mpls.pie-4.1.0	MPLS-TE,[4] LDP,[5] MPLS Forwarding, MPLS OAM,[6] LMP,[7] OUNI,[8] RSVP,[9] and Layer-3 VPN.
Cisco IOS XR Multicast Package	asr9k-mcast.pie-4.1.0	Multicast Routing Protocols (PIM, MSDP,[10] IGMP,[11] Auto-RP), Tools (SAP, MTrace), and Infrastructure (MRIB,[12] MURIB[13], MFWD[14]), and BIDIR-PIM.[15]
Cisco IOS XR Security Package	asr9k-k9sec.pie-4.1.0	Support for Encryption, Decryption, SSH,[16] and SSL[17]

Table 1   *Cisco ASR 9000 Series Router Supported Feature Sets*
                         (Cisco IOS XR Software Release 4.1 PIE Files) (continued)

Feature Set	Filename	Description
Cisco IOS XR Advanced Video Package	asr9k-video-p.pie-4.1.0	Firmware for the advanced video feature for Cisco ASR 9000 Series Router chassis.
Cisco IOS XR Optics Package	asr9k-optic.pie-4.1.0	Firmware for the optics feature for Cisco ASR 9000 Series Router chassis.
Cisco IOS XR Upgrade Package	asr9k-upgrade-p.pie-4.1.0	Firmware for the upgrade feature for Cisco ASR 9000 Series Router chassis.
Cisco IOS XR Documentation Package	asr9k-doc.pie-4.1.0	.man pages for Cisco IOS XR software on the Cisco ASR 9000 Series Router chassis.

1. Packages are installed individually
2. Common Object Request Broker Architecture
3. Extensible Markup Language
4. MPLS Traffic Engineering
5. Label Distribution Protocol
6. Operations, Administration, and Maintenance
7. Link Manager Protocol
8. Optical User Network Interface
9. Resource Reservation Protocol
10. Multicast Source Discovery Protocol
11. Internet Group Management Protocol
12. Multicast Routing Information Base
13. Multicast-Unicast RIB
14. Multicast forwarding
15. Bidirectional Protocol Independent Multicast
16. Secure Shell
17. Secure Socket Layer

Table 2 lists the Cisco ASR 9000 Series Router TAR files.

Table 2   ***Cisco ASR 9000 Series Router Supported Feature Sets
(Cisco IOS XR Software Release 4.1 TAR Files)***

Feature Set	Filename	Description
Cisco IOS XR IP/MPLS Core Software	asr9k-iosxr-4.1.0.tar	• Cisco IOS XR IP Unicast Routing Core Bundle • Cisco IOS XR Manageability Package • Cisco IOS XR MPLS Package • Cisco IOS XR Multicast Package • Cisco IOS XR FPD Package • Cisco IOS XR Diagnostic Package • Cisco IOS XR Advanced Video Package • Cisco IOS XR Optics Package • Cisco IOS XR Upgrade Package • Cisco IOS XR Documentation Package
Cisco IOS XR IP/MPLS Core Software 3DES	asr9k-iosxr-k9-4.1.0.tar	• Cisco IOS XR IP Unicast Routing Core Bundle • Cisco IOS XR Manageability Package • Cisco IOS XR MPLS Package • Cisco IOS XR Multicast Package • Cisco IOS XR Security Package • Cisco IOS XR FPD Package • Cisco IOS XR Diagnostic Package • Cisco IOS XR Advanced Video Package • Cisco IOS XR Optics Package • Cisco IOS XR Upgrade Package • Cisco IOS XR Documentation Package

Memory Requirements

⚠️
Caution   If you remove the media in which the software image or configuration is stored, the router may become unstable and fail.

The minimum memory requirements for Cisco ASR 9000 Series Router running Cisco IOS XR Software Release 4.1 consist of the following:

- minimum 4-GB memory on the route switch processors (RSPs) [maximum is 8-GB]
- minimum 2-GB compact flash on route switch processors (RSPs)
- minimum 4-GB memory on the line cards (LCs)

These minimum memory requirements are met with the base board design.

RSP Memory Upgrade

This section describes the process to upgrade the Cisco ASR 9000 Series Router running Cisco IOS XR Software Release 4.1 from a small memory model (ASR9k-RSP-4G) RSP card to a large memory model (ASR9k-RSP-8G) RSP card.

The upgrade sequence is as follows:

Step 1   Remove the standby small memory (ASR9k-RSP-4G) RSP card.

Step 2   Insert the large memory (ASR9k-RSP-8G) RSP card.

Step 3   Boot up the large memory (ASR9k-RSP-8G) RSP card so that it comes up as standby.

Step 4   Failover from the active small memory (ASR9k-RSP-4G) RSP card to the standby large memory (ASR9k-RSP-8G) RSP card.

Step 5   Remove the standby small memory (ASR9k-RSP-4G) RSP card.

Step 6   Insert the second large memory (ASR9k-RSP-8G) RSP card. Boot up this second large memory (ASR9k-RSP-8G) RSP card so that it comes up as standby.

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RSP Memory Downgrade

This section describes the process to downgrade the Cisco ASR 9000 Series Router running Cisco IOS XR Software Release 4.1 from a large memory model (ASR9k-RSP-8G) RSP card to a small memory model (ASR9k-RSP-4G) RSP card.

⚠️
Caution   Before attempting an RSP memory downgrade, measure the memory consumption of the current system configuration using the large memory model (ASR9k-RSP-8G) RSP card. You need to ensure that the Cisco ASR 9000 Series Router running Cisco IOS XR Software Release 4.1 is still able to run the system configuration using the small memory model (ASR9k-RSP-4G) RSP card.

The RSP memory downgrade sequence is as follows:

Step 1   Verify that the memory consumption on the active large memory model (ASR9k-RSP-8G) RSP card can fit within the memory constraints of the small memory model (ASR9k-RSP-4G) RSP card.

Step 2   Remove the standby large memory model (ASR9k-RSP-8G) RSP card.

Step 3   Insert the small memory model (ASR9k-RSP-4G) RSP card. The system does not boot up the small memory model (ASR9k-RSP-4G) RSP card by default. Send user command to boot up the small memory model (ASR9k-RSP-4G) RSP card as standby.

Step 4   Failover from the active large memory model (ASR9k-RSP-8G) RSP card to the standby small memory model (ASR9k-RSP-4G) RSP card.

Step 5   Remove the standby large memory model (ASR9k-RSP-8G) RSP card.

Step 6   Insert the small memory model (ASR9k-RSP-4G) RSP card. Boot up this second small memory model (ASR9k-RSP-4G) RSP card as standby.

Hardware Supported

Cisco IOS XR Software Release 4.1 supports Cisco ASR 9000 Series Routers. All hardware features are supported on Cisco IOS XR software, subject to the memory requirements specified in the "Memory Requirements" section on page 7.

Table 3 lists the supported hardware components on the Cisco ASR 9000 Series Router and the minimum required software versions. For more information, see the "Other Firmware Support" section on page 11.

Table 3   *Cisco ASR 9000 Series Router Supported Hardware and Minimum Software Requirements*

Component	Part Number	Support from Version
Cisco ASR 9000 Series Router 6-Slot		
Cisco ASR 9000 Series 6-Slot System	ASR-9006	Release 3.7.2
Cisco ASR 9000 Series 6-Slot Fan Tray	ASR-9006-FAN	Release 3.7.2
Cisco ASR 9000 Series 6-Slot Door Kit	ASR-9006-DOOR	NA
Cisco ASR 9000 Series 6-Slot AC Chassis	ASR-9006-AC	Release 3.7.2
Cisco ASR 9000 Series 6-Slot DC Chassis	ASR-9006-DC	Release 3.7.2
Cisco ASR 9000 Series Router 6-Slot Air		
Cisco ASR 9000 Series 6-Slot Air Filter	ASR-9006-FILTER	Release 3.7.2
Cisco ASR 9000 Series Router 10-Slot		
Cisco ASR 9000 Series 10-Slot System	ASR-9010	Release 3.7.2
Cisco ASR 9000 Series 10-Slot Fan Tray	ASR-9010-FAN	Release 3.7.2
Cisco ASR 9000 Series 10-Slot Door Kit	ASR-9010-DOOR	NA
Cisco ASR 9000 Series 10-Slot AC Chassis	ASR-9010-AC	Release 3.7.2
Cisco ASR 9000 Series 10-Slot DC Chassis	ASR-9010-DC	Release 3.7.2

Table 3   Cisco ASR 9000 Series Router Supported Hardware and Minimum Software Requirements (continued)

Component	Part Number	Support from Version
Cisco ASR 9000 Series 2 Post Mounting Kit	ASR-9010-2P-KIT	Release 3.7.2
Cisco ASR 9000 Series 4 Post Mounting Kit	ASR-9010-4P-KIT	Release 3.7.2
Cisco ASR 9000 Series Router 10-Slot Air		
Cisco ASR 9000 Series 10-Slot Air Filter	ASR-9010-FILTER	Release 3.7.2
Cisco ASR 9000 Series 10-Slot External Exhaust Air Shaper	ASR-9010-AIRSHPR	NA
Cisco ASR 9000 Series 10-Slot Air Inlet Grill	ASR-9010-GRL	NA
Cisco ASR 9000 Series Router Power		
Cisco ASR 9000 Series 1.5kW DC Power Module	A9K-1.5KW-DC	Release 3.7.2
Cisco ASR 9000 Series 2kW DC Power Module	A9K-2KW-DC	Release 3.7.2
Cisco ASR 9000 Series 3kW AC Power Module	A9K-3KW-AC	Release 3.7.2
Cisco ASR 9000 Series Router Line Cards		
Cisco ASR 9000 Series 2-Port Ten Gigabit Ethernet + Cisco ASR 9000 Series 20-Port Gigabit Ethernet, Medium Queue	A9K-2T20GE-B	Release 3.9.0
Cisco ASR 9000 Series 2-Port Ten Gigabit Ethernet + Cisco ASR 9000 Series 20-Port Gigabit Ethernet, High Queue	A9K-2T20GE-E	Release 3.9.0
Cisco ASR 9000 Series 4-Port Ten Gigabit Ethernet, Medium Queue	A9K-4T-B	Release 3.7.2
Cisco ASR 9000 Series 4-Port Ten Gigabit Ethernet Extended Line Card, High Queue	A9K-4T-E	Release 3.7.2
Cisco ASR 9000 Series 4-Port Ten Gigabit Ethernet, Low Queue	A9K-4T-L	Release 3.9.0
Cisco ASR 9000 Series 8-Port Ten Gigabit Ethernet, 80G Line Rate Extended Line Card, Medium Queue	A9K-8T-B	Release 4.0.1
Cisco ASR 9000 Series 8-Port Ten Gigabit Ethernet, 80G Line Rate Extended Line Card, High Queue	A9K-8T-E	Release 3.9.0
Cisco ASR 9000 Series 8-Port Ten Gigabit Ethernet, 80G Line Rate, Low Queue	A9K-8T-L	Release 3.9.0
Cisco ASR 9000 Series 8-Port Ten Gigabit Ethernet, Medium Queue	A9K-8T/4-B	Release 3.7.2
Cisco ASR 9000 Series 8-Port TenGE DX Extended Line Card, High Queue	A9K-8T/4-E	Release 3.7.2
Cisco ASR 9000 Series 8-Port Ten Gigabit Ethernet, Low Queue	A9K-8T/4-L	Release 3.9.0
Cisco ASR 9000 Series 16-Port Ten Gigabit Ethernet, Medium Queue	A9K-4T-B	Release 4.0.1
Cisco ASR 9000 Series 40-Port Gigabit Ethernet, Medium Queue	A9K-40GE-B	Release 3.7.2
Cisco ASR 9000 Series 40-Port Gigabit Ethernet Extended Line Card, High Queue	A9K-40GE-E	Release 3.7.2
Cisco ASR 9000 Series 40-Port Gigabit Ethernet, Low Queue	A9K-40GE-L	Release 3.9.0
Cisco ASR 9000 Series Line Card Filler	A9K-LC-FILR	Release 3.7.2

Table 3 *Cisco ASR 9000 Series Router Supported Hardware and Minimum Software Requirements (continued)*

Component	Part Number	Support from Version
ISM (Integrated Service Module) Line Card	A9K-ISM-100	Release 4.1
Cisco ASR 9000 Series Router Processor Cards		
Cisco ASR 9000 Series Route Switch Processor, 4G Memory	A9K-RSP-4G	Release 3.7.2
Cisco ASR 9000 Series Route Switch Processor, 8G Memory	A9K-RSP-8G	Release 4.0.1
Cisco ASR 9000 Series Route Switch Processor Filler	ASR-9000-RSP-FILR	Release 3.7.2
Cisco ASR 9000 Series SIP and SPA Cards		
Cisco ASR 9000 SIP-700 SPA interface processor	A9K-SIP-700	Release 3.9.0
2-Port Channelized OC-12/DS0 SPA	SPA-2XCHOC12/DS0	Release 3.9.0
1-Port Channelized OC48/STM16 DS3 SPA	SPA-1XCHOC48/DS3	Release 4.0.1
2-Port OC-48/STM16 SPA	SPA-2XOC48POS/RPR	Release 4.0.1
8-Port OC12/STM4 SPA	SPA-8XOC12-POS	Release 4.0.1
1-Port OC-192/STM-64 POS/RPR SPA	SPA-OC192POS-XFP	Release 4.0.1
4-Port Clear Channel T3/E3 SPA	SPA-4XT3E3	Release 4.0.1
2-Port Clear Channel T3/E3 SPA	SPA-2XT3E3	Release 4.0.1
1-Port Channelized OC-3/STM-1 SPA	SPA-1XCHSTM1/OC3	Release 4.0.1
4-Port OC-3/STM-1 POS SPA	SPA-4XOC3	Release 4.0.1
8-Port OC-3/STM-1 POS SPA	SPA-8XOC3	Release 4.0.1
4-Port Channelized T3 to DS0 SPA	SPA-4XCT3/DS0	Release 4.1
8-Port Channelized T1/E1 SPA	SPA-8XCHT1/E1	Release 4.1

Software Compatibility

Cisco IOS XR Software Release 4.1 is compatible with the following Cisco ASR 9000 Series Router systems:

- Cisco ASR 9000 Series Router 6-Slot Line Card Chassis
- Cisco ASR 9000 Series Router 10-Slot Line Card Chassis

Table 4 lists the supported software licenses on the Cisco ASR 9000 Series Router and the appropriate part numbers.

Table 4 *Cisco ASR 9000 Series Router Supported Software Licenses*

Software License	Part Number
Cisco ASR 9000 Series iVRF License	A9K-IVRF-LIC
Cisco ASR 9000 Series Per Chassis Advanced Video License	A9K-ADV-VIDEO-LIC
Cisco ASR 9000 Series Per Line Card Advanced Optical License	A9K-ADV-OPTIC-LIC
Cisco ASR 9000 Series L3VPN License, Medium Queue and Low Queue Line Cards	A9K-AIP-LIC-B
Cisco ASR 9000 Series L3VPN License, High Queue Line Cards	A9K-AIP-LIC-E

Note that error messages may display if features run without the appropriate licenses installed. For example, when creating or configuring VRF, if the A9K-IVRF-LIC license is not installed before creating a VRF, the following message displays:

```
RP/0/RSP0/CPU0:PE1-AS1#LC/0/0/CPU0:Dec 15 17:57:53.653 : rsi_agent[247]:
%LICENSE-ASR9K_LICENSE-2-INFRA_VRF_NEEDED : 5 VRF(s) are configured without license
A9K-iVRF-LIC in violation of the Software Right To Use Agreement. This feature may be
disabled by the system without the appropriate license. Contact Cisco to purchase the
license immediately to avoid potential service interruption.
```

For Cisco license support, please contact your Cisco Sales Representative or Customer Service at 800-553-NETS (6387) or 408-526-4000. For questions on the program other than ordering, please send e-mail to: cwm-license@cisco.com.

Cisco ASR 9000 Series Right-To-Use (RTU) Licensing

Here are on-line locations of the Cisco ASR 9000 Series Right-To-Use (RTU) licensing docs:

http://www.cisco.com/en/US/docs/routers/asr9000/hardware/Prodlicense/A9k-AIP-LIC-B.html

http://www.cisco.com/en/US/docs/routers/asr9000/hardware/Prodlicense/A9k-AIP-LIC-E.html

Note Layer 3 VPNs are only to be used after you have purchased a license. Cisco will enforce the RTU of L3VPNs in follow on releases. You should contact Cisco, or check the release notes for the follow on release before upgrading for directions on how to install the license as part of the upgrade - otherwise the L3VPN feature may be affected.

The activation of VRF capability still requires the use of the appropriate per line card license (A9K-IVRF-LIC / A9K-AIP-LIC-B / A9K-AIP-LIC-E). Please contact your sales representative for more details.

Other Firmware Support

The Cisco ASR 9000 Series Router supports the following firmware code:

- The minimum ROMMON version required for this release is 1.05 for the following line cards:
    - A9K-40GE-B
    - A9K-40GE-E
    - A9K-40GE-L
    - A9K-8T/4-B
    - A9K-8T/4-E
    - A9K-8T/4-L
    - A9K-4T-B
    - A9K-4T-E
    - A9K-4T-L
    - A9K-2T20GE-B
    - A9K-2T20GE-E

> – A9K-2T20GE-L

- The minimum ROMMON version required for this release is 1.03 for the following line cards:

  > – A9K-8T-B

  > – A9K-8T-E

  > – A9K-8T-L

  > – A9K-16T/8-B

- The minimum ROMMON version required for this release is 1.05 for RSPs.

- The minimum CPUCNTRL version required for this release is line card-specific. Use the **show fpd package** command to check the firmware needed.

> **Note** For more information about CPU controller bits, see the *Managing the Router Hardware* section in the *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide*.

> **Note** In upgrading from Release 3.7.3 or earlier releases, you may be expected to do a one-time FPD upgrade for any firmware images that may have changed since the last release. Refer to the documents at http://www.cisco.com/web/Cisco_IOS_XR_Software/index.html for upgrade instructions.

Check the firmware needed by running the **show fpd package** command in admin mode.

```
RP/0/RSP0/CPU0:router1(admin)#show fpd package

=============================== =================================================
                                       Field Programmable Device Package
                                =================================================
                                                        SW       Min Req   Min Req
Card Type               FPD Description         Type Subtype  Version   SW Ver    HW Vers
=================== ========================= ==== ======= =========== ======== ========
A9K-40GE-B              Can Bus Ctrl (CBC) LC2   lc   cbc       2.02      0.0       0.1
                       CPUCtrl LC2              lc   cpld1     1.00      0.0       0.1
                       PHYCtrl LC2              lc   cpld2     0.06      0.0       0.1
                       PortCtrl LC2             lc   fpga2     0.10      0.0       0.1
                       Bridge LC2               lc   fpga1     0.43      0.0       0.1
                       ROMMONA LC2              lc   rommonA   1.05      0.0       0.1
                       ROMMONB LC2              lc   rommon    1.05      0.0       0.1
-----------------------------------------------------------------------------------------
A9K-4T-B               Can Bus Ctrl (CBC) LC2   lc   cbc       2.02      0.0       0.1
                       CPUCtrl LC2              lc   cpld1     1.00      0.0       0.1
                       PHYCtrl LC2              lc   cpld2     0.08      0.0       0.1
                       LCClkCtrl LC2            lc   cpld3     0.03      0.0       0.1
                       PortCtrl LC2             lc   fpga2     0.10      0.0       0.1
                       PHY LC2                  lc   fpga3    14.44      0.0       0.1
                       Bridge LC2               lc   fpga1     0.43      0.0       0.1
                       ROMMONB LC2              lc   rommon    1.05      0.0       0.1
-----------------------------------------------------------------------------------------
A9K-8T/4-B             Can Bus Ctrl (CBC) LC2   lc   cbc       2.02      0.0       0.1
                       CPUCtrl LC2              lc   cpld1     1.00      0.0       0.1
                       PHYCtrl LC2              lc   cpld2     0.08      0.0       0.1
                       LCClkCtrl LC2            lc   cpld3     0.03      0.0       0.1
                       PortCtrl LC2             lc   fpga2     0.10      0.0       0.1
                       PHY LC2                  lc   fpga3    14.44      0.0       0.1
                       Bridge LC2               lc   fpga1     0.43      0.0       0.1
```

```
                        ROMMONB LC2                    lc   rommon     1.05      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-2T20GE-B       Can Bus Ctrl (CBC) LC2   lc   cbc        2.02      0.0      0.1
                        CPUCtrl LC2                     lc   cpld1      1.00      0.0      0.1
                        PHYCtrl LC2                     lc   cpld2      0.11      0.0      0.1
                        LCClkCtrl LC2                   lc   cpld3      0.09      0.0      0.1
                        PortCtrl LC2                    lc   fpga2      0.16      0.0      0.1
                        Bridge LC2                      lc   fpga1      0.43      0.0      0.1
                        ROMMONB LC2                     lc   rommon     1.05      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-40GE-E         Can Bus Ctrl (CBC) LC2   lc   cbc        2.02      0.0      0.1
                        CPUCtrl LC2                     lc   cpld1      1.00      0.0      0.1
                        PHYCtrl LC2                     lc   cpld2      0.06      0.0      0.1
                        PortCtrl LC2                    lc   fpga2      0.10      0.0      0.1
                        Bridge LC2                      lc   fpga1      0.43      0.0      0.1
                        ROMMONA LC2                     lc   rommonA    1.05      0.0      0.1
                        ROMMONB LC2                     lc   rommon     1.05      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-4T-E           Can Bus Ctrl (CBC) LC2   lc   cbc        2.02      0.0      0.1
                        CPUCtrl LC2                     lc   cpld1      1.00      0.0      0.1
                        PHYCtrl LC2                     lc   cpld2      0.08      0.0      0.1
                        LCClkCtrl LC2                   lc   cpld3      0.03      0.0      0.1
                        PortCtrl LC2                    lc   fpga2      0.10      0.0      0.1
                        PHY LC2                         lc   fpga3     14.44      0.0      0.1
                        Bridge LC2                      lc   fpga1      0.43      0.0      0.1
                        ROMMONB LC2                     lc   rommon     1.05      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-8T/4-E         Can Bus Ctrl (CBC) LC2   lc   cbc        2.02      0.0      0.1
                        CPUCtrl LC2                     lc   cpld1      1.00      0.0      0.1
                        PHYCtrl LC2                     lc   cpld2      0.08      0.0      0.1
                        LCClkCtrl LC2                   lc   cpld3      0.03      0.0      0.1
                        PortCtrl LC2                    lc   fpga2      0.10      0.0      0.1
                        PHY LC2                         lc   fpga3     14.44      0.0      0.1
                        Bridge LC2                      lc   fpga1      0.43      0.0      0.1
                        ROMMONB LC2                     lc   rommon     1.05      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-2T20GE-E       Can Bus Ctrl (CBC) LC2   lc   cbc        2.02      0.0      0.1
                        CPUCtrl LC2                     lc   cpld1      1.00      0.0      0.1
                        PHYCtrl LC2                     lc   cpld2      0.11      0.0      0.1
                        LCClkCtrl LC2                   lc   cpld3      0.09      0.0      0.1
                        PortCtrl LC2                    lc   fpga2      0.16      0.0      0.1
                        Bridge LC2                      lc   fpga1      0.43      0.0      0.1
                        ROMMONB LC2                     lc   rommon     1.05      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-8T-B           Can Bus Ctrl (CBC) LC3   lc   cbc        6.02      0.0      0.1
                        CPUCtrl LC3                     lc   cpld1      1.02      0.0      0.1
                        PHYCtrl LC3                     lc   cpld2      0.08      0.0      0.1
                        LCClkCtrl LC3                   lc   cpld3      0.03      0.0      0.1
                        DB CPUCtrl LC3                  lc   cpld4      1.03      0.0      0.1
                        PortCtrl LC3                    lc   fpga2      0.11      0.0      0.1
                        Raven LC3                       lc   fpga1      1.02      0.0      0.1
                        ROMMONB LC3                     lc   rommon     1.03      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-16T/8-B        Can Bus Ctrl (CBC) LC3   lc   cbc        6.02      0.0      0.1
                        CPUCtrl LC3                     lc   cpld1      1.02      0.0      0.1
                        PHYCtrl LC3                     lc   cpld2      0.04      0.0      0.1
                        LCClkCtrl LC3                   lc   cpld3      0.01      0.0      0.1
                        DB CPUCtrl LC3                  lc   cpld4      1.03      0.0      0.1
                        PortCtrl LC3                    lc   fpga2      0.01      0.0      0.1
                        Raven LC3                       lc   fpga1      1.02      0.0      0.1
                        ROMMONB LC3                     lc   rommon     1.03      0.0      0.1
           ----------------------------------------------------------------------------------------
           A9K-16T/8-B        Can Bus Ctrl (CBC) LC3   lc   cbc        6.02      0.0      0.1
                        CPUCtrl LC3                     lc   cpld1      1.02      0.0      0.1
```

```
              PHYCtrl LC3                    lc   cpld2    0.04      0.0      0.1
              LCClkCtrl LC3                  lc   cpld3    0.01      0.0      0.1
              DB CPUCtrl LC3                 lc   cpld4    1.03      0.0      0.1
              PortCtrl LC3                   lc   fpga2    0.01      0.0      0.1
              Raven LC3                      lc   fpga1    1.02      0.0      0.1
              ROMMONB LC3                    lc   rommon   1.03      0.0      0.1
         ------------------------------------------------------------------------------
A9K-8T-E      Can Bus Ctrl (CBC) LC3         lc   cbc      6.02      0.0      0.1
              CPUCtrl LC3                    lc   cpld1    1.02      0.0      0.1
              PHYCtrl LC3                    lc   cpld2    0.08      0.0      0.1
              LCClkCtrl LC3                  lc   cpld3    0.03      0.0      0.1
              CPUCtrl LC3                    lc   cpld4    1.03      0.0      0.1
              PortCtrl LC3                   lc   fpga2    0.11      0.0      0.1
              Raven LC3                      lc   fpga1    1.02      0.0      0.1
              ROMMONB LC3                    lc   rommon   1.03      0.0      0.1
         ------------------------------------------------------------------------------
A9K-16T/8-E   Can Bus Ctrl (CBC) LC3         lc   cbc      6.02      0.0      0.1
              CPUCtrl LC3                    lc   cpld1    1.02      0.0      0.1
              PHYCtrl LC3                    lc   cpld2    0.04      0.0      0.1
              LCClkCtrl LC3                  lc   cpld3    0.01      0.0      0.1
              DB CPUCtrl LC3                 lc   cpld4    1.03      0.0      0.1
              PortCtrl LC3                   lc   fpga2    0.01      0.0      0.1
              Raven LC3                      lc   fpga1    1.02      0.0      0.1
              ROMMONB LC3                    lc   rommon   1.03      0.0      0.1
         ------------------------------------------------------------------------------
A9K-16T/8-E   Can Bus Ctrl (CBC) LC3         lc   cbc      6.02      0.0      0.1
              CPUCtrl LC3                    lc   cpld1    1.02      0.0      0.1
              PHYCtrl LC3                    lc   cpld2    0.04      0.0      0.1
              LCClkCtrl LC3                  lc   cpld3    0.01      0.0      0.1
              DB CPUCtrl LC3                 lc   cpld4    1.03      0.0      0.1
              PortCtrl LC3                   lc   fpga2    0.01      0.0      0.1
              Raven LC3                      lc   fpga1    1.02      0.0      0.1
              ROMMONB LC3                    lc   rommon   1.03      0.0      0.1
         ------------------------------------------------------------------------------
A9K-40GE-L    Can Bus Ctrl (CBC) LC2         lc   cbc      2.02      0.0      0.1
              CPUCtrl LC2                    lc   cpld1    1.00      0.0      0.1
              PHYCtrl LC2                    lc   cpld2    0.06      0.0      0.1
              PortCtrl LC2                   lc   fpga2    0.10      0.0      0.1
              Bridge LC2                     lc   fpga1    0.43      0.0      0.1
              ROMMONB LC2                    lc   rommon   1.05      0.0      0.1
         ------------------------------------------------------------------------------
A9K-4T-L      Can Bus Ctrl (CBC) LC2         lc   cbc      2.02      0.0      0.1
              CPUCtrl LC2                    lc   cpld1    1.00      0.0      0.1
              PHYCtrl LC2                    lc   cpld2    0.08      0.0      0.1
              LCClkCtrl LC2                  lc   cpld3    0.03      0.0      0.1
              PortCtrl LC2                   lc   fpga2    0.10      0.0      0.1
              Serdes Upgrade LC2             lc   fpga3    14.44     0.0      0.1
              Bridge LC2                     lc   fpga1    0.43      0.0      0.1
              ROMMONB LC2                    lc   rommon   1.05      0.0      0.1
         ------------------------------------------------------------------------------
A9K-8T/4-L    Can Bus Ctrl (CBC) LC2         lc   cbc      2.02      0.0      0.1
              CPUCtrl LC2                    lc   cpld1    1.00      0.0      0.1
              PHYCtrl LC2                    lc   cpld2    0.08      0.0      0.1
              LCClkCtrl LC2                  lc   cpld3    0.03      0.0      0.1
              PortCtrl LC2                   lc   fpga2    0.10      0.0      0.1
              Serdes Upgrade LC2             lc   fpga3    14.44     0.0      0.1
              Bridge LC2                     lc   fpga1    0.43      0.0      0.1
              ROMMONB LC2                    lc   rommon   1.05      0.0      0.1
         ------------------------------------------------------------------------------
A9K-2T20GE-L  Can Bus Ctrl (CBC) LC2         lc   cbc      2.02      0.0      0.1
              CPUCtrl LC2                    lc   cpld1    1.00      0.0      0.1
              PHYCtrl LC2                    lc   cpld2    0.11      0.0      0.1
              LCClkCtrl LC2                  lc   cpld3    0.09      0.0      0.1
              Tomcat LC2                     lc   fpga2    0.16      0.0      0.1
```

```
                         Bridge LC2                   lc    fpga1     0.43      0.0      0.1
                         ROMMONB LC2                  lc    rommon    1.05      0.0      0.1
       ------------------------------------------------------------------------------------------
       A9K-8T-L          Can Bus Ctrl (CBC) LC3       lc    cbc       6.02      0.0      0.1
                         CPUCtrl LC3                  lc    cpld1     1.02      0.0      0.1
                         PHYCtrl LC3                  lc    cpld2     0.08      0.0      0.1
                         LCClkCtrl LC3                lc    cpld3     0.03      0.0      0.1
                         CPUCtrl LC3                  lc    cpld4     1.03      0.0      0.1
                         PortCtrl LC3                 lc    fpga2     0.11      0.0      0.1
                         Raven LC3                    lc    fpga1     1.02      0.0      0.1
                         ROMMONB LC3                  lc    rommon    1.03      0.0      0.1
       ------------------------------------------------------------------------------------------
       A9K-16T/8-L       Can Bus Ctrl (CBC) LC3       lc    cbc       6.02      0.0      0.1
                         CPUCtrl LC3                  lc    cpld1     1.02      0.0      0.1
                         PHYCtrl LC3                  lc    cpld2     0.04      0.0      0.1
                         LCClkCtrl LC3                lc    cpld3     0.01      0.0      0.1
                         DB CPUCtrl LC3               lc    cpld4     1.03      0.0      0.1
                         PortCtrl LC3                 lc    fpga2     0.01      0.0      0.1
                         Raven LC3                    lc    fpga1     1.02      0.0      0.1
                         ROMMONB LC3                  lc    rommon    1.03      0.0      0.1
       ------------------------------------------------------------------------------------------
       A9K-SIP-700       Can Bus Ctrl (CBC) LC5       lc    cbc       3.05      0.0      0.1
                         CPUCtrl LC5                  lc    cpld1     0.15      0.0      0.1
                         QFPCPUBridge LC5             lc    fpga2     5.14      0.0      0.1
                         NPUXBarBridge LC5            lc    fpga1     0.22      0.0      0.1
                         ROMMONA LC5                  lc    rommonA   1.03      0.0      0.1
                         ROMMONB LC5                  lc    rommon    1.03      0.0      0.1
       ------------------------------------------------------------------------------------------
       A9K-SIP-500       Can Bus Ctrl (CBC) LC5       lc    cbc       3.05      0.0      0.1
                         CPUCtrl LC5                  lc    cpld1     0.15      0.0      0.1
                         QFPCPUBridge LC5             lc    fpga2     5.14      0.0      0.1
                         NPUXBarBridge LC5            lc    fpga1     0.22      0.0      0.1
                         ROMMONA LC5                  lc    rommonA   1.03      0.0      0.1
                         ROMMONB LC5                  lc    rommon    1.03      0.0      0.1
       ------------------------------------------------------------------------------------------
       A9K-RSP-2G        Can Bus Ctrl (CBC) RSP2      lc    cbc       1.02      0.0      0.1
                         CPUCtrl RSP2                 lc    cpld2     1.17      0.0      0.1
                         IntCtrl RSP2                 lc    fpga2     1.15      0.0      0.1
                         ClkCtrl RSP2                 lc    fpga3     1.23      0.0      0.1
                         UTI RSP2                     lc    fpga4     3.08      0.0      0.1
                         PUNT RSP2                    lc    fpga1     1.05      0.0      0.1
                         HSBI RSP2                    lc    hsbi      4.00      0.0      0.1
                         ROMMONA RSP2                 lc    rommonA   1.05      0.0      0.1
                         ROMMONB RSP2                 lc    rommon    1.05      0.0      0.1
       ------------------------------------------------------------------------------------------
       A9K-RSP-4G        Can Bus Ctrl (CBC) RSP2      lc    cbc       1.02      0.0      0.1
                         CPUCtrl RSP2                 lc    cpld2     1.17      0.0      0.1
                         IntCtrl RSP2                 lc    fpga2     1.15      0.0      0.1
                         ClkCtrl RSP2                 lc    fpga3     1.23      0.0      0.1
                         UTI RSP2                     lc    fpga4     3.08      0.0      0.1
                         PUNT RSP2                    lc    fpga1     1.05      0.0      0.1
                         HSBI RSP2                    lc    hsbi      4.00      0.0      0.1
                         ROMMONA RSP2                 lc    rommonA   1.05      0.0      0.1
                         ROMMONB RSP2                 lc    rommon    1.05      0.0      0.1
       ------------------------------------------------------------------------------------------
       A9K-RSP-8G        Can Bus Ctrl (CBC) RSP2      lc    cbc       1.02      0.0      0.1
                         CPUCtrl RSP2                 lc    cpld2     1.17      0.0      0.1
                         IntCtrl RSP2                 lc    fpga2     1.15      0.0      0.1
                         ClkCtrl RSP2                 lc    fpga3     1.23      0.0      0.1
                         UTI RSP2                     lc    fpga4     3.08      0.0      0.1
                         PUNT RSP2                    lc    fpga1     1.05      0.0      0.1
                         HSBI RSP2                    lc    hsbi      4.00      0.0      0.1
                         ROMMONA RSP2                 lc    rommonA   1.05      0.0      0.1
                         ROMMONB RSP2                 lc    rommon    1.05      0.0      0.1
```

```
--------------------------------------------------------------------------------
ASR-9010-FAN        Can Bus Ctrl (CBC) FAN    lc   cbc       4.00      0.0      0.1
--------------------------------------------------------------------------------
ASR-9006-FAN        Can Bus Ctrl (CBC) FAN    lc   cbc       5.00      0.0      0.1
--------------------------------------------------------------------------------
A9K-BPID2-10-SLOT   Can Bus Ctrl (CBC) BP2    lc   cbc       7.00      0.0      0.1
--------------------------------------------------------------------------------
A9K-BPID2-6-SLOT    Can Bus Ctrl (CBC) BP2    lc   cbc       7.00      0.0      0.1
--------------------------------------------------------------------------------
A9K-ISM-100         Can Bus Ctrl (CBC) LC6    lc   cbc      18.05      0.0      0.1
                    CPUCtrl LC6               lc   cpld1     0.01      0.0      0.1
                    Maintenance LC6           lc   fpga2     0.06      0.0      0.1
                    Amistad LC6               lc   fpga1     0.25      0.0
0.20
                    ROMMONA LC6               lc   rommonA   1.02      0.0      0.1
                    ROMMONB LC6               lc   rommon    1.02      0.0      0.1
--------------------------------------------------------------------------------
A9K-8T-B            CPUCtrl LC3               lc   cpld1     1.02      0.0      0.1
                    PHYCtrl LC3               lc   cpld2     0.08      0.0      0.1
                    DB CPUCtrl LC3            lc   cpld4     1.03      0.0      0.1
                    PortCtrl LC3              lc   fpga2     0.11      0.0      0.1
                    Raven LC3                 lc   fpga1     1.02      0.0      0.1
--------------------------------------------------------------------------------
A9K-8T-E            CPUCtrl LC3               lc   cpld1     1.02      0.0      0.1
                    DB CPUCtrl LC3            lc   cpld4     1.03      0.0      0.1
                    PortCtrl LC3              lc   fpga2     0.11      0.0      0.1
                    Raven LC3                 lc   fpga1     1.02      0.0      0.1
--------------------------------------------------------------------------------
SPA-4XT3/E3         SPA E3 Subrate FPGA       spa  fpga2     1.04      0.0      0.0
                    SPA T3 Subrate FPGA       spa  fpga3     1.04      0.0      0.0
                    SPA I/O FPGA              spa  fpga1     1.01      0.0      0.0
                    SPA ROMMON                spa  rommon    2.12      0.0      0.0
--------------------------------------------------------------------------------
SPA-2XT3/E3         SPA E3 Subrate FPGA       spa  fpga2     1.04      0.0      0.0
                    SPA T3 Subrate FPGA       spa  fpga3     1.04      0.0      0.0
                    SPA I/O FPGA              spa  fpga1     1.01      0.0      0.0
                    SPA ROMMON                spa  rommon    2.12      0.0      0.0
--------------------------------------------------------------------------------
SPA-4XCT3/DS0       SPA T3 Subrate FPGA       spa  fpga2     0.11      0.0
0.100
                    SPA T3 Subrate FPGA       spa  fpga2     1.04      0.0
0.200
                    SPA I/O FPGA              spa  fpga1     2.08      0.0
0.100
                    SPA ROMMON                spa  rommon    2.12      0.0
0.100
--------------------------------------------------------------------------------
SPA-2XCT3/DS0       SPA T3 Subrate FPGA       spa  fpga2     0.11      0.0
0.100
                    SPA T3 Subrate FPGA       spa  fpga2     1.04      0.0
0.200
                    SPA I/O FPGA              spa  fpga1     2.08      0.0
0.100
                    SPA ROMMON                spa  rommon    2.12      0.0
0.100
--------------------------------------------------------------------------------
SPA-1XCHSTM1/OC3    SPA T3 Subrate FPGA       spa  fpga2     1.04      0.0      0.0
                    SPA I/O FPGA              spa  fpga1     1.08      0.0      0.0
                    SPA ROMMON                spa  rommon    2.12      0.0      0.0
--------------------------------------------------------------------------------
SPA-1XCHOC48/DS3    SPA I/O FPGA              spa  fpga2     1.00      0.0
0.49
                    SPA I/O FPGA              spa  fpga3     1.00      0.0
0.52
```

```
                       SPA I/O FPGA           spa  fpga1    1.36       0.0
0.49
                       SPA ROMMON             spa  rommon   2.02       0.0
0.49
-------------------------------------------------------------------------------------
SPA-2XCHOC12/DS0   SPA FPGA2 swv1.00      spa  fpga2    1.00       0.0        0.0
                   SPA FPGA swv1.36       spa  fpga1    1.36       0.0
0.49
                   SPA ROMMON swv2.2      spa  rommon   2.02       0.0
0.49
-------------------------------------------------------------------------------------
SPA-8XOC12-POS     SPA FPGA swv1.0        spa  fpga1    1.00       0.0        0.5
-------------------------------------------------------------------------------------
SPA-8XCHT1/E1      SPA I/O FPGA           spa  fpga1    2.08       0.0        0.0
                   SPA ROMMON             spa  rommon   2.12       0.0
0.140
-------------------------------------------------------------------------------------
SPA-OC192POS-XFP   SPA FPGA swv1.2 hwv2   spa  fpga1    1.02       0.0        2.0
-------------------------------------------------------------------------------------
SPA-2XOC48POS/RPR  SPA FPGA swv1.0        spa  fpga1    1.00       0.0        0.0
-------------------------------------------------------------------------------------
SPA-8XOC3-POS      SPA FPGA swv1.0        spa  fpga1    1.00       0.0        0.5
-------------------------------------------------------------------------------------
SPA-10X1GE-V2      SPA FPGA swv1.10       spa  fpga1    1.10       0.0        0.0
-------------------------------------------------------------------------------------
SPA-5X1GE-V2       SPA FPGA swv1.10       spa  fpga1    1.10       0.0        0.0
-------------------------------------------------------------------------------------
SPA-1X10GE-L-V2    SPA FPGA swv1.9        spa  fpga1    1.09       0.0        0.0
-------------------------------------------------------------------------------------
SPA-4XOC3-POS-V2   SPA FPGA swv1.0        spa  fpga1    1.00       0.0        0.5
-------------------------------------------------------------------------------------
SPA-1X10GE-WL-V2   SPA FPGA swv1.9        spa  fpga1    1.09       0.0        0.0
-------------------------------------------------------------------------------------
```

Determining Your Software Version

To determine the version of Cisco IOS XR software running on your router, log in to the router and enter the **show version** command:

Step 1   Establish a Telnet session with the router.

Step 2   Enter the **show version** command:

```
RP/0/RSP0/CPU0:router#show version

Cisco IOS XR Software, Version 4.1.0[Default]
Copyright (c) 2011 by Cisco Systems, Inc.

ROM: System Bootstrap, Version 1.05(20101118:025914) [ASR9K ROMMON],

router1 uptime is 2 hours, 35 minutes
System image file is "bootflash:disk0/asr9k-os-mbi-4.1.0/mbiasr9k-rp.vm"

cisco ASR9K Series (MPC8641D) processor with 4194304K bytes of memory.
MPC8641D processor at 1333MHz, Revision 2.2
ASR-9010 AC Chassis

4 Management Ethernet
18 WANPHY controller(s)
```

```
18 TenGigE
18 DWDM controller(s)
70 GigabitEthernet
8 SONET/SDH
8 Packet over SONET/SDH
219k bytes of non-volatile configuration memory.
977M bytes of compact flash card.
67988M bytes of hard disk.
1605616k bytes of disk0: (Sector size 512 bytes).
1605616k bytes of disk1: (Sector size 512 bytes).


Configuration register on node 0/RSP0/CPU0 is 0x102
Boot device on node 0/RSP0/CPU0 is disk0:
Package active on node 0/RSP0/CPU0:
iosxr-ce, V 4.1.0[00], Cisco Systems, at disk0:iosxr-ce-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-optics-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-optics-supp-4.1.0
    Built on Sun Apr 24 12:57:32 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-fwding, V 4.1.0[00], Cisco Systems, at disk0:asr9k-fwding-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-cpp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-cpp-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-ce, V 4.1.0[00], Cisco Systems, at disk0:asr9k-ce-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9K-doc-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9K-doc-supp-4.1.0
    Built on Sun Apr 24 12:57:07 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-scfclient, V 4.1.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-security, V 4.1.0[00], Cisco Systems, at disk0:iosxr-security-4.1.0
    Built on Sun Apr 24 12:56:58 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-video-adv, V 4.1.0[00], Cisco Systems, at disk0:iosxr-video-adv-4.1.0
    Built on Sun Apr 24 12:57:25 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-mpls, V 4.1.0[00], Cisco Systems, at disk0:iosxr-mpls-4.1.0
    Built on Sun Apr 24 12:56:04 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-mgbl, V 4.1.0[00], Cisco Systems, at disk0:iosxr-mgbl-4.1.0
    Built on Sun Apr 24 12:56:46 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-mcast, V 4.1.0[00], Cisco Systems, at disk0:iosxr-mcast-4.1.0
    Built on Sun Apr 24 12:56:28 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-routing, V 4.1.0[00], Cisco Systems, at disk0:iosxr-routing-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
```

```
        By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-infra, V 4.1.0[00], Cisco Systems, at disk0:iosxr-infra-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-fwding, V 4.1.0[00], Cisco Systems, at disk0:iosxr-fwding-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

iosxr-diags, V 4.1.0[00], Cisco Systems, at disk0:iosxr-diags-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-adv-video-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.1.0
    Built on Sun Apr 24 12:57:25 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-fpd, V 4.1.0[00], Cisco Systems, at disk0:asr9k-fpd-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-diags-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.1.0
    Built on Sun Apr 24 12:50:52 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-k9sec-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-k9sec-supp-4.1.0
    Built on Sun Apr 24 12:56:58 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-mgbl-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-mgbl-supp-4.1.0
    Built on Sun Apr 24 12:56:46 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-mcast-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.1.0
    Built on Sun Apr 24 12:56:28 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-base, V 4.1.0[00], Cisco Systems, at disk0:asr9k-base-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-os-mbi, V 4.1.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.1.0
    Built on Sun Apr 24 12:53:10 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

Configuration register on node 0/RSP1/CPU0 is 0x102
Boot device on node 0/RSP1/CPU0 is disk0:
Package active on node 0/RSP1/CPU0:
iosxr-ce, V 4.1.0[00], Cisco Systems, at disk0:iosxr-ce-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-optics-supp, V 4.1.0[00], Cisco Systems, at disk0:asr9k-optics-supp-4.1.0
    Built on Sun Apr 24 12:57:32 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie

asr9k-fwding, V 4.1.0[00], Cisco Systems, at disk0:asr9k-fwding-4.1.0
    Built on Sun Apr 24 12:50:53 UTC 2011
    By sjc-lds-511 in /auto/srcarchive5/production/4.1.0/asr9k/workspace for pie
```

Features Supported on the Cisco ASR 9000 Series Router

The following sections describe the features supported on the Cisco ASR 9000 Series Router platform:

- Features Introduced in Cisco IOS XR Software Release 4.1
- Features Introduced in Cisco IOS XR Software Release 4.0.1
- Features Introduced in Cisco IOS XR Software Release 4.0.0
- Features Introduced in Cisco IOS XR Software Release 3.9.2
- Features Introduced in Cisco IOS XR Software Release 3.9.1
- Features Introduced in Cisco IOS XR Software Release 3.9.0
- Features Introduced in Cisco IOS XR Software Release 3.7.3
- Features Introduced in Cisco IOS XR Software Release 3.7.2

Note   The Cisco ASR 9000 Series Router platform is not supported on Cisco IOS XR Software Release 3.8.0.

Features Introduced in Cisco IOS XR Software Release 4.1

The following sections contain information on new features and enhancements in Cisco IOS XR Software Release 4.1:

- Software Features Introduced in Cisco IOS XR Software Release 4.1 for the Cisco ASR 9000 Series Router, page 20
- Hardware Features Introduced in Cisco IOS XR Software Release 4.1 for the Cisco ASR 9000 Series Router, page 23

Software Features Introduced in Cisco IOS XR Software Release 4.1 for the Cisco ASR 9000 Series Router

The following new software features were introduced in Cisco IOS XR Software Release 4.1 on the Cisco ASR 9000 Series Router platform:

- Link Noise Monitoring (LNM) Enhancement on ASR 9000 SIP-700—Support for a Link Noise Monitoring enhancement was added on the Cisco 2-Port Channelized OC-12c/DS0 SPA to set thresholds for noise errors on T1/E1 links that are used to signal the Noise Attribute to PPP for removal of an MLPPP bundle link.

  For more information about LNM, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide.*

- 5k BGP NSR Support—The number of supported BGP NSR is increased to 5000. For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Routing Command Reference*.

- 2R3C Policing Support on ASR 9000 SIP-700—The following commands were added:

  - conform-color
  - exceed-color
  - police rate

For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Modular Quality of Service Command Reference.*

- Label Switched Multicast (LSM) Point-to-Multipoint Traffic Engineering—LSM is a solution framework providing multicast services over an MPLS/GMPLS backbone network. This feature uses extensions to RSVP-TE to build P2MP trees and data planes and provides support for MPLS replications.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide.*

- VRF aware TACACS+—This feature allows you to setup a management VRF in an MPLS backbone and sends TACACS+ accounting requests or records to this management VRF.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router System Security Configuration Guide* and the *Cisco ASR 9000 Series Aggregation Services Router System Security Command Reference.*

- IRB Interoperability Support on ASR 9000 SIP-700—This feature provides IRB interoperability support between SIP-700 and Ethernet line cards.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide.*

- MPLS VPN OSPFv3 PE-CE—This feature provides support for OSPFv3 Routing Protocol between provider edge-to-customer edge (PE-CE) router over IPv6 L3VPN.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router L3VPN and Ethernet Services Configuration Guide.*

- IPv6 Access Services: DHCPv6 Relay Agent—RFC 3315 defines a DHCP relay agent, which resides on the client's link and relays messages between the client and server. This agent allows a DHCP client to send a message to a DHCP server that is not connected to the same link.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide.*

- Virtual Router Redundancy Protocol (VRRP) over IPv6—This feature provides support to virtual IPv6 addresses. VRRP Version 3 is implemented for both IPv4 and IPv6. The feature also includes VRRP support for IPv6 VRFs and BFD.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide*.

- Virtual Private LAN Services (VPLS) Support on ASR 9000 SIP-700—VPLS is a mechanism for transporting Ethernet traffic across multiple sites that belong to the same L2 broadcast domain. This feature builds a point-to-point connection to interconnect two peering customer sites.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide*.

- One-way Delay Measurement—Beginning in Cisco IOS XR Release 4.1, the Delay Measurement Message (DMM) and Delay Measurement Response (DMR) packets carry timestamps derived from the DTI timing input on the clock interface port on the RSP.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide.*

- MGSCP—The MGSCP solution uses EtherChannel (EC) and the Link Aggregation Control Protocol (LACP) 802.3ad to enable scaling the SCE platform by sending the traffic to an EC. The EtherChannel load balancing is used to distribute the traffic over several SCE platforms.

For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide.*

- Link Bundling—The link bundle interface is enabled to be used as an edge-facing interface by providing new features, for example ACL, Mac Accounting, IPv6, PIMv6, uRPF, MVPNv4 with edge-facing link bundles, L2VPN, BFD, and Unequal BW.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide.*

- Integrated Service Module (ISM)—This feature is used for video integration and other services such as content streaming on the ASR9000-SIM-100 platform.

  For more information about installing ISM line cards, refer to the *Cisco ASR 9000 Series Aggregation Services Router ISM Line Card Installation Guide.*

- Call Home—Call Home provides an email-based notification for critical system policies. A range of message formats are available for compatibility with pager services or XML-based automated parsing applications. You can use this feature to page a network support engineer, email a Network Operations Center, or use Cisco Smart CallHome services to generate a case with the Technical Assistance Center. The Call Home feature can deliver alert messages containing information about diagnostics and environmental faults and events.

  For more information about the Call Home feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide* and the *Cisco ASR 9000 Series Aggregation Services Router System Management Command Reference*.

- Ethernet Local Management Interface (E-LMI) —E-LMI is an asymmetric protocol that runs on the PE to CE link or User-Network Interface (UNI). The user-facing Provider Edge (uPE) device uses E-LMI to communicate connectivity status (EVC status) and configuration parameters of ethernet services available on the UNI to the CE device.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide.*

- Lawful Intercept IPv4—Lawful intercept is the process by which law enforcement agencies conduct electronic surveillance of circuit and packet-mode communications, authorized by a judicial or administrative order. Service providers worldwide are legally required to assist law enforcement agencies in conducting electronic surveillance in both circuit-switched and packet-mode networks.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router System Security Configuration Guide*.

- BGP Private AS Filter - Provide the ability for customers to remove/replace Private AS Numbers in the as-path from outgoing BGP updates.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide* and the *Cisco ASR 9000 Series Aggregation Services Router Routing Command Reference.*

- IGMP Snooping on ASR 9000 SIP-700—Cisco IOS XR Release 4.1 supports IGMP snooping on the ASR 9000 SIP-700.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Multicast Configuration Guide*.

- ITU-T G.8032 Ethernet Ring Protection Switching—This feature implements the Automatic Protection Switching (APS) protocol and protection switching mechanisms for Ethernet layer ring topologies.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration.*

- IEEE 802.1ab Link Layer Discovery Protocol (LLDP)—This feature enables discovering the network topology in a standardized way using standard management tools such as SNMP. LLDP is initially deployed in Ethernet-based enterprise switching networks, which can also be used over other media types such as Token Ring and FDDI.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

- IPv6 Unicast IRB—Support for IPv6 unicast addressing in IRB and 6PE/6VPE support with BVI interfaces was added in Cisco IOS XR Release 4.1 for the following Gigabit Ethernet line cards on the Cisco ASR 9000 Series Router:

  - 2-Port 10-Gigabit Ethernet, 20-Port Gigabit Ethernet Combination Line Cards (A9K-2T20GE-B and A9K-2T20GE-L)

  - 4-Port 10-Gigabit Ethernet Line Cards (A9K-4T-B, -E, -L)

  - 8-Port 10-Gigabit Ethernet DX Line Cards (A9K-8T/4-B, -E, -L)

  - 8-Port 10-Gigabit Ethernet Line Cards (A9K-8T-B, -E, -L)

  - 16-Port 10-Gigabit Ethernet Line Cards (A9K-16T/8-B, -E, -L)

  - 40-Port Gigabit Ethernet Line Cards (A9K-40GE-B, -E, -L)

  Note IPv6 addressing is not supported for IRB on any SPAs on the Cisco ASR 9000 SIP-700.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

- MSTAG Edge Mode—In this feature, you can configure MSTAG, so the gateway devices appear to have the best path to the best possible Multiple Spanning Tree Protocol (MSTP) root node.

  For more information, refer to the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide*.

- Some ASR 9000 SIP-700 QFP processes are now restartable. Non reloadable SMUs can be created for these processes.

Hardware Features Introduced in Cisco IOS XR Software Release 4.1 for the Cisco ASR 9000 Series Router

The following hardware features introduced in Cisco IOS XR Software Release 4.1 are supported on the Cisco ASR 9000 Series Router platform:

- SPA-4XCT3/DS0—4-Port Channelized T3 to DS0 SPA
- SPA-8XCHT1/E1Å—8-Port Channelized T1/E1 SPA
- ISM (Integrated Service Module) Line Card—A9K-ISM-100

Features Introduced in Cisco IOS XR Software Release 4.0.1

The following sections contain information on new features and enhancements in Cisco IOS XR Software Release 4.0.1:

Software Features Introduced in Cisco IOS XR Software Release 4.0.1 for the Cisco ASR 9000 Series Router

The following new software features were introduced in Cisco IOS XR Software Release 4.0.1 on the Cisco ASR 9000 Series Router platform:

- IP Fast Reroute (IPFRR)—The following commands are introduced on the Cisco IOS XR Software Release 4.0.1:
  - ipfrr lfa
  - ipfrr lfa exclude interface

  The following commands are modified to support this feature:
  - fast-reroute per-link
  - fast-reroute per-link exclude interface

  For more information about these commands, refer to the *Cisco IOS XR Routing Command Reference* documentation.

- CFM on MC-LAG—This feature adds Cisco ASR 9000 Series Router support for Operations, Administration, and Maintenance operations defined by IEEE 802.1ag Connectivity Fault Management (CFM) on Multi-Chassis Link Aggregation Group (MC-LAG) for deployments where the link bundle (LAG) terminates on separate chassis.

- Downstream on Demand for BGP Labels—This feature adds support for the downstream-on-demand mode where the label is not advertised to a peer unless the peer explicitly requests it. At the same time, because the peer does not automatically advertise labels, a label request must be sent whenever the next-hop points to a peer to which no remote label has been assigned.

  For more information about this feature, refer to the Downstream on Demand section of the *Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide*.

- Any Transport over MPLS (AToM): HDLC over MPLS (HDLCoMPLS)—The attachment circuit (AC) is a main interface configured with HDLC encapsulation. Packets to or from the AC are transported using an AToM pseudowire (PW) of VC type 0x6 to or from the other provider edge (PE) router over te MPLS core network.

  With HDLC over MPLS, the entire HDLC packet is transported. The ingress PE router removes only the HDLC flags and FCS bits.

- Any Transport over MPLS (AToM): PPP over MPLS (PPPoMPLS)—The AC is a main interface configured with PPP encapsulation. Packets to or from the AC are transported through an AToM PW of VC type 0x7 to or from the other PE routers over the MPLS core network.

  With PPP over MPLS, the ingress PE router removes the flags, address, control field, and the FCS bits.

- Load Balancing on Link Bundles—The Cisco ASR 9000 Series Router supports load balancing for all links in a bundle using Layer 2, Layer 3, and Layer 4 routing information. For more information about load balancing on link bundles, see the Configuring Link Bundling on the Cisco ASR 9000 Series Router section of the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

  - Dynamic Load Balancing for LAG—Beginning in Cisco IOS XR Release 4.0.1, the Cisco ASR 9000 Series Router supports a method of dynamic load balancing among link aggregation (LAG) members. With dynamic load balancing, the hash algorithms for link selection include up to a maximum of 64 links, and are based on the current number of active members in the bundle.

  - Layer 3 Load Balancing on Link Bundles—Layer 3 load balancing for link bundles is done when outgoing interfaces are either bundles or bundle subinterfaces. 5-tuple hashing is used for load balancing among bundle member links, using the following parameters:

    IP source address

    IP destination address

    Router ID

    Layer 4 source port

    Layer 4 destination port

    Note In Cisco IOS XR Release 4.0.1, the **hw-module load-balance bundle l2-service l3-params** command is replaced by the **load-balancing flow** command in L2VPN configuration mode.

- BFD Per Member Link—Beginning in Cisco IOS XR Release 4.0.1, the BFD feature supports BFD sessions on individual physical bundle member links to monitor Layer 3 connectivity on those links, rather than just at a single bundle member as in prior releases on the Cisco ASR 9000 Series Router.

  When you run BFD on link bundles, you can run an independent BFD session on each underlying physical interface that is part of that bundle.

  When BFD is running on a link bundle member, the following layers of connectivity are effectively tested as part of the interface state monitoring for BFD:

  - Layer 1 physical state

  - Layer 2 Link Access Control Protocol (LACP) state

  - Layer 3 BFD state

  The BFD agent on each bundle member link monitors state changes on the link. BFD agents for sessions running on bundle member links communicate with a bundle manager. The bundle manager determines the state of member links and the overall availability of the bundle. The state of the member links contributes to the overall state of the bundle based on the threshold of minimum active links or minimum active bandwidth that is configured for that bundle.

  BFD Echo Latency Detection—Beginning in Cisco IOS XR 4.0.1, you can configure BFD sessions on non-bundle interfaces to bring down a BFD session when it exceeds the configured echo latency tolerance.

  BFD Echo Startup Validation—Beginning in Cisco IOS XR Release 4.0.1, you can verify that the echo packet path is working and within configured latency thresholds before starting a BFD session on non-bundle interfaces.

  For more information about BFD Per Member Link, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

- PVST+ Gateway—Per-Vlan STP (PVST) is a mechanism for creating multiple spanning trees. Using PVST, a separate spanning tree is created for each VLAN.

  For more information about this feature, refer to the Implementing Multiple Spanning Tree Protocol section of the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide.*

- Integrated Routing and Bridging (IRB)—IRB provides the ability to exchange traffic between bridging services on the Cisco ASR 9000 Series Router and a routed interface using a Bridge-Group Virtual Interface (BVI). This feature is supported on the following line cards:

  – 2-Port 10-Gigabit Ethernet, 20-Port Gigabit Ethernet Combination Line Cards (A9K-2T20GE-B and A9K-2T20GE-L)

  – 4-Port 10-Gigabit Ethernet Line Cards (A9K-4T-B, -E, -L)

  – 8-Port 10-Gigabit Ethernet DX Line Cards (A9K-8T/4-B, -E, -L)

  – 8-Port 10-Gigabit Ethernet Line Cards (A9K-8T-B, -E, -L)

  – 40-Port Gigabit Ethernet Line Cards (A9K-40GE-B, -E, -L)

  Multicast IRB provides the ability to route multicast packets between a bridge group and a routed interface using a bridge-group virtual interface (BVI).

  For more information about IRB, refer to the Configuring Integrated Routing and Bridging on the Cisco ASR 9000 Series Router section of the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

- Traffic Mirroring—The following traffic mirroring features are added:

  – Traffic mirroring over a pseudowire

  – Flow or ACL-based traffic mirroring

  – Layer 3 interface support

  – Partial packet mirroring

  For more information about the traffic mirroring features, refer to the Configuring Traffic Mirroring on the Cisco ASR 9000 Series Router section of the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide.*

- Dynamic ARP Inspection (DAI)—This feature is method of providing protection against address resolution protocol (ARP) spoofing attacks. It intercepts, logs, and discards ARP packets with invalid IP-to-MAC address bindings.

  For more information about DAI, refer to the Dynamic ARP Inspection section of the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide.*

- PW Over Recursive Path—The following commands are modified in Cisco ASR 9000 Series in Cisco IOS XR software Release 4.0.1:

  – **permit** (IPv4) —The *capture* keyword is added.

  – **permit** (IPv6) —The *capture* keyword is added.

  For more information about these commands, refer to the *Cisco ASR 9000 Series Aggregation Services Router IP Addressing Command Reference.*

- IP Source Guard—This feature provides source IP address filtering on a Layer 2 port to prevent a malicious host from manipulating a legitimate host by assuming the legitimate host's IP address.

  For more information about this feature, refer to the IP Source Guard section of the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide.*

- Dynamic 32x IGP ECMP

  MAC Address Security for EVC Bridge-Domain—For information about how to configure MAC Address Security, refer to the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide.*

- Enhanced Performance Monitoring for Layer 2—Beginning in Cisco IOS XR Release 4.0.1, the Cisco ASR 9000 Series Router adds support for basic counters for performance monitoring on Layer 2 interfaces.

  The **interface basic-counters** keyword has been added to support a new entity for performance statistics collection and display on Layer 2 interfaces in the following commands:

  - **performance-mgmt statistics interface basic-counters**
  - **performance-mgmt threshold interface basic-counters**
  - **performance-mgmt apply statistics interface basic-counters**
  - **performance-mgmt apply threshold interface basic-counters**
  - **performance-mgmt apply monitor interface basic-counters**
  - **show performance-mgmt monitor interface basic-counters**
  - **show performance-mgmt statistics interface basic-counters**

  The **performance-mgmt threshold interface basic-counters** command supports the following attribute values for Layer 2 statistics, which also appear in the **show performance-mgmt statistics interface basic-counters** and **show performance-mgmt monitor interface basic-counters** command:

Attribute	Description
InOctets	Bytes received (64-bit)
InPackets	Packets received (64-bit)
InputQueueDrops	Input queue drops (64-bit)
InputTotalDrops	Inbound correct packets discarded (64-bit)
InputTotalErrors	Inbound incorrect packets discarded (64-bit)
OutOctets	Bytes sent (64-bit)
OutPackets	Packets sent (64-bit)
OutputQueueDrops	Output queue drops (64-bit)
OutputTotalDrops	Outband correct packets discarded (64-bit)
OutputTotalErrors	Outband incorrect packets discarded (64-bit)

  For information about how to configure Performance Monitoring, see the Implementing Performance Management section of the *Cisco ASR 9000 Series Aggregation Services Router System Monitoring Configuration Guide*.

- Video Monitoring Trap and Clone—The following commands are introduced on the Cisco ASR 9000 Series Router in Cisco IOS XR software Release 4.0.1:

  - **clear performance traffic clone profile**
  - **show performance traffic clone profile**

For more information about these commands, refer to the Video Monitoring Commands on Cisco ASR 9000 Series Router section of the *Cisco ASR 9000 Series Aggregation Services Router Multicast Command Reference.*

- IPv6 Multicast Routing is supported on the Cisco ASR 9000 Series Cisco IOS XR software Release 4.0.1.

    For more information about this feature, refer to the Implementing Layer-3 Multicast Routing on Cisco ASR 9000 Series Routers section of the *Cisco ASR 9000 Series Aggregation Services Router Multicast Configuration Guide.*

- PW Load Balancing—Traffic load balancing over multiple links is typically required to maximize networks while maintaining redundancy. This feature applies to pseudowires under L2VPN and includes both VPWS and VPLS.

    For more information, refer to the Pseudowire Load Balancing section of the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide.*

- DHCP over PW—The Cisco ASR 9000 Series Routers provide the ability to perform DHCP snooping where the DHCP server is reachable on a pseudowire. The dhcp ipv4 snoop profile {dhcp-snooping-profile1} command is provided under the bridge domain to:

    - enable DHCP snooping on a bridge

    - attach a DHCP snooping profile to the bridge

- QoS Port Shaping Policies—Support for simultaneous configuration of port-shape policies in main interfaces and individual subinterface service policies was added.

    For more information, refer to the Configuring Modular QoS Service Packet Classification and Marking on Cisco ASR 9000 Series Routers section of the *Cisco ASR 9000 Series Aggregation Services Router Modular Quality of Service Configuration Guide.*

- Scale Profiles—The scale profile is a user-configurable setting that tunes the router to perform more efficiently to the selected application. You should specify the scale profile before deploying the router to production use.

    For information about how to configure scale profiles, refer to the Information About Scale Profiles section of the *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide.*

> **Note** Video Monitoring is not supported in the L3XL scale profile.

- ACL Based Forwarding (ABF) OT—This feature enables you to choose services from multiple providers for broadcast TV over IP, IP telephony, data, and so on.

    For information about how to configure ABF, refer to the ABF section of the *Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide.*

- MPLS TE Hop Limit—You can limit the number of hops traversed by MPLS-TE Tunnels. Cisco IOS XR Release 4.0.1 introduces the following new command:

    ```
    router#(config-if) path-selection hop-limit <1-255>
    ```

- IGMP Snooping—Cisco IOS XR software Release 4.0.1 adds support for the CISCO-MLD-SNOOPING-MIB. This MIB provides remote network management systems the ability to manage the IGMP Snooping feature when IGMP Snooping is enabled at the Bridge-Domain level.

To obtain SNMP data from the CISCO-MLD-SNOOPING-MIB for a bridge domain, create an snmp community mapped to the bridge domain using the following commands:

```
router(config)#snmp-server community community-name rw systemowner
router(config)#snmp-server community-map community-name context
vpls_bridge-domain-name
```

For more information about IGMP Snooping, refer to the Implementing Layer-2 Multicast with IGMP Snooping on *Cisco ASR 9000 Series Routers section of the Cisco ASR 9000 Series Aggregation Services Router Multicast Configuration Guide*.

- Other Performance Management Enhancements—The following additional performance management enhancements are included in Cisco IOS XR Release 4.0.1:

You can retain performance management history statistics across a process restart or route processor (RP) failover using the new history-persistent keyword option for the performance-mgmt statistics interface command.

You can save performance management statistics to a local file using the performance-mgmt resources dump local command.

You can filter performance management instances by defining a regular expression group (performance-mgmt regular-expression command), which includes multiple regular expression indices that specify strings to match. You apply a defined regular expression group to one or more statistics or threshold templates in the performance-mgmt statistics interface or performance-mgmt thresholds interface commands.

Hardware Features Introduced in Cisco IOS XR Software Release 4.0.1 for the Cisco ASR 9000 Series Router

The following hardware features introduced in Cisco IOS XR Software Release 4.0.1 are supported on the Cisco ASR 9000 Series Router platform:

- 4-Port Clear Channel T3/E3 SPA (SPA-4XT3E3)
- 2-Port Clear Channel T3/E3 SPA (SPA-2XT3E3)
- 1-Port Channelized OC-3/STM-1 SPA (SPA-1XCHSTM1/OC3)
- 4-Port OC-3/STM-1 POS SPA (SPA-4XOC3)
- 8-Port OC-3/STM-1 POS SPA (SPA-8XOC3)

Features Introduced in Cisco IOS XR Software Release 4.0.0

The following sections contain information on new features and enhancements in Cisco IOS XR Software Release 4.0.0:

Note Cisco Session Border Controller (SBC) is not supported on any platform in Cisco IOS XR Software Release 4.0.0. Cisco IOS XR Software Release 3.7 is the last release that supports SBC.

Note When upgrading the Cisco IOS XR Software Release 3.9.2 to Cisco IOS XR Software Release 4.0.0, IOS XR directories are also created on the boot disk (disk0) along with the ASR 9000 directories.

New Software Features Supported on all Platforms

The following new software features in Cisco IOS XR Software Release 4.0.0 are supported on all platforms:

- BGP-AD with LDP Signalling
- SSH Remote Command Execution
- Non-default SSM Range
- MPLS features
    - Automatic Backup Tunnels
    - SRLG

        MPLS-TE SRLG CLI Migration Steps from pre Release 4.0 to Release 4.0

        In Cisco IOS XR Software Release 4.0.0 the MPLS TE SRLG command has been moved from MPLS TE config to Global level config. Other protocols can now use the SRLG configuration.

        SRLG command syntax in releases prior to Release 4.0:

        ```
        mpls  traffic-eng
            interface GigabitEthernet0/3/0/0
                srlg  400
                srlg  401
                srlg  402
        ```

        SRLG command syntax in releases prior to Release 4.0:

        ```
        srlg
            interface GigabitEthernet0/3/0/0
                value 400
                value 401
                value 402
        ```

        Migration Steps

Step 1   Load the new 4.0 image

Step 2   Execute the **show run mpls traffic-eng** command

Step 3   Delete all the SRLG values under the interface in MPLS Traffic-eng configuration using the **no srlg** command

```
config t
mpls traffic-eng
int GigabitEthernet0/3/0/0
   no srlg  400
   no srlg 401
   no srlg 402
```

```
                            commit
```

Step 4   Add the SRLG values in the new configuration using the srlg and value commands

```
            config t <enter>
                srlg <enter>
                interface GigabitEthernet0/3/0/0 <enter>
                    value 400 <enter>
                    value 401 <enter>
                    value 402 <enter>
            commit
```

   – MPLS OAM

For more information on these new MPLS features, refer to the *Implementing MPLS Traffic Engineering* module and the *Implementing MPLS OAM* module of the *Cisco IOS XR MPLS Configuration Guide for the Cisco ASR 9000 Series Router, Release 4.0*.

Cisco ASR 9000 Series-Specific Software Features

The following new software features were introduced in Cisco IOS XR Software Release 4.0.0 on the Cisco ASR 9000 Series Router platform:

- Multi-Chassis Link Aggregation.

   – Multi-chassis support for LACP

- IPoDWDM Proactive Protection For ISIS and IP FRR

- Layer 3 load-balancing on Layer 2 LAG

- Cisco ASR 9000 SIP 700 linecard software features

   – IPHC (IP Header Compression for PPP/MLPPP/MLPPP-LFI) support only on A9K-SIP-700/SPA-2xCHOC12/DS0

   > ✎
   >
   > **Note**   Slot level IPHC configuration is supported on the XR12000, but not on the ASR-9000.

   – MPLS/TE-FRR support

   Only the 8-port OC-12 SPA, the 2-port OC-48 SPA and the 1-port OC-192 SPA support the MPLS/TE Fast Reroute feature. The MPLS/TE Fast Reroute feature is supported on the main interface, not on sub-interfaces. There is no support for the MPLS/TE FRR feature on the 2-port channelized OC-12 SPA or on the 1-port channelized OC 48 SPA.

   – Layer 3 VPN (vpn4,mvpn4) support only on the A9K-SIP-700/SPA-8xOC12-POS, A9K-SIP-700/SPA-2xCHOC12-POS, A9K-SIP-700/SPA-2xOC48-POS and the A9K-SIP-700/SPA-1xCHOC48

   – Inter-AS,CSC,6VPE support only on the A9K-SIP-700/SPA-8xOC12-POS, A9K-SIP-700/SPA-2xCHOC12-POS, A9K-SIP-700/SPA-2xOC48-POS and the A9K-SIP-700/SPA-1xCHOC48

   – Frame Relay (FR), MLFR/LFI & FRF.12 support on the Cisco ASR 9000 SIP 700 linecard

   – Link Noise Monitoring support on the Cisco ASR 9000 SIP 700 linecard

   – IPv4 BGP-Policy Accounting and BFD (on the Cisco ASR 9000 SIP 700 linecard only)

- IPv6 uRPF (on the Cisco ASR 9000 SIP 700 linecard only)
- Software support for the following SPAs on the Cisco ASR 9000 SIP 700 linecard:
  - SPA-OC192POS-XFP
  - SPA-2XOC48POS/RPR
  - SPA-8XOC12-POS
  - SPA-1XCHOC48/DS3
- 6PE features for IPv6 L3VPN on the Cisco ASR 9000 SIP 700 linecard.
  - BGP per VRF/CE label allocation for 6PE feature
- 6VPE features for IPv6 L3VPN on Cisco ASR 9000 SIP 700 linecard
- IPv6 ACL support on the Cisco ASR 9000 SIP 700 linecard

For detailed software configuration information on the shared port adapters (SPAs) and SPA interface processors (SIPs), see the following document:

- *Cisco ASR 9000 Series Aggregation Services Router SIP and SPA Hardware Installation Guide*
- *Cisco Interface and Hardware Component Configuration Guide for the Cisco ASR 9000 Series Router, Release 4.0.0*
- IPv4 multicast support on serial interfaces

  For more information on this feature, refer to the *Implementing Multicast Routing on Cisco IOS XR Software* module of the *Cisco IOS XR Multicast Configuration Guide for the Cisco ASR 9000 Series Router, Release 4.0.*

- Multicast features:
  - MVPN Extranet
  - MVPN Auto-RP Lite
  - MVPN Hub and Spoke Topology

  For more information on these features, refer to the *Implementing Multicast Routing on Cisco IOS XR Software* module of the *Cisco IOS XR Multicast Configuration Guide for the Cisco ASR 9000 Series Router, Release 4.0.*

- BGP features:
  - BGP Additional Path Support

    With this feature, BGP advertises additional paths.
  - Accumulated Interior Gateway Protocol (AIGP) Metric Attribute

    Use this attribute for BGP to report the sum of the metric of each link along the path.
  - Unipath PIC for Non-VPN Address-families (6PE/IPv4 Unicast)

  For more information on these features, refer to the *Cisco IOS XR Routing Configuration Guide for the Cisco ASR 9000 Series Router, Release 4.0.*

- Multiprotocol Label Switching (MPLS) Ping and Trace features
- Any Transport over MPLS (AToM) features on Point to Point Layer 2 services

  For more information on these new MPLS features, refer to the *Implementing MPLS Traffic Engineering* module and the *Implementing MPLS OAM* module of the *Cisco IOS XR MPLS Configuration Guide for the Cisco ASR 9000 Series Router, Release 4.0.*

Cisco ASR 9000 Series Hardware Features Introduced in Cisco IOS XR Software Release 4.0.0

The following hardware features introduced in Cisco IOS XR Software Release 4.0.0 are supported on the Cisco ASR 9000 Series Router platform:

- 1-Port Channelized OC48/STM16 DS3 SPA (SPA-1XCHOC48/DS3)

- 2-Port OC-48/STM16 SPA (SPA-2XOC48POS/RPR)

- 8-Port OC12/STM4 SPA (SPA-8XOC12-POS)

- 1-Port OC192/STM64 POS SPA (SPA-OC192POS-XFP)

For detailed hardware information on the shared port adapters (SPAs) and SPA interface processors (SIPs), see the following document:

- *Cisco ASR 9000 Series Router SIP and SPA Hardware Installation Guide*

- *Cisco Interface and Hardware Component Configuration Guide for the Cisco ASR 9000 Series Router, Release 4.0.0*

Features Introduced in Cisco IOS XR Software Release 3.9.2

The following features introduced in Cisco IOS XR Software Release 3.9.2 are supported on the Cisco ASR 9000 Series Router platform:

- IPv6 Over Bundle

    Cisco IOS XR Software Release 3.9.2 adds IPv6 as a protocol that can be passed over link bundles on the Cisco ASR 9000 Series Router platform.

    This feature covers IPv6 support over Ethernet and POS bundles, including Bundle-VLANs. The features in this release that are supported on IPv6 over bundle interfaces are:

    - IPv6 Unicast

    - IPv6 Multicast

    - 32 members per bundle (bundle-pos or bundle-ether).

    - Bundle interfaces of different bandwidth.

    - IPv6 QOS

    - IPv6 ACL

    - L2 load balance of v6 traffic over bundle interfaces.

    - Ipv6 BGP Policy Accounting

    The following features are not supported in IPv6 over Bundle:

    - RSVP signaling on top of IPv6 bundle interfaces

    - TE and FRR on top of IPv6 bundle interfaces

    - GRE, L2TPv3 tunnels on top of IPv6 bundle interfaces

    - IPSEC tunnels over IPv6 bundle interfaces

    Limitations:

    - User shall be able to configurable thresholds for the number of component links that need to be up and active for a link bundle to be up and active

    - Support up to 4000 (4k) Bundle VLANs in total.

- L2VPN service over IPv6 bundled interfaces
- MVPN Service over IPv6 bundled interfaces
- On the Cisco ASR 9000 Series Router platform, this feature is available for all line cards
- Ipv6 on bundles is not supported on the SIP-700 on the Cisco ASR 9000 Series Router platform
- IPv6 ACLs on bundles is supported from release 3.9.2 onwards
- IPv6 multicast is not supported on bundle interfaces/normal interfaces in 3.9.2
- IPv6 BGP Policy Accounting is currently not supported over physical or sub-interfaces.

More information about link bundling configuration and monitoring can be found in the following Command Reference Guides, *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Command Reference* and *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Command Reference*, online.

- ACL Based Forwarding (ABF)

Cisco IOS XR Software Release 3.9.2 introduces support on the Cisco ASR 9000 Series Router platform for packet forwarding and routing according to customer defined policies.

An access control list (ACL) consists of one or more access control entries (ACE) that collectively define the network traffic profile. This profile can then be referenced by Cisco IOS XR software features such as traffic filtering, route filtering, QoS classification, and access control. Each ACL includes an action element (permit or deny) and a filter element based on criteria such as source address, destination address, protocol, and protocol-specific parameters.

Prefix lists are used in route maps and route filtering operations and can be used as an alternative to access lists in many Border Gateway Protocol (BGP) route filtering commands. A prefix is a portion of an IP address, starting from the far left bit of the far left octet. By specifying exactly how many bits of an address belong to a prefix, you can then use prefixes to aggregate addresses and perform a function on them, such as redistribution (filter routing updates).

Hardware Limitations:

- Support for ABF is only for IPv4 and Ethernet line cards. IPv6 and other interfaces are not supported
- ABF is an ingress line card feature and the egress line card must be ABF aware.
- SIP-700 is not ABF aware and hence drops ABF packets.

Restrictions:

- The following *nexthop* configurations are not supported:

  Attaching ACL having a *nexthop* option in the **egress** direction.

  Modifying an ACL attached in the **egress** direction having *nexthop*.

  deny ACE with *nexthop*.

- The following interfaces are not supported: loopback, interflex, and L2.
- The ABF feature configuration on **A9K-SIP-700** is not supported.
- ABF *nexthop* packets received by **A9K-SIP-700** are dropped.

Note   There is one exception to this. In case of IP to TAG, the label is imposed by the ingress LC (based on ABF *nexthop*), and the packet crosses the fabric as a tag packet. These packets are handled by A9K-SIP-700 without any issue.

– Packets punted in the **ingress** direction from the NPU to the LC CPU are not subjected to ABF treatment due to lack of ABF support in the slow path.

> ✎
> **Note** For example, **IP Options** packets are not subjected to ABF. The packet is forwarded without ABF.

– Packets punted in the **egress** direction from the NPU to the LC CPU other than in order to glean adjacency are not subjected to ABF treatment due to the lack of ABF support in the slow path.

> ✎
> **Note** IP packet(s) needing **fragmentation** are not subjected to ABF. The packet is forwarded in the traditional way. Fragmented packets received are handled by ABF.

– *nexthop* in **VRF** is not supported. *nexthop* is looked at in the global table only.

- Generic Routing Encapsulation (GRE)

  Cisco IOS XR Software Release 3.9.2 introduces support on the Cisco ASR 9000 Series Router platform for the GRE tunneling protocol. GRE is a simple, generic way to transport packets of one protocol over another protocol by means of encapsulation. The GRE tunneling protocol enables:

  – High Assurance Internet Protocol Encryptor (HAIPE) devices for encryption over the public Internet and non secure connections.

  – Service providers (that do not run MPLS in their core network) to provide VPN services along with the security services.

For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* and the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Command Reference* online.

Hardware Limitations:

– Support for GRE is only for the Ethernet line card.

– SIP-700 is not GRE aware and will drop GRE packets.

Restrictions:

The GRE feature has the following restrictions.

– A maximum of 500 GRE tunnels can be configured per system.

– GRE is limited to tunneling of unicast IPv4 data packets.

– Packets received with nested and concatenated GRE headers are dropped.

– Transport header support is limited to IPv4

– Path MTU discovery is not supported over GRE tunnel interfaces. When size of the packet going over GRE tunnel interface exceeds the tunnel MTU, the ucode will punt the packet to the slow path for best effort fragmentation. Since punted packets are policed, this doesn't provide real fragmentation support. If the decap router receives a fragmented GRE packet, the fragments will also be punted to the slow path for best-effort reassembly. The user is responsible for making sure the MTUs configured along the tunnel path are large enough to guarantee the GRE packet will not be fragmented between tunnel source and destination routers.

– No Layer 3 features (like QoS, ACL and netflow) are supported over GRE tunnel interfaces. Features configured on the underlying physical interface will be applied.

– No support for optional checksum as defined in RFC2784.

– No support for key, and sequence number fields as defined in RFC2890.

Features Introduced in Cisco IOS XR Software Release 3.9.1

The following features introduced in Cisco IOS XR Software Release 3.9.1 are supported on the Cisco ASR 9000 Series Router platform:

- AIS for CFM (Y.1732 Performance Monitoring)

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for Alarm Indication Signal (AIS) functionality for Connectivity Fault Management (CFM) in conformance to the ITU-T Y.1731 standard. For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* online.

- CFM over BLM

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for Ethernet Connectivity Fault Management (CFM) over bundled link members (BLM). For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* online.

- CFM over Link Aggregation Groups (LAGs)

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for Ethernet Connectivity Fault Management (CFM) over link aggregation groups (LAGs). For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* online.

- Ethernet Fault Detection for CFM

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for EFD for CFM. Ethernet Fault Detection (EFD) is a feature of Ethernet Connectivity Fault Management (CFM) that provides line protocol fault detection for Ethernet interfaces.

- CFM Configurable Tagging

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for configurable tagging for CFM. For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* online.

- PBB

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for the IEEE 802.1ah Standard for Provider Backbone Bridging (PBB). For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Configuration Guide* online.

- MVRP-Lite

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for MVRP-Lite (Multiple VLAN Registration Protocol Lite). For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Multicast Command Reference* and the *Cisco ASR 9000 Series Aggregation Services Router Multicast Configuration Guide* online.

  Note that MVRP-Lite describes does not implement the MAP or Registrar functions of the MRP specification or enact attribute registrations in the local forwarding table.

- Netflow

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for Netflow. NetFlow is useful for the following:

  – Accounting/Billing—NetFlow data provides fine grained metering for highly flexible and detailed resource utilization accounting.

  – Network Planning and Analysis—NetFlow data provides key information for strategic network planning.

  – Network Monitoring—NetFlow data enables near real-time network monitoring capabilities.

  For more information on this feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Netflow Command Reference* and the *Cisco ASR 9000 Series Aggregation Services Router Netflow Configuration Guide* online.

- 6PE/VPE

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for the 6PE (IPv6 over MPLS) feature. 6PE allows IPv6 domains to communicate with each other over an MPLS IPv4 core network. Note that IPv6 over bundles is NOT supported on the Cisco ASR 9000 Series Router platform running Cisco IOS XR Software Release 3.9.1 or earlier.

  Also note that when downgrading from Cisco IOS XR Software Release 4.0.1 or Release 3.9.1 to an earlier release, if a 6PE/VPE configuration is present in the system, the 6PE/VPE configuration needs to be unconfigured before initiating the downgrade.

- 16x10-Gigabit Ethernet (16 x 10 GE) SFP+ Line Card

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for the 16x10-Gigabit Ethernet (16 x 10 GE) SFP+ line card.

- BGP-AD with LDP Signalling

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for extending the BGP-AD feature to add support for LDP signalling. BGP-AD with BGP signalling was already supported on the Cisco ASR 9000 Series Router platform. LDP signalling is tied to L2VPN services.

- SSH Remote Command Execution

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for the SSH remote command execution feature. This feature allows an operator to execute a command on the Cisco ASR 9000 Series Router without logging into the Cisco ASR 9000 Series Router, using non-interactive SSH mode. The result of the command is sent via the established channel to the operator. The SSH client running on the operator end prints the output.

- Uncompressed Vidmon

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router platform for high bandwidth flow on the Video Monitoring service introduced in Cisco IOS XR Software Release 3.9.0.

- 16K Queues per NPU on 10 Gigabit Ethernet Line Cards

  Cisco IOS XR Software Release 3.9.1 added support on the Cisco ASR 9000 Series Router for 16K Queues per Network Processing Unit (NPU) on the 10 Gigabit Ethernet line cards.

- 2000 VRRP Sessions

  Cisco IOS XR Software Release 3.9.1 added support on the Cisco ASR 9000 Series Router for up to 2000 Virtual Router Redundancy Protocol (VRRP) sessions.

- SONET DS3

  Cisco IOS XR Software Release 3.9.1 added support for SONET DS3 on the
  Cisco ASR 9000 Series Router with SIP-700 and SPA-2XCH0C12. For more information on this
  feature, refer to the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware
  Component Configuration Guide* online.

- BPID-02

  Cisco IOS XR Software Release 3.9.1 added support for the show plugin slot counts command
  which displays cumulative and running counts of card inserts per slot on the
  Cisco ASR 9000 Series Router with the BPID-02 card. For more information on the show plugin
  slot counts command, refer to the *Cisco ASR 9000 Series Aggregation Services Router System
  Management Command Reference* online.

- MPLS-TE Automatic Bandwidth

  Cisco IOS XR Software Release 3.9.1 added support for the MPLS-TE automatic bandwidth feature
  The MPLS-TE automatic bandwidth feature measures the traffic in a tunnel and periodically adjusts
  the signaled bandwidth for the tunnel.

- Multicast VPN

  Cisco IOS XR Software Release 3.9.1 added support for the Multicast VPN feature. (For IPv4
  address family only - MVPNv6 is not supported on the Cisco ASR 9000 Series Routers in
  Cisco IOS XR Software Release 4.1.0). For more information on this feature, refer to the *Cisco ASR
  9000 Series Aggregation Services Router Multicast Command Reference* and the *Cisco ASR 9000
  Series Aggregation Services Router Multicast Configuration Guide* online.

- Policy Based Forwarding and Layer 2 Protocol Tunneling

  Cisco IOS XR Software Release 3.9.1 added support for the Policy Based Forwarding and Layer 2
  Protocol Tunneling features. Layer 2 Protocol Tunneling (L2PT) is a Cisco proprietary protocol for
  tunneling Ethernet protocol frames across Layer 2 (L2) switching domains. This includes protocol
  tunnelling of CDP, PVST+, STP, and VTP protocol frames. For more information on these two
  features, refer to the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet
  Services Configuration Guide* online.

- Multiple Spanning Tree Protocol (MSTP) over Link Aggregation Groups (LAGs)

  Cisco IOS XR Software Release 3.9.1 added support for the Multiple Spanning Tree Protocol
  (MSTP) over Link Aggregation Groups (LAGs) feature and the MSTP over MSTAG feature. For
  more information on these features, refer to the *Cisco ASR 9000 Series Aggregation Services Router
  L2VPN and Ethernet Services Configuration Guide* online.

- 8x10-Gigabit Ethernet (8 x 10 GE) Line Card Medium Queue

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router
  platform for the medium queue 8x10-Gigabit Ethernet line card (A9K-8T-B). Support for the high
  and low queue 8x10-Gigabit Ethernet line cards was introduced in Cisco IOS XR Software Release
  3.9.0.

- REP Access Gateway

  Cisco IOS XR Software Release 3.9.1 introduced support on the Cisco ASR 9000 Series Router
  platform for the REP (Resilient Ethernet Protocol) Access Gateway feature.

  The REP (Resilient Ethernet Protocol) Access Gateway provides the same functionality as
  MST-AG, (Multiple Spanning Tree Access Gateway) but where the access network is running REP
  rather than MST. All of the old syntax is extended to allow 'repag' where 'mstag' could be specified
  before:

Configuration Commands including REPAG

```
spanning-tree { mstag | repag } <protocol instance identifier>
    preempt delay { until <hh:mm:ss> |
                    for <n> { hours | minutes | seconds } }
    interface <Inteface name>
        name <name>
        revision <revision>
        max age <secs>
        provider-bridge
        bridge-id <bridge id> [ startup-value <startup bridge id> ]
        port-id <port id> [ startup-value <startup port id> ]
        external-cost <cost> [ startup-value <startup cost> ]
        hello-time <secs>
        instance <id>
            vlan-id <vlan range>[,<vlan range>][,<vlan range>][,<vlan range>]
            priority <pri> [ startup-value <startup pri> ]
            port-priority <pri> [ startup-value <startup pri> ]
            cost <cost> [ startup-value <startup cost> ]
            root-id <bridge id> [ startup-value <startup bridge id> ]
            root-priority <pri> [ startup-value <startup pri> ]
```

Show Commands

```
show spanning-tree { mstag | repag }  <proto-inst> [interface <intf>] [brief]
show spanning-tree { mstag | repag }  <proto-inst> bpdu interface <intf>
```

Debug Command

```
debug spanning-tree { mstag | repag } packet { brief | full } { sent | received }
```

Features Introduced in Cisco IOS XR Software Release 3.9.0

The following features introduced in Cisco IOS XR Software Release 3.9.0 are supported on the Cisco ASR 9000 Series Router platform:

- ANCP over IP Unnumbered Interfaces

    Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for up to 400 Access Node Control Protocol (ANCP) sessions and an associated 400 IP unnumbered interfaces.

    Note IP unnumbered interfaces on bundled Ethernet is only supported on the Cisco ASR 9000 Series Router platform.

- 100ms LACP

    Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for LACP running over bundle member interfaces at intervals down to 100 ms.

- Cisco ASR 9000 Series 8-Port Ten Gigabit Ethernet line card, 80G Line Rate

    Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for the A9K-8T line card, which provides an 80G line rate line card.

- 2x10GE + 20xGE on a Single Line Card

    Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for the A9K-2T20GE line card, which provides 2x10GE + 20xGE on a single line card.

- WAN PHY and OTN(G.709) modes

  Cisco IOS XR Software Release 3.9.0 added support for WAN PHY and OTN(G.709) modes, which provide IPoDWM on the newly-introduced A9K-8T line card and on the newly-introduced A9K-2T20G line card.

  Here is the syntax of the **transport-mode** command, used to choose WAN PHY or OTN(G.709) mode:

  ```
  [no] transport-mode {wan | otn}
  ```

  ```
  RP/0/RSP0/CPU0:ROSH10(config-if)#transport-mode  wan
  RP/0/RSP0/CPU0:ROSH10(config-if)#transport-mode  otn bit-transparent {opu1e | ouu2e}
  ```

  There are two loopback modes available under IPoDWDM:

  ```
  RP/0/RSP0/CPU0:ROSH10(config)#controller dwdm 0/2/0/0
  RP/0/RSP0/CPU0:ROSH10(config-dwdm)#loopback ?
    internal  Select internal loopback mode
    line      Select line loopback mode
  ```

  There are three types of admin states: in-service, maintenance, and out-of-service. Set the admin-state to out-of-service before provisioning any command under controller dwdm mode.

  ```
  RP/0/RSP0/CPU0:ROSH10(config)#controller dwdm 0/2/0/0
  RP/0/RSP0/CPU0:ROSH10(config-dwdm)#admin-state ?
    in-service      change the admin-state to In-service (IS)
    maintenance     change the admin-state to Out-of-service-Maintenance (OOS-MT)
    out-of-service  change the admin-state to Out-of-service (OOS)
  ```

  Here are the **show controllers** commands introduced to support the three states (**lan**, **wanphy** and **dwdm**):

  ```
  RP/0/RSP0/CPU0:ROSH10#sh controllers tenGigE 0/2/0/0 ?
    all      Show all the information
    bert     Show BERT status
    control  Show configuration and control information
    internal Show internal information
    mac      Show mac information
    phy      Show phy information
    regs     Show registers information
    stats    Show stats information
    xgxs     Show xgxs information
  ```

  ```
  RP/0/RSP0/CPU0:ROSH10#sh controllers wanphy 0/2/0/1 ?
    alarms     Show alarm information
    all        Show all information
    registers  Show register information
  ```

  ```
  RP/0/RSP0/CPU0:ROSH10#sh controllers dwdm 0/2/0/0 ?
    g709          Show G709  info
    log           Signal logging information
    optics        Show transponder info
    pm            show dwdm performance monitoring
    proactive     Proactive Protection Feature Status
    srlg          Display Network SRLGs configured at this port
    tdc           Show Tunable Dispersion info
    wavelength-map Wavelength channel number  map table
  ```

- Low Queue Line Cards

Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for the following low queue line cards:

- – A9K-40GE-L
- – A9K-8T/4-L
- – A9K-4T-L
- – A9K-8T-L

- SIP-700

Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for the SIP-700, a 20G SPA Interface Processor.

- SPA-2XCHOC12/DS0

Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for the SPA-2XCHOC12/DS0, a 2-Port Channelized OC-12/DS0 SPA (Shared Port Adapter).

- SIP-700 and SPA-2XCHOC12/DS0 Software Features

Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router with the SIP-700 and SPA-2XCHOC12/DS0 for the following software features:

- – MLPPP/LFI
- – IC-SSO
- – MR-APS
- – SONET, T1
- – Frequency Synchronization
- – IPv4 Netflow

- QoS Features

Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router with the SIP-700 and SPA-2XCHOC12/DS0 for the following QoS features:

- – Support for IPv4 payload on Serial (PPP encapsulation), MLPPP, and MCMP interfaces. Support for LFI traffic on MLPPP or MCMP bundles.
- – Support for classification based on DSCP, precedence, protocol, qos-group (egress only), discard-class (egress only), and access-lists.
- – Support for marking, policing, and priority (see Fabric QoS section) in the ingress direction.
- – Support for marking, policing, and all queueing actions (bandwidth, bandwidth-remaining, shaping, queue-limit, priority levels 1 and 2, and random-detect) in the egress direction.
- – On the SIP-700 and SPA-2XCHOC12/DS0 only a 2-parameter scheduler is supported i.e. either bandwidth or bandwidth-remaining can be used in the same policy, but not both.
- – Note that traffic shaping on an input interface is not supported on the SIP-700.
- – Two levels of hierarchy supported, with only class-default permitted in the parent policy-map.
- – Fabric QoS configured using the priority action in the ingress direction.
- – Support for re-programming the QoS policy in response to underlying link bandwidth change on multi-link interfaces. There is no support for in place QoS policy modification on the SIP-700.

- Support for the "encap-sequence" action to set the traffic class for traffic on multi-class MLPPP interfaces in the egress direction.

- The "set cos" command on the egress of a Layer 3 interface is valid and supported. The "set cos" command on the ingress of a Layer 3 interface is rejected when performed on a subinterface. The "set cos" command on the ingress of a Layer 3 interface is ignored on a main interface.

- Y.1731 Performance Monitoring - Delay & Delay Variance

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for Y.1731 PM, which initially supports 2-way scheduled delay and delay variance measurements.

- IP FRR

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for IPFRR (IP Fast ReRoute), a set of technologies used in order to rapidly converge traffic flows around link and/or node failures. Only MLPPP encapsulation channels on the OC-12 SONET interface can be protected by IP-FRR in Cisco IOS XR Software Release 4.1.0.

- L2 Multicast Limit

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for the Layer 2 Multicast Limit feature, which supports IGMP Snooping based limits for both the maximum number of allowed multicast channels per subscriber and the maximum bandwidth available for multicast per subscriber.

- Traffic Mirroring

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for Local Traffic Mirroring (EFP to EFP) and also the option of appending a VLAN tag on the destination port for transport across an Ethernet network. Traffic Mirroring copies traffic from one or more Layer 2 interfaces or sub-interfaces, including Layer 2 link bundle interfaces/sub-interfaces, and sends the copied traffic to one or more destinations for analysis by a network analyzer or other monitoring device.

  On a switch, unicast traffic from A to B is only forwarded to the B port. Therefore, the network analyzer does not see this traffic. When the Traffic Mirroring feature is enabled, the network analyzer is attached to a port that is configured to receive a copy of every packet that host A sends. This port is called a traffic mirroring port.

  Currently, the Cisco ASR 9000 Series Router only supports Local SPAN and R-SPAN.

  A maximum of 8 monitor sessions, and 800 source ports are supported.

  You can configure 800 source ports on a single monitor session or configure an aggregate total of 800 source ports on up to 8 different monitor sessions.

  The following SPAN types are not supported:

  - ER-SPAN (Encapsulated Remote Switched Port Analyzer)

    Traffic is mirrored to a remote site via a GRE tunnel.

  - Pseudowire SPAN (PW-SPAN).

    Traffic is mirrored to a remote site via an MPLS pseudowire, instead of using a standard destination interface. (Plan to be supported in 4.0.1 release.)

  - VLAN-based SPAN.

    In this case, the source for the mirrored traffic is not simply a set of interfaces, but is a full bridge-domain.

– Filter-SPAN (F-SPAN)

In this case, flow and ACL are applied in mirroring the traffic.

Cisco recommends not mirroring more 15% of total transit traffic. On TenGigE or bundle interfaces there is a limit of 1.5G on each ingress and egress traffic port to be mirrored.

SPAN Configurations:

To create a "monitor-session" in global config:

-monitor-session <name>

-   destination interface <dst_interface>

To attach a source port in local-plane config:

-interface <src-interface> l2transport

-   monitor-session <name> [direction {rx_only | tx_only]

SPAN Configuration Samples:

SPAN with Physical Interfaces (Local SPAN)

The following example shows a basic configuration for SPAN with physical interfaces. When traffic flows over the point to point cross connect between gig0/2/0/19 and gig0/2/0/11, packets received and transmitted on gig0/2/0/19 will also get mirrored to gig0/2/0/15.

```
monitor-session ms1
 destination interface gig0/2/0/15
!
interface gig0/2/0/11
 l2transport
!
interface gig0/2/0/15
 l2transport
!
interface gig0/2/0/19
 l2transport
  monitor-session ms1
!
l2vpn
 xconnect group xg1
  p2p xg1_p1
    interface gig0/2/0/11
    interface gig0/2/0/19
  !
 !
!
```

SPAN with EFPs (R-SPAN)

The following example shows a basic configuration for SPAN with EFP interfaces. When traffic flows over the point to point cross connect between gig0/2/0/19.10 and gig0/2/0/11.10, packets received and transmitted on gig0/2/0/19.10 will also get mirrored to gig0/2/0/15.10.

```
monitor-session ms1
 destination interface gig0/2/0/15.10
!
interface gig0/2/0/11.10 l2transport
 encapsulation dot1q 10
!
```

```
interface gig0/2/0/15.10 l2transport
 encapsulation dot1q 10
!
interface gig0/2/0/19.10 l2transport
 encapsulation dot1q 10
 monitor-session ms1
!
l2vpn
 xconnect group xg1
  p2p xg1_p1
   interface gig0/2/0/11.10
   interface gig0/2/0/19.10
  !
 !
!
```

Display Commands

show monitor-session [session_name] status [detail] [error]

Shows the status of different monitor sessions.

Keywords:

session_name

detail

errors

Example output:

```
RP/0/RSP0/CPU0:RTP-VIKING-L2-8#show monitor-session status
Fri Feb 20 14:56:04.233 UTC
Monitor-session cisco-rtp1
Destination interface GigabitEthernet0/5/0/38
================================================================================
Source Interface      Dir   Status
-------------------- ----  ----------------------------------------------------
Gi0/5/0/4             Both  Operational
Gi0/5/0/17            Both  Operational
```

show monitor-session [session_name] counters

Shows the statistics/counters (received/transmitted/dropped) of different source ports.

- Video Monitoring

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for the Video Monitor application, used to monitor video flows, detect quality degradation, report metrics and raise alarms.

- LAG integration with H-QOS

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for extending Hierarchical QoS (H-QoS) support to link aggregation bundles. Shared Policy Instances (SPI) allow for QoS policy shared across multiple sub-interfaces.

- EFP Based Load Balancing

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for EFP based load balancing, which provides a way to carry all the traffic of a specific EFP over a single physical member link.

- Ethernet Connectivity Fault Management (E-CFM) with Ethernet Wire Service (EWS)

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for Ethernet Connectivity Fault Management (E-CFM), a subset of EOAM that provides a number of protocols and procedures that allow discovery and verification of the path through 802.1 bridges and LANs. Note that CFM 100 ms CCMs and CFM Exploratory Linktrace were introduced on the Cisco ASR 9000 Series Router with Cisco IOS XR Software Release 3.7.2.

- BGP PIC Edge for IP/MPLS

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for BGP PIC Edge for IP/MPLS, which provides sub-second convergence for IP and MPLS-VPN.

- MPLS TE Path Protection

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for MPLS TE path protection, which provides a backup tunnel between the MPLS/TE head-end and the tail router and added to Cisco's MPLS/TE suite of bandwidth protection features, which also include node protection and link protection.

- Image Refresh using Compact Flash

  Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Router for performing an image refresh using compact flash.

Features Introduced in Cisco IOS XR Software Release 3.7.3

The following features introduced in Cisco IOS XR Software Release 3.7.3 are supported on the Cisco ASR 9000 Series Router platform:

- MSTAG Enhancements

  Cisco IOS XR Software Release 3.7.3 added support on the Cisco ASR 9000 Series Router for multiple spanning tree access gateway (MSTAG) topology control.

- MSTP Enhancements

  Cisco IOS XR Software Release 3.7.3 added support on the Cisco ASR 9000 Series Router for the following features added to MSTP:

  - PortFast—allows a port to be marked as an edge port that does not participate in the spanning tree.
  - BPDUGuard—protects PortFast ports from misconfigurations by error-disabling them if they receive a BPDU.
  - UplinkFast—allows a RootPort to transition straight to forwarding, if there are no other active RootPorts on the box.
  - BackboneFast—allows for accelerated recovery from indirect link failures.
  - RootGuard—prevents a port from becoming the RootPort.
  - MSTAG support on physical and bundle Ethernet interfaces.

- EFP Egress Filtering on the Cisco ASR 9000 Series Router

  Cisco IOS XR Software Release 3.7.3 introduced EFP Egress Filtering on the Cisco ASR 9000 Series Router.

  For more information on configuring the EFP Egress Filtering feature including the associated EFP Egress Filtering commands on the Cisco ASR 9000 Series router, refer to the *Egress EFP Filtering on the Cisco ASR 9000 Series Router* feature module.

- Flood Optimization

  In prior releases the Cisco ASR 9000 Series Router acting as a bridge flooded broadcast and unknown unicast traffic to all the forwarding engines on all the line cards.

  In Cisco IOS XR Software Release 3.7.2 if a pseudo wire is configured in a bridge domain all broadcast and unknown unicast traffic is flooded to all line cards in the system in order to attain fast convergence. With Cisco IOS XR Software Release 3.7.3 the flood optimization feature changes this default behavior. FGID will get programmed based on the primary paths on which the pseudo wire is going out and traffic will get flooded only to the line cards on which the pseudo wire resides. This mode is called Bandwidth Optimization mode.

  But if a Fast ReRoute event occurs when fast convergence is set up it will take a longer time to complete the reroute as more hardware programming such as adding bridge ports etc. needs to be done. So for customers who are sensitive to this increased delay a command called **flood mode convergence-optimized** is provided in Cisco IOS XR Software Release 3.7.3. Use this **flood mode convergence-optimized** command to switch back to the convergence optimized mode where traffic gets flooded to all the line cards.

  With this **flood mode convergence-optimized** command users are able to turn on/off the bandwidth optimized mode.

  For more information on the flooding disable command and other Layer 2 VPLS commands on the Cisco ASR 9000 Series router, refer to the Point to Point Layer 2 Services Commands section in the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Command Reference* here:

  http://www.cisco.com/en/US/partner/docs/routers/asr9000/software/asr9k_r4.0/lxvpn/command/reference/lesr40lp2p.html

- ECMP (Equal Cost Multipath Protocol) Link Bundle hashing for PWs (pseudo wires) on Layer 3 NNI (Network to Network Interface) is now based on Virtual Connection labels

  In Cisco IOS XR software Release 3.7.3 as part of pseudo wire flood optimization, the Layer 3 interface list for a pseudo wire is now based on Virtual Connection labels. By using ECMP Link Bundle hashing, the Layer 3 interface list for a pseudo wire can be condensed to a single Layer 3 interface. This Layer 3 interface (slot and network protocol flood mask) is derived from the ordered array of Layer 3 interface list (masks).

- Early Fast Discard command

  Cisco IOS XR software Release 3.7.3 added support for the Early Fast Discard command. This command was added to process all high priority packets

  Command syntax:

```
(config)# hw-module location <loc> early-fast-discard
    (config-early-fast-discard)# mode [outer-encap-only | include-inner-encap]
    (config-early-fast-discard)# vlan-cos <0-8> vlan-op [lt | ge]
    The defaults are 6 and ge (greater than or equal to)
    (config-early-fast-discard)# ip-prec <0-8> ip-op [lt | ge]
    The defaults are 6 and ge (greater than or equal to)
    (config-early-fast-discard)# mpls-exp <0-8> mpls-op [lt | ge]
    The defaults are 6 and ge (greater than or equal to)
```

```
(config)# no hw-module location <loc> early-fast-discard
```

- Power Management multiple override mechanism

  Cisco IOS XR software Release 3.7.3 added support for the user to override the Power Management feature in order to configure extra line cards without full power supply redundancy.

  This feature allows a card to be forced to power up, regardless of an unprogrammed EEPROM power draw value. As with the ROMMON variable, this feature is intended for temporary use. After the cookie value has been programmed, remove this configuration by repeating the CLI command with the "no" option.

  Command example:

```
RP/0/RSP0/CPU0:ios(admin-config)# hw-mod power override location <loc>
```

- The IGMP Snooping feature no longer removes the state after a port goes down

  Starting with Cisco IOS XR software Release 3.7.3, mrouter and membership states on the Cisco ASR 9000 Series Router no longer need to be relearned after a port goes down. Once a port goes down, the IGMP Snooping feature immediately removes all group membership states from that port. Once an mrouter port goes down, the IGMP Snooping feature removes the port from the list of mrouter ports and removes that port from the flood set of all multicast routes.

  New CLI:

```
tcn_relearning [cisco | rfc4541 | none]
```

  For more information on the IGMP Snooping feature on the Cisco ASR 9000 Series router, refer to the Implementing Layer 2 Multicast using IGMP Snooping on Cisco ASR 9000 Series Routers section in the Cisco ASR 9000 Series Aggregation Services Router Multicast Configuration Guide here:

  http://www.cisco.com/en/US/docs/routers/asr9000/software/multicast/configuration/guide/mcasr9 kigsn.html

- The VRRP & FRR failover time is no longer greater than 1 sec after a hardware module reload

  Cisco IOS XR software Release 3.7.3 improves the Cisco ASR 9000 Series Router VRRP & FRR failover time after a hardware module reload to less than or equal to one second.

- The VPLS preferred path fallback enable option is now supported on the Cisco ASR 9000 Series Router

  Layer 2 VPNs can provide pseudo wire resiliency through their routing protocols. When the connectivity between end-to-end PE routers fails, an alternative path to the directed LDP session and the user data takes over. With Cisco IOS XR software Release 3.7.3, the user can fall-back to the preferred path once it has been restored.

- 32k EFPs/HQOS/ANCP/ACL/IGMP EFP up time > 30 minutes. This enhancement provides a five minute improvement over Cisco IOS XR software Release 3.7.2.

- The **show environment power-supply** command has been updated:

```
RP/0/RSP0/CPU0:Green_RO(admin)#show environment power-supply
Thu Jul 23 17:01:08.829 pst
R/S/I   Modules Sensor        Watts       Status

0/PM0/*
        host    PM            3000        Ok

0/PM1/*
        host    PM            3000        Ok
```

```
0/PM4/*
        host    PM              3000            Ok

0/PM5/*
        host    PM              3000            Ok


Power Shelves Type: AC

Total Power Capacity:                        12000W
Usable Power Capacity:                       9000W
Supply Failure Protected Capacity:           9000W
Feed Failure Protected Capacity:             6000W
Worst Case Power Used:                       3010W

 Slot                                          Max Watts
 ----                                          ---------
 0/0/CPU0                                            375
 0/1/CPU0                                            395
 0/RSP0/CPU0                                         250
 0/RSP1/CPU0                                         250
 0/4/CPU0                                            375
 0/6/CPU0                                            375
 0/FT0/SP                                            495  (default)
 0/FT1/SP                                            495  (default)


Worst Case Power Available:          5990W
Supply Protected Capacity Available: 5990W
Feed Protected Capacity Available:   2990W
```

Features Introduced in Cisco IOS XR Software Release 3.7.2

The following features in Cisco IOS XR Software Release 3.7.2 are supported on the Cisco ASR 9000 Series Router platform:

- CFM 100ms CCMs

- CFM Exploratory Linktrace

- IPv6 Filtering

- IPv6 Routing

- IPv6 Forwarding

- IPv6 ACL

- ECMP

- ICMP

- HSRP-VRRP L3VPN support

- QoS Shared Policy Instance

- ANCP-triggered interface bandwidth modification

- Tri-rate SFP copper port bandwidth modification

- IPv6 Classification

- Tri-rate copper SFP

- ANCP Termination

- IPv4 VRF on main and sub-interfaces

- CSC, Inter-AS L3VPN

- CE-PE Link and FRR Protection for VPNv4 traffic on MPLS core

- IGMP Snooping v2 and v3

- Multicast Redirect UNI

- PIM to SSM Mapping

- IGMP VRF override

- IPv6 OSPF, RIP, BGP

- Multi-segment dynamic and static VPWS pseudo wires

- Split Horizon Group for ACs

- BGP Auto-discovery and signaling for VPLS and VPWS

- Broadcast Storm Control

Important Notes

For Cisco IOS XR Software Release ,4.1.0 the Cisco ASR 9000 Series Router does not support the following inventory schemas:

  - `vkg_invmgr_adminoper.xsd`

  - `vkg_invmgr_common.xsd`

  - `vkg_invmgr_oper.xsd`

- Only MLPPP encapsulation channels on the OC-12 SONET interface can be protected by IP-FRR in Cisco IOS XR software Release 3.9.0 and above.

- For Cisco IOS XR software Release 3.9.0 and above the SIP 700 with the 2-Port Channelized OC-12/DS0 SPA does not support SDH (including all the mappings under SDH) or DS0 mappings.

- For Cisco IOS XR software Release 3.9.0 and above the SIP 700 with the 2-Port Channelized OC-12/DS0 SPA does not support ATM or POS.

- For Cisco IOS XR software Release 3.9.0 and above the SIP 700 with the 2-Port Channelized OC-12/DS0 SPA does not support MPLS/Traffic Engineering FRR.

- For Cisco IOS XR software Release 4.0.1 and above the SIP 700 with the 1-Port Channelized OC48/STM16 DS3 SPA does not support MPLS/Traffic Engineering FRR.

- For Cisco IOS XR software Release 4.0.1 and above the SIP 700 with the 1-Port Channelized OC48/STM16 DS3 SPA, the 2-Port Channelized OC-12/DS0 SPA , the 8-Port OC12/STM4 SPA , and the 2-Port OC-48/STM16 SPA Layer 2VPN support only includes FR.

- **Country-specific laws, regulations, and licenses—**In certain countries, use of these products may be prohibited and subject to laws, regulations, or licenses, including requirements applicable to the use of the products under telecommunications and other laws and regulations; customers must comply with all such applicable laws in the countries in which they intend to use the products.

- **Card, fan controller, and RSP removal—**For all card removal and replacement (including fabric cards, line cards, fan controller, and RSP) follow the instructions provided by Cisco to avoid impact to traffic. See the *Cisco ASR 9000 Series Router Getting Started Guide* for procedures.

- **Exceeding Cisco testing—**If you intend to test beyond the combined maximum configuration tested and published by Cisco, contact your Cisco Technical Support representative to discuss how to engineer a large-scale configuration maximum for your purpose.

- **Installing a Line Card**—For a fully populated 40-port high density Line Card with cable optics, maintenance time required for card replacement is higher. For more information about Line Card installation and removal, refer to the *Cisco ASR 9000 Aggregation Services Router Ethernet Line Card Installation Guide*.

- **Serial Interfaces Out of Order in "show ip interface brief" Command** —The show ip interface brief command might display interfaces out of order if different types of serialization are used on the SPA cards.

  The serial interfaces are displayed in the show ip interface brief command output in the order shown in the example below:

  The ordering is based on:

  1. Slot
  2. SPA
  3. Type
  a. T3
  b. T3/T1
  c. vt15-T1
  d. multilink

  This may be confusing (the interfaces appear out of order) for the user who is accustomed to IOS.

  Example output:

  With multiple cards:

```
Serial0/2/0/1/1/1:0  (t3/t1)
Serial0/2/0/1/2/1:0
Serial0/2/0/1/3/1:0
Serial0/2/0/1/4/1:0
Serial0/2/0/1/5/1:0
Serial0/2/0/1/6/1:0
Serial0/2/0/1/7/1:0
Serial0/2/0/1/8/1:0
Serial0/2/0/1/9/1:0
Serial0/2/0/1/10/1:0
Serial0/2/0/1/11/1:0
Serial0/2/0/1/12/1:0

Serial0/2/0/0/1/1/1:0  (vt15)
Serial0/2/0/0/2/1/1:0
Serial0/2/0/0/3/1/1:0
Serial0/2/0/0/4/1/1:0
Serial0/2/0/0/5/1/1:0
Serial0/2/0/0/6/1/1:0
Serial0/2/0/0/7/1/1:0
Serial0/2/0/0/8/1/1:0
Serial0/2/0/0/9/1/1:0
Serial0/2/0/0/10/1/1:0
Serial0/2/0/0/11/1/1:0
Serial0/2/0/0/12/1/1:0
```

```
Multilink 0/2/0/0/1

Serial0/2/1/0/1  (t3)

Serial0/2/1/1/1/1:0  (t3/t1)
Serial0/2/1/1/2/1:0
Serial0/2/1/1/3/1:0
Serial0/2/1/1/4/1:0
Serial0/2/1/1/5/1:0
Serial0/2/1/1/6/1:0
Serial0/2/1/1/7/1:0
Serial0/2/1/1/8/1:0
Serial0/2/1/1/9/1:0
Serial0/2/1/1/10/1:0
Serial0/2/1/1/11/1:0
Serial0/2/1/1/12/1:0


Serial0/6/0/1/1/1:0
Serial0/6/0/1/2/1:0
Serial0/6/0/1/3/1:0
Serial0/6/0/1/4/1:0
Serial0/6/0/1/5/1:0
Serial0/6/0/1/6/1:0
Serial0/6/0/1/7/1:0
Serial0/6/0/1/8/1:0
Serial0/6/0/1/9/1:0
Serial0/6/0/1/10/1:0
Serial0/6/0/1/11/1:0
Serial0/6/0/1/12/1:0

Serial0/6/0/0/1/1/1:0
Serial0/6/0/0/2/1/1:0
Serial0/6/0/0/3/1/1:0
Serial0/6/0/0/4/1/1:0
Serial0/6/0/0/5/1/1:0
Serial0/6/0/0/6/1/1:0
Serial0/6/0/0/7/1/1:0
Serial0/6/0/0/8/1/1:0
Serial0/6/0/0/9/1/1:0
Serial0/6/0/0/10/1/1:0
Serial0/6/0/0/11/1/1:0
Serial0/6/0/0/12/1/1:0

Multilink 0/6/0/0/1

Serial0/6/1/0/1

Serial0/6/1/1/1/1:0
Serial0/6/1/1/2/1:0
Serial0/6/1/1/3/1:0
Serial0/6/1/1/4/1:0
Serial0/6/1/1/5/1:0
Serial0/6/1/1/6/1:0
Serial0/6/1/1/7/1:0
Serial0/6/1/1/8/1:0
Serial0/6/1/1/9/1:0
Serial0/6/1/1/10/1:0
Serial0/6/1/1/11/1:0
Serial0/6/1/1/12/1:0
```

- Starting with Cisco IOS XR Software Release 3.9 the **pw-class class name encapsulation mpls** command **control-word** option default is now **disable** -In Cisco IOS XR Software Release 3.9 and above the control word is disabled by default. To configure the control word, enter the control-word keyword shown in the following example:

  ```
  pw-class class1 encapsulation mpls control-word
  ```

- For configured policer rates of less than 1 Mbps, the actual policer rate can be approximately 10 percent less than the configured rate. For example, for a configured policer rate of 500 kbps, the actual policer rate is 448 kbps due to a granularity round down in hardware.

- In Cisco ASR 9000 Series Router Software Release 4.0.0, the minimum configurable logging buffered size has been increased to 307200. Any configuration with a value less than 307200 fails to upgrade to Release 4.0.1.

  – Run the **show configuration failed startup** command on startup to display the failed configuration.

  – Workaround: Prior to upgrading to Release 4.0.1, set the logging buffer size to a value of 307200 or greater (**logging buffered 307200)**.

- **dsu mode Command Default**—For E3 interfaces on the 4-Port Clear Channel T3/E3 SPA that interoperate with E3 interfaces on a Cisco 10000 Series router, the default data service unit (DSU) mode is digital-link. To change the DSU mode to cisco, configure scrambling.

- For Cisco IOS XR software Release 4.0.0 and above the **hw-module location <LOC> reload warm** command has been disabled. This means that the warm reload feature has been disabled.

- In Cisco ASR 9000 Series Router Software Release 4.1.0, you use the **cablelength short** command to set a cable length of 655 feet or shorter for a DS1 link on a 4-Port Channelized T1/E1 SPA. The **cablelength short** command options are listed as follows:

  ```
  RP/0/RSP0/CPU0:vkg_ro1_a(config-t1)#cablelength short ?
    133ft  0-133ft
    266ft  134-266ft
    399ft  267-399ft
    533ft  400-533ft
    655ft  534-655ft
  ```

  However, when using the **cablelength short** command on a 4-Port Channelized T1/E1 SPA in Cisco ASR 9000 Series Router Software Release 4.1.0, only the 133ft option (for cable lengths from 0 to 133 feet) works. The other values that are greater than 133 feet (266, 399, 533, or 655) all cause the T1 controller to go down. The workaround is to restart the controller after you set the cable length to 266, 399, 533, or 655 feet. The **cablelength long** command works correctly.

Caveats

Caveats describe unexpected behavior in Cisco IOS XR software releases. Severity-1 caveats are the most serious caveats; severity-2 caveats are less serious.

This section lists the caveats for Cisco ASR 9000 Series Router Software Release 4.1 and the Cisco ASR 9000 Series platform.

Open Cisco IOS XR Software Release 4.1 Caveats

The following open caveats apply to Cisco IOS XR Software Release and are not platform specific:

- **CSCtn02761**

Basic Description:

IPv6 svd role shown as "Standard" even without any ip config on ints.

Symptom:

This occurs when there is an incorrect role calculation for IPv6 AFI. A typical occurrence would be enabling IPv6 ACL on the interface which is being used only for IPv4 forwarding. This causes SVD infra to assume that IPv6 forwarding is also intended on the interface and the SVD card role would change to Core/Customer/Standard based on the usual role calculation rules. Incorrect role calculation could cause more VRFs/prefixes to be downloaded on the card as an impact. There should not be any forwarding impact due to this caveat.

Conditions:

IPv6 Features (for example, IPv6 ACL, IPv6 MTU, and so forth) are enabled on the interface without assigning it an IPv6 address (Global or LinkLocal) via ipv6 address or ipv6 enable command.

```
RP/0/5/CPU0:ios#show running-config interface GigabitEthernet0/1/2/3
interface GigabitEthernet0/1/2/3
 :
 ipv6 access-group test ingress
 ipv6 bgp policy accounting input source-accounting destination-accounting
 ipv6 mtu 1300
 ipv6 verify unicast source reachable-via rx
 :

RP/0/5/CPU0:ios#show im database interface GigabitEthernet 0/0/0/0

View: OWN - Owner, L3P - Local 3rd Party, G3P - Global 3rd Party,
      LDP - Local Data Plane, GDP - Global Data Plane, RED - Redundancy

Node 0/0/CPU0 (0x821)

Interface GigabitEthernet0/1/2/3, ifh 0x04000080 (down, 1514)
  Interface flags:         0x000000000010059f (IFCONNECTOR|IFINDEX
                           |SUP_NAMED_SUB|BROADCAST|CONFIG|HW|VIS|DATA
                           |CONTROL)
  Encapsulation:           ether
  Interface type:          IFT_GETHERNET
  Control parent:          None
  Data parent:             None
  Views:                   GDP|LDP|L3P|OWN

  Protocol       Caps (state, mtu)
  --------       ----------------
  None           ether (down, 1514)
  arp            arp (down, 1500)
  ipv4           ipv4 (down, 1500)
  mpls           mpls (down, 1500)
  ipv6           ipv6_preswitch (down, 1500)
  ipv6           ipv6 (down, 1300)
  ether_sock     ether_sock (down, 1500)
```

Workaround:

None.

Recovery:

Remove the IPv6 features from the interfaces which are not being used for IPv6 forwarding. If an interface on which IPv6 features were enabled and then VRF was configured on the interface, the process restart rsi_agent on the node where the interface is hosted is also required.

For the interfaces not being used for IPv6:

```
RP/0/5/CPU0:ios(config)#interface GigabitEthernet 0/1/2/3
RP/0/5/CPU0:ios(config-if)#no ipv6 access-group test egress
RP/0/5/CPU0:ios(config-if)#no ipv6 mtu
::
RP/0/5/CPU0:ios#process restart rsi_agent location 0/0/CPU0
```

- **CSCtn83882**

  Basic Description:

  4-10GE-ITU/C and 16OC48-POS/DPT have hierarchy issue in entity mib.

  Symptom:

  In the ENTITY-MIBs entPhysicalTable, some of the 'portslot' entities for a PLIM only show up when polled via community-strings or usernames with the SystemOwner configuration attribute.

  - entPhysicalName of the format "portslot 0/0/CPU0/3"

  - entPhysicalDescr = "PLIM Optics Port Slot"

  - entPhysicalClass = 'container'

  Conditions:

  This issue occurs when the PLIM with entPhysicalName equals "Cisco CRS-1 4 port 10GE (C-band) DWDM PLIM" entPhysicalVendorType = "cevModuleCrs14x10GeCDwdmPlim"

  Workaround:

  Poll with community-strings or usernames with the SystemOwner configuration.

  An alternative workaround is to restart the mibd_entity process prior to initial entPhysicalTable discovery after reload

  Recovery:

  Restart the mibd_entity process.

- **CSCto11030**

  Basic Description:

  Ping process crashed with parallel pings.

  Symptom:

  Ping process crashes.

  Conditions:

  This issue is seen when parallel pings are performed on multiple vty sessions.

  Workaround:

  None.

  Recovery:

  None.

- **CSCto72677**

  Basic Description:

PE not sending route-refresh request after reconfiguring VRF.

Symptom:

PE is not sending route-refresh request to RR on reconfiguring VRF. This is visible in the **show bgp neighbor** CLI output where the sent counter for refresh requests does not increment on VRF RT config changes.

As a result, the updated VRF config is not in effect.

Conditions:

This issue occurs after configuring and unconfiguring RT SAFI between PE and RR, with the RR side still having the RT SAFI configured for the PE neighbor. When a new vrf is configured on PE, the PE is not sending route-refresh request to the RR.

Workaround:

The workaround is to remove the RT SAFI config under the RR for the PE nbr.

Recovery

To recover, you can manually issue router fresh via clear bgp vpnv4 unicast soft in.

- **CSCto72695**

  Basic Description:

  RR sending full vpn table to PE though no route-refresh from PE.

  Symptom:

  RR sends a full vpn table although RT Constraint is configured between RR and PE.

  On the RR, the "show bgp neighbor" counters for advertised prefixes increment correspondingly to reflect a large number of prefixes advertised to PE.

  Conditions:

  This issue occurs when a VRF on the PE is unconfigured and reconfigured within a short interval.

  Workaround:

  Have a interval of approximately one minute before reconfiguring a VRF after unconfiguring it.

  Recovery:

  No recovery is necessary if the workaround is used.

- **CSCto91788**

  Basic Description:

  P2MP perm traffic loss on the tail doing 'clear pim topology.'

  Symptom:

  This issue occurs with permanent P2MP multicast traffic loss.

  Conditions:

  This condition occurs when doing a 'clear pim topology' on the tail node.

  Workaround:

  Restart the PIM process (process restart) instead of doing "clear pim topology".

  Alternatively, remove the IGMP/PIM Join on the decap and rejoin.

Recovery:

Restart the PIM process (process restart).

or

Remove/add multicast-routing config related to P2MP.

or

Remove S,G IGMP/PIM. Join on decap, and rejoin the S,G.

- **CSCto96827**

  Basic Description:

  Harmless sysdb_mc timeout messages periodically pops up in the console

  Symptom:

  Harmless sysdb_mc timeout messages periodically pops up in the console, for example:

  ```
  RP/0/RSP1/CPU0:Apr 27 00:41:58.486 : sysdb_mc[380]: %SYSDB-SMC-7-TIMEOUT :
  Message #0x2004bd2e state:0x13fe5326, gid(1011),destined for shared plane,
  timed out having received 0 of 1 expected responses: returning error to client
  Unknown. Check for potential transport issues within the system, or deadlocked
  SysDB processes.
  ```

  Conditions:

  This issue occurs with an RSP switchover.

  Workaround:

  None. However, these messages are level-7 messages and are not functionally impacting.

  Recovery:

  Issue a RSP switchover.

- **CSCto99989**

  Basic Description:

  SNMP bulk config, or load from saved config, or rollback shows error.

  Symptom:

  SNMP bulk configuration, or load from saved configuration, or rollback (which include multiple SNMP commands) can cause following messages to print on console.

  ```
  RP/0/RSP0/CPU0:Apr 27 19:26:59.446 : snmpd[1112]: %SNMP-SNMP-4-VIEWOID_NOT_FOUND : The
  command "snmp view li-view ifMIB included" could not be applied at this time because
  the oid "ifMIB" does not belong to a known MIB module.
  RP/0/RSP0/CPU0:Apr 27 19:26:59.481 : snmpd[1112]: %SNMP-SNMP-4-VIEWOID_NOT_FOUND : The
  command "snmp view li-view ciscoTap2MIB included" could not be applied at this time
  because the oid "ciscoTap2MIB" does not belong to a known MIB module.
  RP/0/RSP0/CPU0:Apr 27 19:26:59.495 : snmpd[1112]: %SNMP-SNMP-4-VIEWOID_NOT_FOUND : The
  command "snmp view li-view ciscoIpTapMIB included" could not be applied at this time
  because the oid "ciscoIpTapMIB" does not belong to a known MIB module.
  ```

  Conditions:

  SNMP bulk configuration, or load from saved configuration, or rollback (which include multiple SNMP commands) can cause the error messages.

This behavior is observed since the MIB is not loaded and the OID translation is not in place. After few seconds, this gets resolved, and you can query the MIB successfully.

Workaround:

None. When this behavior is observed during SNMP configuration for lawful intercept, it still allows adding taps. Lawful intercept functionality does not impact in any manner.

Recovery:

None. These are harmless messages and do not impact any functionality.

- **CSCto21373**

  Basic Description:

  mibd_interfaces crash while polling cIpMRouteNextHopTable.

  Symptom:

  In Cisco IOS-XR a crash of process mibd_interface might be observed when the mroute mib is polled.

  Conditions:

  Multicast is configured. The OID cIpMRouteNextHopTable of mroute mib is polled.

  Workaround:

  Not available.

  Recovery:

  The process is restarted automatically.

- **CSCti50227**

  Basic Description:

  Not able to modify RPL and delete prefix-set in a single commit.

  Symptom:

  When a policy that is attached directly or indirectly to an attach point needs to be modified, a single commit operation cannot be performed when:

  - Removing a set or policy referred by another policy that is attached to any attach point directly or indirectly.
  - Modifying the policy to remove the reference to the same set or policy that is getting removed.

  Workaround:

  The commit must be performed in two steps:

  1. Modify the policy to remove the reference to the policy or set and then commit.
  2. Remove the policy or set and commit.

Caveats Specific to the Cisco ASR 9000 Series Router

The following caveats are specific to the Cisco ASR 9000 Series platform:

- **CSCto06504**

  Basic Description:

Proc restart ospfv3 with scale causes a neighbor flap: Dead timer expired.

Symptom:

This issue occurs when PE-CE OSPFv3 neighbor-ship flaps following to ospfv3 process restart.

Conditions:

This occurs with 250 Subinterfaces on POS48 with Dual stack vrf. IPv4 has eBGP and IPv6 has OSPFv3.

Workaround:

Extend the default dead timer from 40 sec to 60 sec.

Recovery:

This recovers on its own with one flap on few interfaces among the 250.

- **CSCto15005**

  Basic Description:

  L3 span in both directions causes traffic drops for VPLS and VPWS traffic.

  Symptom:

  On the VPLS core interface if you have both ingress and egress span enabled, you could have some packets dropped.

  Conditions:

  L3 SPAN on both the ingress and egress direction of the core interface has to be configured.

  Workaround:

  Have L3 SPAN configuration on the core interface in one direction only.

  Recovery:

  Remove L3 SPAN configuration from the core interface in one direction.

- **CSCto94570**

  Basic Description:

  mibd_interface crash on mib walk with lldp feature enabled.

  Symptom:

  mibd_interface process crashes on mib walk.

  Conditions:

  When doing a mib walk, mibd_interface process could crash.

  Workaround:

  None.

  Recovery:

  Self recovery. Process comes back up fine.

- **CSCto95435**

  Basic Description:

IGMP joins not being forwarded on the PW over ASR 9000 Ethernet Line Cards and ASR9K-SIP-700.

Symptom:

IGMP host reports do not propagate through the network as expected.

Conditions:

This behavior is observed when IGMP snooping is enabled in the L2VPN bridge domain with flow based load balancing configured using IP parameters.

When the mrouter port is a pseudo-wire, it is possible for the host reports to be dropped due to inaccurate flood optimization.

Workaround:

If the problem is seen, the only viable solution is to use static groups instead of dynamic ones.

Recovery:

None.

Example:

(Host) ------- RTR1 ====== PW ====== RTR2--------- (Querier)

In the above example, it is possible that the reports sent by the host are not propagated to RTR2 from RTR1.

- **CSCto95462**

  Basic Description:

  MTU is not inherited from the PPP bundle on 8XCHT1E1 SPA.

  Symptom:

  On a multilink PPP bundle, packets larger than 1500 bytes are dropped by the 8XCHT1E1 SPA. Packets less than or equal to 1500 are not dropped.

  Conditions:

  This issue occurs when configuring a bundle with MTU more than 1500 bytes. The problem is that member serial interfaces are not inheriting the bundle MTU size.

  Workaround:

  There is no workaround. However, as long as the bundle MTU is configured with a value less than or equal to 1500, the feature works.

  Recovery:

  None.

- **CSCto96804**

  Basic Description:

  Ethernet CFM over bundle - Domain d2 Ping and traceroute test fails.

  Symptom:

  CFM frames injected or forwarded to bundle interfaces or sub interfaces (with L2 transport configuration) get dropped in the forwarding engine due to an invalid cross connect ID or zero cross connect ID.

Conditions:

This affects all CFM/Y.1731 functionality for MEPs/MIPs on bundle interfaces or subinterfaces with L2 transport configured.

Workaround:

None.

Recovery:

Disable and re-enable CFM configuration related to the affected interface. This disables and enables CFM service for MIPs.

- **CSCto99989**

  Basic Description:

  SNMP bulk config, or load from saved config, or rollback will show error.

  Symptom:

  SNMP bulk configuration, or load from saved configuration, or rollback (which include multiple SNMP commands) can cause the following messages to print on the console:

  ```
  RP/0/RSP0/CPU0:Apr 27 19:26:59.446 : snmpd[1112]: %SNMP-SNMP-4-VIEWOID_NOT_FOUND : The
  command "snmp view li-view ifMIB included" could not be applied at this time because
  the oid "ifMIB" does not belong to a known MIB module.
  RP/0/RSP0/CPU0:Apr 27 19:26:59.481 : snmpd[1112]: %SNMP-SNMP-4-VIEWOID_NOT_FOUND : The
  command "snmp view li-view ciscoTap2MIB included" could not be applied at this time
  because the oid "ciscoTap2MIB" does not belong to a known MIB module.
  RP/0/RSP0/CPU0:Apr 27 19:26:59.495 : snmpd[1112]: %SNMP-SNMP-4-VIEWOID_NOT_FOUND : The
  command "snmp view li-view ciscoIpTapMIB included" could not be applied at this time
  because the oid "ciscoIpTapMIB" does not belong to a known MIB module.
  ```

  Conditions:

  SNMP bulk configuration, or load from saved configuration, or rollback (which include multiple SNMP commands) can cause the error messages.

  This behavior is observed since the MIB is not loaded and the OID translation is not in place. After few seconds, this gets resolved, and you can query the MIB successfully.

  Workaround:

  None. When this behavior is observed during the SNMP configuration for lawful intercept, it still allows adding taps, and lawful intercept functionality is not impacted.

  Recovery:

  None. These are harmless messages that do not impact any functionality.

- **CSCtq07754**

  Basic Description:

  Missing Src XID for punted IGMP pkts leads queries to wrong BD.

  Symptom:

  IGMP queries are going to the wrong BD.

  Conditions:

  There are multiple bridge domains and pseudo-wires on ASR9K-SIP-700 LC interfaces, and IGMP snooping is enabled.

Workaround:

None.

Recovery:

None.

- **CSCtr26695**

    Basic Description:

    ASR9K: Line Card Issue with NP lockup.

    Symptom:

    NP lockup may result on an automatic LC reload with an error of
    PLATFORM-DIAGS-3-PUNT_FABRIC_DATA_PATH_FAILED.

    Conditions:

    This behavior has been seen when running Cisco IOS XR Software Release 4.1.0 and processing
    an IPv4 packet which triggers a DMA operation.

    Workaround:

    None available.

Upgrading Cisco IOS XR Software

Cisco IOS XR software is installed and activated from modular packages, allowing specific features or
software patches to be installed, upgraded, or downgraded without affecting unrelated processes.
Software packages can be upgraded or downgraded on all supported card types, or on a single card
(node).

Software packages are installed from package installation envelope (PIE) files that contain one or more
software components. Refer to Table 1 for a list of the Cisco ASR 9000 Series Router software feature
set matrix (PIE files) and associated filenames available for the Cisco IOS XR Software Release 4.1.0
supported on the Cisco ASR 9000 Series Router.

The following URL contains links to information about how to upgrade Cisco IOS XR software:

http://www.cisco.com/web/Cisco_IOS_XR_Software/index.html

Troubleshooting

For information on troubleshooting Cisco IOS XR software, see the
Cisco ASR 9000 Series Aggregation Services Routers Getting Started Guide and the *Cisco ASR 9000
Series Router Troubleshooting Feature Module*.

Resolving Upgrade File Issues

✎

Note In some very rare cases inconsistencies in the content of the internal configuration files can appear. In such situations, to avoid configuration loss during upgrade, the following steps can be optionally done before activating packages:

a. Clear the NVGEN cache:

```
RP/0/RSP0/CPU0:PE44_ASR-9010# run nvgen -F 1
```

b. Create a dummy config commit:

```
RP/0/RSP0/CPU0:PE44_ASR-9010# config
RP/0/RSP0/CPU0:PE44_ASR-9010(config)# hostname <hostname>
RP/0/RSP0/CPU0:PE44_ASR-9010(config)# commit
RP/0/RSP0/CPU0:PE44_ASR-9010(config)# end
```

c. Force a commit update by using the **reload** command. Press "**n**" when the confirmation prompt appears:

```
RP/0/RSP0/CPU0:PE44_ASR-9010# reload
Updating Commit Database. Please wait...[OK]
Proceed with reload? [confirm]
```

d. Press "**n**".

In some cases other activity may preclude a reload. The following message may display:

```
RP/0/RSP0/CPU0:PE44_ASR-9010# reload
Preparing system for backup. This may take a few minutes ............System
configuration backup in progress [Retry later]
```

If you receive this message wait and then retry the command after some time.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see *What's New in Cisco Product Documentation* at: http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html.

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