Release Notes for Cisco ASR 9000 Series Aggregation Services Routers for Cisco IOS XR Software Release 4.2

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Cisco ASR 9000 Series Aggregation Services Router Software Release 4.2

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Note   For information on Cisco ASR 9000 Series Aggregation Services Router running Cisco IOS XR Software Release 4.2, see the "Features Supported on the Cisco ASR 9000 Series Aggregation Services Router" section on page 31.

These release notes describe the features provided on the Cisco ASR 9000 Series Aggregation Services Router running Cisco IOS XR Software Release 4.2 and are updated as needed.

For a list of software caveats that apply to the Cisco ASR 9000 Series Aggregation Services Router running Cisco IOS XR Software Release 4.2, see the "Caveats" section on page 73. 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 Aggregation Services Router provides the following features and benefits:

- **IP and Routing**—This 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 4.2 running on the Cisco ASR 9000 Series Aggregation Services 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**—This 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 without MPLS. This fast convergence innovation is unique to Cisco IOS XR Software.

- **Multiprotocol Label Switching (MPLS)**—This 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**—This provides comprehensive IP Multicast software including Source Specific Multicast (SSM) and Protocol Independent Multicast (PIM) in Sparse Mode only. The Cisco ASR 9000 Series Aggregation Services 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)**—This 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 Aggregation Services 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**—This 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**—This 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**—This 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 Aggregation Services 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 43 in this document.

System Requirements

This section describes the system requirements for Cisco ASR 9000 Series Aggregation Services Router Software Release 4.2. The system requirements include the following information:

Feature Set Table

The Cisco ASR 9000 Series Aggregation Services Router Software is packaged in *feature sets* (also called *software images*). Each feature set contains a specific set of Cisco ASR 9000 Series Aggregation Services Router Software Release 4.2 features.

Table 1 lists the Cisco ASR 9000 Series Aggregation Services Router Software feature set matrix (PIE files) and associated filenames available for the Release 4.2 supported on the Cisco ASR 9000 Series Aggregation Services Router.

Table 1   Cisco ASR 9000 Series Aggregation Services Router Supported Feature Sets (Cisco IOS XR Software Release 4.2 PIE Files)

Feature Set	Filename	Description
Composite Package		
Cisco IOS XR IP Unicast Routing Core Bundle	asr9k-mini-p.pie-4.2	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-4.2	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-p.pie-4.2	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-p.pie-4.2	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-p.pie-4.2	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-p.pie-4.2	Support for Encryption, Decryption, SSH,[16] and SSL[17]

Table 1   *Cisco ASR 9000 Series Aggregation Services Router Supported Feature Sets*
                 (Cisco IOS XR Software Release 4.2 PIE Files) (continued)

Feature Set	Filename	Description
Cisco IOS XR Advanced Video Package	asr9k-video-p.pie-4.2	Firmware for the advanced video feature for Cisco ASR 9000 Series Aggregation Services Router chassis.
Cisco IOS XR Optics Package	asr9k-optic-p.pie-4.2	Firmware for the optics feature for Cisco ASR 9000 Series Aggregation Services Router chassis.
Cisco IOS XR Upgrade Package	asr9k-upgrade-p.pie-4.2	Firmware for the upgrade feature for Cisco ASR 9000 Series Aggregation Services Router chassis.
Cisco IOS XR Documentation Package	asr9k-doc-p.pie-4.2	.man pages for Cisco IOS XR software on the Cisco ASR 9000 Series Aggregation Services Router chassis.
Cisco IOS XRServices Package	asr9k-services-p.pie-4.2.0	Includes binaries to support CGv6 on ISM.

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 Aggregation Services Router Software feature set matrix (PX PIE files) and associated filenames available for the Release 4.2 supported on the Cisco ASR 9000 Series Aggregation Services Router.

Table 2   Cisco ASR 9000 Series Aggregation Services Router Supported Feature Sets (Cisco IOS XR Software Release 4.2 PX PIE Files)

Feature Set	Filename	Description
Composite Package		
Cisco IOS XR IP Unicast Routing Core Bundle	asr9k-mini-px.pie-4.2	Contains the required core packages, including OS, Admin, Base, Forwarding, Modular Services Card, Routing, SNMP Agent, and Alarm Correlation.
Cisco IOS XR IP Unicast Routing Core Bundle	asr9k-mini-px.vm-4.2	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-px.pie-4.2	CORBA2 agent, XML3 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-px.pie-4.2	MPLS-TE,[9] LDP,[10] MPLS Forwarding, MPLS OAM,[11] LMP,[12] OUNI,[13] RSVP,[14] and Layer-2 VPN and Layer-3 VPN.
Cisco IOS XR Multicast Package	asr9k-mcast-px.pie-4.2	Multicast Routing Protocols (PIM, MSDP,[2] IGMP,[3] Auto-RP), Tools (SAP, MTrace), and Infrastructure (MRIB,[4] MURIB[5], MFWD[6]), and BIDIR-PIM.[7]
Cisco IOS XR Security Package	asr9k-k9sec-px.pie-4.2	Support for Encryption, Decryption, IPSec,[15]SSH,[16] SSL,[17]and PKI[18] (Software based IPSec support—maximum of 500 tunnels).

Table 2　　*Cisco ASR 9000 Series Aggregation Services Router Supported Feature Sets (Cisco IOS XR Software Release 4.2 PX PIE Files) (continued)*

Feature Set	Filename	Description
Cisco IOS XR Advanced Video Package	asr9k-video-px.pie-4.2	Firmware for the advanced video feature for Cisco ASR 9000 Series Router chassis.
Cisco IOS XR Optics Package	asr9k-optic-px.pie-4.2	Firmware for the optics feature for Cisco ASR 9000 Series Aggregation Services Router Chassis. It enables Transport / OTN feature under interfaces.
Cisco IOS XR FPD Package	asr9k-fpd-px.pie-4.2.0	If required, it is used to upgrade firmware ona RSP3 system.
Cisco IOS XR Documentation Package	asr9k-doc-px.pie-4.2	.man pages for Cisco IOS XR software on the Cisco ASR 9000 Series Aggregation Services Router Chassis.
Cisco IOS XRServices Package	asr9k-services-px.pie-4.2.0	Includes binaries to support CGv6 on ISM.

1. Packages are installed individually
2. Multicast Source Discovery Protocol
3. Internet Group Management Protocol
4. Multicast Routing Information Base
5. Multicast-Unicast RIB
6. Multicast forwarding
7. Bidirectional Protocol Independent Multicast

Table 3 lists the Cisco ASR 9000 Series Aggregation Services Router TAR files.

Table 3   ***Cisco ASR 9000 Series Aggregation Services Router Supported Feature Sets (Cisco IOS XR Software Release 4.2 TAR Files)***

Feature Set	Filename	Description
Cisco IOS XR IP/MPLS Core Software	asr9k-iosxr-4.2.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-k9-4.2.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

The following two Linux binaries must be installed on ISM card to enable CGv6 feature on Cisco ASR 9000 Series Aggregation Services Routers for Cisco IOS XR Software Release 4.2:

• ism_infra.tgz or ism_infra-4.2.0.tgz—This contains Linux infra and CGv6 application.

• kernel.rpm or kernel-4.2.0.rpm—This contains Linux kernel.

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 Aggregation Services Router running Cisco IOS XR Software Release 4.2 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 Aggregation Services Router running Cisco IOS XR Software Release 4.2 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 Aggregation Services Router running Cisco IOS XR Software Release 4.2 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 Aggregation Services Router running Cisco IOS XR Software Release 4.2 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 4.2 supports Cisco ASR 9000 Series Aggregation Services Routers. All hardware features are supported on Cisco IOS XR Software, subject to the memory requirements specified in the "Memory Requirements" section on page 9.

Table 4 lists the supported hardware components on the Cisco ASR 9000 Series Aggregation Services Router and the minimum required software versions. For more information, see the "Other Firmware Support" section on page 15.

Table 4 *Cisco ASR 9000 Series Aggregation Services Router Supported Hardware and Minimum Software Requirements*

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

Table 4 **Cisco ASR 9000 Series Aggregation Services Router Supported Hardware and Minimum Software Requirements (continued)**

Component	Part Number	Support from Version
Cisco ASR 9000 Series Aggregration Services Router 10-Slot System	ASR-9010	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 10-Slot Fan Tray	ASR-9010-FAN	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 10-Slot Door Kit	ASR-9010-DOOR	NA
Cisco ASR 9000 Series Aggregration Services Router 10-Slot AC Chassis	ASR-9010-AC	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 10-Slot DC Chassis	ASR-9010-DC	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 2 Post Mounting Kit	ASR-9010-2P-KIT	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 4 Post Mounting Kit	ASR-9010-4P-KIT	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router 10-Slot Air		
Cisco ASR 9000 Series Aggregration Services Router 10-Slot Air Filter	ASR-9010-FILTER	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 10-Slot External Exhaust Air Shaper	ASR-9010-AIRSHPR	NA
Cisco ASR 9000 Series Aggregration Services Router 10-Slot Air Inlet Grill	ASR-9010-GRL	NA
Cisco ASR 9000 Series Aggregation Services Router Power		
Cisco ASR 9000 Series Aggregration Services Router 1.5kW DC Power Module	A9K-1.5KW-DC	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 2kW DC Power Module	A9K-2KW-DC	Release 3.7.2
Cisco ASR 9000 Series Aggregration Services Router 3kW AC Power Module	A9K-3KW-AC	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router Line Cards		
Cisco ASR 9000 Series Aggregration Services Router 2-Port Ten Gigabit Ethernet + Cisco ASR 9000 Series Aggregration Services Router 20-Port Gigabit Ethernet, Medium Queue	A9K-2T20GE-B	Release 3.9.0
Cisco ASR 9000 Series Aggregration Services Router 2-Port Ten Gigabit Ethernet + Cisco ASR 9000 Series Aggregration Services Router 20-Port Gigabit Ethernet, High Queue	A9K-2T20GE-E	Release 3.9.0
Cisco ASR 9000 Series Aggregration Services Router 4-Port Ten Gigabit Ethernet, Medium Queue	A9K-4T-B	Release 3.7.2

Table 4 *Cisco ASR 9000 Series Aggregation Services Router Supported Hardware and Minimum Software Requirements (continued)*

Component	Part Number	Support from Version
Cisco ASR 9000 Series Aggregation Services Router 4-Port Ten Gigabit Ethernet Extended Line Card, High Queue	A9K-4T-E	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router 4-Port Ten Gigabit Ethernet, Low Queue	A9K-4T-L	Release 3.9.0
Cisco ASR 9000 Series Aggregation Services Router 8-Port Ten Gigabit Ethernet, 80G Line Rate Extended Line Card, Medium Queue	A9K-8T-B	Release 4.0.1
Cisco ASR 9000 Series Aggregation Services Router 8-Port Ten Gigabit Ethernet, 80G Line Rate Extended Line Card, High Queue	A9K-8T-E	Release 3.9.0
Cisco ASR 9000 Series Aggregation Services Router 8-Port Ten Gigabit Ethernet, 80G Line Rate, Low Queue	A9K-8T-L	Release 3.9.0
Cisco ASR 9000 Series Aggregation Services Router 8-Port Ten Gigabit Ethernet, Medium Queue	A9K-8T/4-B	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router 8-Port TenGE DX Extended Line Card, High Queue	A9K-8T/4-E	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router 8-Port Ten Gigabit Ethernet, Low Queue	A9K-8T/4-L	Release 3.9.0
Cisco ASR 9000 Series Aggregation Services Router 16-Port Ten Gigabit Ethernet, Medium Queue	A9K-4T-B	Release 4.0.1
Cisco ASR 9000 Series Aggregation Services Router 40-Port Gigabit Ethernet, Medium Queue	A9K-40GE-B	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router 40-Port Gigabit Ethernet Extended Line Card, High Queue	A9K-40GE-E	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router 40-Port Gigabit Ethernet, Low Queue	A9K-40GE-L	Release 3.9.0
Cisco ASR 9000 Series Aggregation Services Router Line Card Filler	A9K-LC-FILR	Release 3.7.2
ISM (Integrated Service Module) Line Card	A9K-ISM-100	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router 2-Port Hundred Gigabit Ethernet, Service Edge Optimized	A9K-2X100GE-SE	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router 2-Port Hundred Gigabit Ethernet, Packet Transport Optimized	A9K-2X100GE-TR	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router 24-Port Ten Gigabit Ethernet, Service Edge Optimized	A9K-24X10GE-SE	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router 24-Port Ten Gigabit Ethernet, Packet Transport Optimized	A9K-24X10GE-TR	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router Modular Line Cards		
Cisco ASR 9000 Series Aggregation Services Router 80 Gig Modular Line Card, Service Edge Optimized	A9K-MOD80-SE	Release 4.2.0

Table 4 *Cisco ASR 9000 Series Aggregation Services Router Supported Hardware and Minimum Software Requirements (continued)*

Component	Part Number	Support from Version
Cisco ASR 9000 Series Aggregation Services Router 80 Gig Modular Line Card, Packet Transport Optimized	A9K-MOD80-TR	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router Modular Port Adapters (MPAs)		
Cisco ASR 9000 Series Aggregation Services Router 4-port 10GE Modular Port Adapter	A9K-MPA-4X10GE	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router 20-port 1GE Modular Port Adapter	A9K-MPA-20X1GE	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router Route Switch Processor Cards		
Cisco ASR 9000 Series Aggregation Services Router Route Switch Processor, 4G Memory	A9K-RSP-4G	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router Route Switch Processor, 8G Memory	A9K-RSP-8G	Release 4.0.1
Cisco ASR 9000 Series Aggregation Services Router Route Switch Processor Filler	ASR-9000-RSP-FILR	Release 3.7.2
Cisco ASR 9000 Series Aggregation Services Router Next Generation Route Switch Processor, Service Edge Optimized	A9K-RSP-440-SE	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router Next Generation Route Switch Processor, Packet Transport Optimized	A9K-RSP-440-TR	Release 4.2.0
Cisco ASR 9000 Series Aggregation Services Router 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 4.1.0
8-Port Channelized T1/E1 SPA	SPA-8XCHT1/E1	Release 4.1.0
1-Port and 3-Port Clear Channel OC-3 ATM SPA	SPA-1/3XOC3ATM	Release 4.2.0
1-Port Clear Channel OC-12 ATM SPA	SPA-1XOC12ATM	Release 4.2.0
1-Port Channelized OC-3 ATM CEoP SPA	SPA-1xOC3-CE-ATM	Release 4.2.0

Software Compatibility

Cisco IOS XR Software Release 4.2 is compatible with the following
Cisco ASR 9000 Series Aggregation Services Router systems:

- Cisco ASR 9000 Series Aggregation Services Router 6-Slot Line Card Chassis

- Cisco ASR 9000 Series Aggregation Services Router 10-Slot Line Card Chassis

Table 5 lists the supported software licenses on the
Cisco ASR 9000 Series Aggregation Services Router and the appropriate part numbers.

Table 5   ***Cisco ASR 9000 Series Aggregation Services Router Supported Software Licenses***

Software License	Part Number
Cisco ASR 9000 Series Aggregation Services Router iVRF License	A9K-IVRF-LIC
Cisco ASR 9000 Series Aggregation Services Router Per Chassis Advanced Video License	A9K-ADV-VIDEO-LIC
Cisco ASR 9000 Series Aggregation Services Router Per Line Card Advanced Optical License	A9K-ADV-OPTIC-LIC
Cisco ASR 9000 Series Aggregation Services Router L3VPN License, Medium Queue and Low Queue Line Cards	A9K-AIP-LIC-B
Cisco ASR 9000 Series Aggregation Services Router 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 Aggregation Services Router Right-To-Use (RTU) Licensing

Here are on-line locations of the Cisco ASR 9000 Series Aggregation Services Router 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

To check the firmware code supported by the Cisco ASR 9000 Series Aggregation Services Router, run the **show fpd package** command in admin mode.

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:router#show fpd package
Fri Dec 23 09:56:49.322 PST

=============================== ===================================================
                                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       0.00       0.1
                     CPUCtrl LC2              lc   cpld1    1.00       0.00       0.1
                     PHYCtrl LC2              lc   cpld2    0.06       0.00       0.1
                     PortCtrl LC2             lc   fpga2    0.10       0.00       0.1
                     Bridge LC2               lc   fpga1    0.43       0.00       0.1
                     HSBI LC2                 lc   hsbi     3.00       0.00       0.1
                     ROMMONB LC2              lc   rommon   1.05       0.00       0.1
----------------------------------------------------------------------------------------
A9K-4T-B             Can Bus Ctrl (CBC) LC2   lc   cbc      2.02       0.00       0.1
                     CPUCtrl LC2              lc   cpld1    1.00       0.00       0.1
                     PHYCtrl LC2              lc   cpld2    0.08       0.00       0.1
                     LCClkCtrl LC2            lc   cpld3    0.03       0.00       0.1
                     PortCtrl LC2             lc   fpga2    0.10       0.00       0.1
                     PHY LC2                  lc   fpga3    14.44      0.00       0.1
                     Bridge LC2               lc   fpga1    0.43       0.00       0.1
                     HSBI LC2                 lc   hsbi     3.00       0.00       0.1
                     ROMMONB LC2              lc   rommon   1.05       0.00       0.1
----------------------------------------------------------------------------------------
A9K-8T/4-B           Can Bus Ctrl (CBC) LC2   lc   cbc      2.02       0.00       0.1
                     CPUCtrl LC2              lc   cpld1    1.00       0.00       0.1
                     PHYCtrl LC2              lc   cpld2    0.08       0.00       0.1
                     LCClkCtrl LC2            lc   cpld3    0.03       0.00       0.1
                     PortCtrl LC2             lc   fpga2    0.10       0.00       0.1
                     PHY LC2                  lc   fpga3    14.44      0.00       0.1
                     Bridge LC2               lc   fpga1    0.43       0.00       0.1
                     HSBI LC2                 lc   hsbi     3.00       0.00       0.1
```

```
                     ROMMONB LC2                   lc   rommon    1.05      0.00      0.1
           --------------------------------------------------------------------------------
           A9K-2T20GE-B        Can Bus Ctrl (CBC) LC2  lc   cbc       2.02      0.00      0.1
                     CPUCtrl LC2                  lc   cpld1     1.00      0.00      0.1
                     PHYCtrl LC2                  lc   cpld2     0.11      0.00      0.1
                     LCClkCtrl LC2                lc   cpld3     0.10      0.00      0.1
                     PortCtrl LC2                 lc   fpga2     0.16      0.00      0.1
                     Bridge LC2                   lc   fpga1     0.43      0.00      0.1
                     HSBI LC2                     lc   hsbi      3.00      0.00      0.1
                     ROMMONB LC2                  lc   rommon    1.05      0.00      0.1
           --------------------------------------------------------------------------------
           A9K-40GE-E          Can Bus Ctrl (CBC) LC2  lc   cbc       2.02      0.00      0.1
                     CPUCtrl LC2                  lc   cpld1     1.00      0.00      0.1
                     PHYCtrl LC2                  lc   cpld2     0.06      0.00      0.1
                     PortCtrl LC2                 lc   fpga2     0.10      0.00      0.1
                     Bridge LC2                   lc   fpga1     0.43      0.00      0.1
                     HSBI LC2                     lc   hsbi      3.00      0.00      0.1
                     ROMMONB LC2                  lc   rommon    1.05      0.00      0.1
           --------------------------------------------------------------------------------
           A9K-4T-E            Can Bus Ctrl (CBC) LC2  lc   cbc       2.02      0.00      0.1
                     CPUCtrl LC2                  lc   cpld1     1.00      0.00      0.1
                     PHYCtrl LC2                  lc   cpld2     0.08      0.00      0.1
                     LCClkCtrl LC2                lc   cpld3     0.03      0.00      0.1
                     PortCtrl LC2                 lc   fpga2     0.10      0.00      0.1
                     PHY LC2                      lc   fpga3    14.44      0.00      0.1
                     Bridge LC2                   lc   fpga1     0.43      0.00      0.1
                     HSBI LC2                     lc   hsbi      3.00      0.00      0.1
                     ROMMONB LC2                  lc   rommon    1.05      0.00      0.1
           --------------------------------------------------------------------------------
           A9K-8T/4-E          Can Bus Ctrl (CBC) LC2  lc   cbc       2.02      0.00      0.1
                     CPUCtrl LC2                  lc   cpld1     1.00      0.00      0.1
                     PHYCtrl LC2                  lc   cpld2     0.08      0.00      0.1
                     LCClkCtrl LC2                lc   cpld3     0.03      0.00      0.1
                     PortCtrl LC2                 lc   fpga2     0.10      0.00      0.1
                     PHY LC2                      lc   fpga3    14.44      0.00      0.1
                     Bridge LC2                   lc   fpga1     0.43      0.00      0.1
                     HSBI LC2                     lc   hsbi      3.00      0.00      0.1
                     ROMMONB LC2                  lc   rommon    1.05      0.00      0.1
           --------------------------------------------------------------------------------
           A9K-2T20GE-E        Can Bus Ctrl (CBC) LC2  lc   cbc       2.02      0.00      0.1
                     CPUCtrl LC2                  lc   cpld1     1.00      0.00      0.1
                     PHYCtrl LC2                  lc   cpld2     0.11      0.00      0.1
                     LCClkCtrl LC2                lc   cpld3     0.10      0.00      0.1
                     PortCtrl LC2                 lc   fpga2     0.16      0.00      0.1
                     Bridge LC2                   lc   fpga1     0.43      0.00      0.1
                     HSBI LC2                     lc   hsbi      3.00      0.00      0.1
                     ROMMONB LC2                  lc   rommon    1.05      0.00      0.1
           --------------------------------------------------------------------------------
           A9K-8T-B            Can Bus Ctrl (CBC) LC3  lc   cbc       6.02      0.00      0.1
                     CPUCtrl LC3                  lc   cpld1     1.02      0.00      0.1
                     PHYCtrl LC3                  lc   cpld2     0.08      0.00      0.1
                     LCClkCtrl LC3                lc   cpld3     0.03      0.00      0.1
                     DB CPUCtrl LC3               lc   cpld4     1.03      0.00      0.1
                     PortCtrl LC3                 lc   fpga2     0.11      0.00      0.1
                     Serdes Upgrade LC3           lc   fpga3    14.44      0.00      0.1
                     Raven LC3                    lc   fpga1     1.02      0.00      0.1
                     ROMMONB LC3                  lc   rommon    1.03      0.00      0.1
           --------------------------------------------------------------------------------
           A9K-8T-B            Can Bus Ctrl (CBC) LC3  lc   cbc       6.02      0.00      0.1
                     CPUCtrl LC3                  lc   cpld1     1.02      0.00      0.1
                     PHYCtrl LC3                  lc   cpld2     0.08      0.00      0.1
                     LCClkCtrl LC3                lc   cpld3     0.03      0.00      0.1
                     DB CPUCtrl LC3               lc   cpld4     1.03      0.00      0.1
                     PortCtrl LC3                 lc   fpga2     0.11      0.00      0.1
```

```
                        Raven LC3                       lc   fpga1    1.02     0.00     0.1
                        HSBI LC3                        lc   hsbi     3.00     0.00     0.1
                        ROMMONB LC3                     lc   rommon   1.03     0.00     0.1
       -----------------------------------------------------------------------------------------
       A9K-16T/8-B      Can Bus Ctrl (CBC) LC3          lc   cbc      6.02     0.00     0.1
                        CPUCtrl LC3                     lc   cpld1    1.02     0.00     0.1
                        PHYCtrl LC3                     lc   cpld2    0.04     0.00     0.1
                        LCClkCtrl LC3                   lc   cpld3    0.01     0.00     0.1
                        DB CPUCtrl LC3                  lc   cpld4    1.03     0.00     0.1
                        PortCtrl LC3                    lc   fpga2    0.01     0.00     0.1
                        Serdes Upgrade LC3              lc   fpga3    14.44    0.00     0.1
                        Raven LC3                       lc   fpga1    1.02     0.00     0.1
                        ROMMONB LC3                     lc   rommon   1.03     0.00     0.1
       -----------------------------------------------------------------------------------------
       A9K-16T/8-B      Can Bus Ctrl (CBC) LC3          lc   cbc      6.02     0.00     0.1
                        CPUCtrl LC3                     lc   cpld1    1.02     0.00     0.1
                        PHYCtrl LC3                     lc   cpld2    0.04     0.00     0.1
                        LCClkCtrl LC3                   lc   cpld3    0.01     0.00     0.1
                        DB CPUCtrl LC3                  lc   cpld4    1.03     0.00     0.1
                        PortCtrl LC3                    lc   fpga2    0.01     0.00     0.1
                        Raven LC3                       lc   fpga1    1.02     0.00     0.1
                        HSBI LC3                        lc   hsbi     3.00     0.00     0.1
                        ROMMONB LC3                     lc   rommon   1.03     0.00     0.1
       -----------------------------------------------------------------------------------------
       A9K-8T-E         Can Bus Ctrl (CBC) LC3          lc   cbc      6.02     0.00     0.1
                        CPUCtrl LC3                     lc   cpld1    1.02     0.00     0.1
                        PHYCtrl LC3                     lc   cpld2    0.08     0.00     0.1
                        LCClkCtrl LC3                   lc   cpld3    0.03     0.00     0.1
                        DB CPUCtrl LC3                  lc   cpld4    1.03     0.00     0.1
                        PortCtrl LC3                    lc   fpga2    0.11     0.00     0.1
                        Serdes Upgrade LC3              lc   fpga3    14.44    0.00     0.1
                        Raven LC3                       lc   fpga1    1.02     0.00     0.1
                        ROMMONB LC3                     lc   rommon   1.03     0.00     0.1
       -----------------------------------------------------------------------------------------
       A9K-8T-E         Can Bus Ctrl (CBC) LC3          lc   cbc      6.02     0.00     0.1
                        CPUCtrl LC3                     lc   cpld1    1.02     0.00     0.1
                        PHYCtrl LC3                     lc   cpld2    0.08     0.00     0.1
                        LCClkCtrl LC3                   lc   cpld3    0.03     0.00     0.1
                        CPUCtrl LC3                     lc   cpld4    1.03     0.00     0.1
                        PortCtrl LC3                    lc   fpga2    0.11     0.00     0.1
                        Raven LC3                       lc   fpga1    1.02     0.00     0.1
                        HSBI LC3                        lc   hsbi     3.00     0.00     0.1
                        ROMMONB LC3                     lc   rommon   1.03     0.00     0.1
       -----------------------------------------------------------------------------------------
       A9K-16T/8-E      Can Bus Ctrl (CBC) LC3          lc   cbc      6.02     0.00     0.1
                        CPUCtrl LC3                     lc   cpld1    1.02     0.00     0.1
                        PHYCtrl LC3                     lc   cpld2    0.04     0.00     0.1
                        LCClkCtrl LC3                   lc   cpld3    0.01     0.00     0.1
                        DB CPUCtrl LC3                  lc   cpld4    1.03     0.00     0.1
                        PortCtrl LC3                    lc   fpga2    0.01     0.00     0.1
                        Serdes Upgrade LC3              lc   fpga3    14.44    0.00     0.1
                        Raven LC3                       lc   fpga1    1.02     0.00     0.1
                        ROMMONB LC3                     lc   rommon   1.03     0.00     0.1
       -----------------------------------------------------------------------------------------
       A9K-16T/8-E      Can Bus Ctrl (CBC) LC3          lc   cbc      6.02     0.00     0.1
                        CPUCtrl LC3                     lc   cpld1    1.02     0.00     0.1
                        PHYCtrl LC3                     lc   cpld2    0.04     0.00     0.1
                        LCClkCtrl LC3                   lc   cpld3    0.01     0.00     0.1
                        DB CPUCtrl LC3                  lc   cpld4    1.03     0.00     0.1
                        PortCtrl LC3                    lc   fpga2    0.01     0.00     0.1
                        Raven LC3                       lc   fpga1    1.02     0.00     0.1
                        HSBI LC3                        lc   hsbi     3.00     0.00     0.1
                        ROMMONB LC3                     lc   rommon   1.03     0.00     0.1
       -----------------------------------------------------------------------------------------
```

```
A9K-40GE-L        Can Bus Ctrl (CBC) LC2    lc    cbc      2.02     0.00     0.1
                  CPUCtrl LC2               lc    cpld1    1.00     0.00     0.1
                  PHYCtrl LC2               lc    cpld2    0.06     0.00     0.1
                  PortCtrl LC2              lc    fpga2    0.10     0.00     0.1
                  Bridge LC2                lc    fpga1    0.43     0.00     0.1
                  HSBI LC2                  lc    hsbi     3.00     0.00     0.1
                  ROMMONB LC2               lc    rommon   1.05     0.00     0.1
------------------------------------------------------------------------------------
A9K-4T-L          Can Bus Ctrl (CBC) LC2    lc    cbc      2.02     0.00     0.1
                  CPUCtrl LC2               lc    cpld1    1.00     0.00     0.1
                  PHYCtrl LC2               lc    cpld2    0.08     0.00     0.1
                  LCClkCtrl LC2             lc    cpld3    0.03     0.00     0.1
                  PortCtrl LC2              lc    fpga2    0.10     0.00     0.1
                  Serdes Upgrade LC2        lc    fpga3   14.44     0.00     0.1
                  Bridge LC2                lc    fpga1    0.43     0.00     0.1
                  HSBI LC2                  lc    hsbi     3.00     0.00     0.1
                  ROMMONB LC2               lc    rommon   1.05     0.00     0.1
------------------------------------------------------------------------------------
A9K-8T/4-L        Can Bus Ctrl (CBC) LC2    lc    cbc      2.02     0.00     0.1
                  CPUCtrl LC2               lc    cpld1    1.00     0.00     0.1
                  PHYCtrl LC2               lc    cpld2    0.08     0.00     0.1
                  LCClkCtrl LC2             lc    cpld3    0.03     0.00     0.1
                  PortCtrl LC2              lc    fpga2    0.10     0.00     0.1
                  Serdes Upgrade LC2        lc    fpga3   14.44     0.00     0.1
                  Bridge LC2                lc    fpga1    0.43     0.00     0.1
                  HSBI LC2                  lc    hsbi     3.00     0.00     0.1
                  ROMMONB LC2               lc    rommon   1.05     0.00     0.1
------------------------------------------------------------------------------------
A9K-2T20GE-L      Can Bus Ctrl (CBC) LC2    lc    cbc      2.02     0.00     0.1
                  CPUCtrl LC2               lc    cpld1    1.00     0.00     0.1
                  PHYCtrl LC2               lc    cpld2    0.11     0.00     0.1
                  LCClkCtrl LC2             lc    cpld3    0.10     0.00     0.1
                  Tomcat LC2                lc    fpga2    0.16     0.00     0.1
                  Bridge LC2                lc    fpga1    0.43     0.00     0.1
                  HSBI LC2                  lc    hsbi     3.00     0.00     0.1
                  ROMMONB LC2               lc    rommon   1.05     0.00     0.1
------------------------------------------------------------------------------------
A9K-8T-L          Can Bus Ctrl (CBC) LC3    lc    cbc      6.02     0.00     0.1
                  CPUCtrl LC3               lc    cpld1    1.02     0.00     0.1
                  PHYCtrl LC3               lc    cpld2    0.08     0.00     0.1
                  LCClkCtrl LC3             lc    cpld3    0.03     0.00     0.1
                  CPUCtrl LC3               lc    cpld4    1.03     0.00     0.1
                  PortCtrl LC3              lc    fpga2    0.11     0.00     0.1
                  Raven LC3                 lc    fpga1    1.02     0.00     0.1
                  HSBI LC3                  lc    hsbi     3.00     0.00     0.1
                  ROMMONB LC3               lc    rommon   1.03     0.00     0.1
------------------------------------------------------------------------------------
A9K-16T/8-L       Can Bus Ctrl (CBC) LC3    lc    cbc      6.02     0.00     0.1
                  CPUCtrl LC3               lc    cpld1    1.02     0.00     0.1
                  PHYCtrl LC3               lc    cpld2    0.04     0.00     0.1
                  LCClkCtrl LC3             lc    cpld3    0.01     0.00     0.1
                  DB CPUCtrl LC3            lc    cpld4    1.03     0.00     0.1
                  PortCtrl LC3              lc    fpga2    0.01     0.00     0.1
                  Raven LC3                 lc    fpga1    1.02     0.00     0.1
                  HSBI LC3                  lc    hsbi     3.00     0.00     0.1
                  ROMMONB LC3               lc    rommon   1.03     0.00     0.1
------------------------------------------------------------------------------------
A9K-SIP-700       Can Bus Ctrl (CBC) LC5    lc    cbc      3.05     0.00     0.1
                  CPUCtrl LC5               lc    cpld1    0.15     0.00     0.1
                  QFPCPUBridge LC5          lc    fpga2    5.14     0.00     0.1
                  NPUXBarBridge LC5         lc    fpga1    0.23     0.00     0.1
                  HSBI LC5                  lc    hsbi     3.00     0.00     0.1
                  ROMMONB LC5               lc    rommon   1.03     0.00     0.1
------------------------------------------------------------------------------------
```

```
A9K-SIP-500        Can Bus Ctrl (CBC) LC5    lc   cbc      3.05     0.00     0.1
                   CPUCtrl LC5               lc   cpld1    0.15     0.00     0.1
                   QFPCPUBridge LC5          lc   fpga2    5.14     0.00     0.1
                   NPUXBarBridge LC5         lc   fpga1    0.23     0.00     0.1
                   ROMMONB LC5               lc   rommon   1.03     0.00     0.1
--------------------------------------------------------------------------------------
A9K-RSP-2G         Can Bus Ctrl (CBC) RSP2   lc   cbc      1.02     0.00     0.1
                   CPUCtrl RSP2              lc   cpld2    1.18     0.00     0.1
                   IntCtrl RSP2              lc   fpga2    1.15     0.00     0.1
                   ClkCtrl RSP2              lc   fpga3    1.23     0.00     0.1
                   UTI RSP2                  lc   fpga4    3.08     0.00     0.1
                   PUNT RSP2                 lc   fpga1    1.05     0.00     0.1
                   HSBI RSP2                 lc   hsbi     4.00     0.00     0.1
                   ROMMONB RSP2              lc   rommon   1.05     0.00     0.1
--------------------------------------------------------------------------------------
A9K-RSP-4G         Can Bus Ctrl (CBC) RSP2   lc   cbc      1.02     0.00     0.1
                   CPUCtrl RSP2              lc   cpld2    1.18     0.00     0.1
                   IntCtrl RSP2              lc   fpga2    1.15     0.00     0.1
                   ClkCtrl RSP2              lc   fpga3    1.23     0.00     0.1
                   UTI RSP2                  lc   fpga4    3.08     0.00     0.1
                   PUNT RSP2                 lc   fpga1    1.05     0.00     0.1
                   HSBI RSP2                 lc   hsbi     4.00     0.00     0.1
                   ROMMONB RSP2              lc   rommon   1.05     0.00     0.1
--------------------------------------------------------------------------------------
A9K-RSP-8G         Can Bus Ctrl (CBC) RSP2   lc   cbc      1.02     0.00     0.1
                   CPUCtrl RSP2              lc   cpld2    1.18     0.00     0.1
                   IntCtrl RSP2              lc   fpga2    1.15     0.00     0.1
                   ClkCtrl RSP2              lc   fpga3    1.23     0.00     0.1
                   UTI RSP2                  lc   fpga4    3.08     0.00     0.1
                   PUNT RSP2                 lc   fpga1    1.05     0.00     0.1
                   HSBI RSP2                 lc   hsbi     4.00     0.00     0.1
                   ROMMONB RSP2              lc   rommon   1.05     0.00     0.1
--------------------------------------------------------------------------------------
A9K-RSP440-TR      Can Bus Ctrl (CBC) RSP3   lc   cbc      16.114   0.00     0.1
                   ClockCtrl0 RSP3           lc   fpga2    0.08     0.00     0.1
                   UTI RSP3                  lc   fpga3    4.09     0.00     0.1
                   CPUCtrl RSP3              lc   fpga1    0.09     0.00     0.1
                   ROMMONB RSP3              lc   rommon   0.46     0.00     0.1
--------------------------------------------------------------------------------------
A9K-RSP440-SE      Can Bus Ctrl (CBC) RSP3   lc   cbc      16.114   0.00     0.1
                   ClockCtrl0 RSP3           lc   fpga2    0.08     0.00     0.1
                   UTI RSP3                  lc   fpga3    4.09     0.00     0.1
                   CPUCtrl RSP3              lc   fpga1    0.09     0.00     0.1
                   ROMMONB RSP3              lc   rommon   0.46     0.00     0.1
--------------------------------------------------------------------------------------
A9K-24x10GE-SE     Can Bus Ctrl (CBC) LC6    lc   cbc      19.108   0.00     0.0
                   DBCtrl LC6                lc   fpga2    1.01     0.00     0.0
                   LinkCtrl LC6              lc   fpga3    1.00     0.00     0.0
                   LCCPUCtrl LC6             lc   fpga4    1.01     0.00     0.0
                   ROMMONB LC6               lc   rommon   1.21     0.00     0.0
--------------------------------------------------------------------------------------
A9K-2x100GE-SE     Can Bus Ctrl (CBC) LC4    lc   cbc      21.107   0.00     0.1
                   DB IO FPGA1               lc   cpld1    1.01     0.00     0.0
                   MB CPUCtrl                lc   fpga2    1.02     0.00     0.0
                   PortCtrl                  lc   fpga3    1.01     0.00     0.0
                   Imux                      lc   fpga4    1.00     0.00     0.0
                   Emux                      lc   fpga5    1.01     0.00     0.0
                   100GIGMAC                 lc   fpga6    23.00    0.00     0.0
                   ROMMONB LC4               lc   rommon   1.22     0.00     0.0
--------------------------------------------------------------------------------------
A9K-MOD80-SE       Can Bus Ctrl (CBC) LC4    lc   cbc      20.113   0.00     0.1
                   DB Ctrl                   lc   fpga2    0.05     0.00     0.0
                   MB CPUCtrl                lc   fpga4    0.06     0.00     0.0
                   ROMMONB LC4               lc   rommon   1.21     0.00     0.1
```

```
--------------------------------------------------------------------------------
A9K-MOD160-SE      Can Bus Ctrl (CBC) LC4    lc   cbc      20.113    0.00    0.1
                   DB Ctrl                   lc   fpga2     0.05      0.00    0.0
                   MB CPUCtrl                lc   fpga4     0.06      0.00    0.0
                   ROMMONB LC4               lc   rommon    1.21      0.00    0.1
--------------------------------------------------------------------------------
A9K-24x10GE-TR     Can Bus Ctrl (CBC) LC6    lc   cbc      19.108    0.00    0.0
                   DBCtrl LC6                lc   fpga2     1.01      0.00    0.0
                   LinkCtrl LC6              lc   fpga3     1.00      0.00    0.0
                   LCCPUCtrl LC6             lc   fpga4     1.01      0.00    0.0
                   ROMMONB LC6               lc   rommon    1.21      0.00    0.0
--------------------------------------------------------------------------------
A9K-2x100GE-TR     Can Bus Ctrl (CBC) LC4    lc   cbc      21.107    0.00    0.1
                   DB IO FPGA1               lc   cpld1     1.01      0.00    0.0
                   MB CPUCtrl                lc   fpga2     1.02      0.00    0.0
                   PortCtrl                  lc   fpga3     1.01      0.00    0.0
                   Imux                      lc   fpga4     1.00      0.00    0.0
                   Emux                      lc   fpga5     1.01      0.00    0.0
                   100GIGMAC                 lc   fpga6    23.00      0.00    0.0
                   ROMMONB LC4               lc   rommon    1.22      0.00    0.0
--------------------------------------------------------------------------------
A9K-MOD80-TR       Can Bus Ctrl (CBC) LC4    lc   cbc      20.113    0.00    0.1
                   DB Ctrl                   lc   fpga2     0.05      0.00    0.0
                   MB CPUCtrl                lc   fpga4     0.06      0.00    0.0
                   ROMMONB LC4               lc   rommon    1.21      0.00    0.1
--------------------------------------------------------------------------------
A9K-MOD160-TR      Can Bus Ctrl (CBC) LC4    lc   cbc      20.113    0.00    0.1
                   DB Ctrl                   lc   fpga2     0.05      0.00    0.0
                   MB CPUCtrl                lc   fpga4     0.06      0.00    0.0
                   ROMMONB LC4               lc   rommon    1.21      0.00    0.1
--------------------------------------------------------------------------------
A9K-8T-TEST        Can Bus Ctrl (CBC) LC17   lc   cbc      17.213    0.00    0.0
                   LCCPUCtrl LC6             lc   fpga4     0.03      0.00    0.0
                   ROMMONB LC6               lc   rommon    1.04      0.00    0.0
--------------------------------------------------------------------------------
ASR-9010-FAN       Can Bus Ctrl (CBC) FAN    lc   cbc       4.00      0.00    0.1
--------------------------------------------------------------------------------
ASR-9006-FAN       Can Bus Ctrl (CBC) FAN    lc   cbc       5.00      0.00    0.1
--------------------------------------------------------------------------------
A9K-BPID2-10-SLOT  Can Bus Ctrl (CBC) BP2    lc   cbc       7.103     0.00    0.1
--------------------------------------------------------------------------------
A9K-BPID2-6-SLOT   Can Bus Ctrl (CBC) BP2    lc   cbc       7.103     0.00    0.1
--------------------------------------------------------------------------------
A9K-ISM-100        Can Bus Ctrl (CBC) LC6    lc   cbc      18.05      0.00    0.1
                   CPUCtrl LC6               lc   cpld1     0.01      0.00    0.1
                   Maintenance LC6           lc   fpga2     2.00      0.00    0.1
                   Amistad LC6               lc   fpga1     0.29      0.00    0.20
                   ROMMONB LC6               lc   rommon    1.02      0.00    0.1
--------------------------------------------------------------------------------
A9K-RSP-3G         ClockCtrl0 RSP3           lc   fpga2     0.08      0.00    0.1
                   UTI RSP3                  lc   fpga3     4.09      0.00    0.1
                   CPUCtrl RSP3              lc   fpga1     0.09      0.00    0.1
                   ROMMONB RSP3              lc   rommon    0.46      0.00    0.1
--------------------------------------------------------------------------------
A9K-RSP-24G        ClockCtrl0 RSP3           lc   fpga2     0.08      0.00    0.1
                   UTI RSP3                  lc   fpga3     4.09      0.00    0.1
                   CPUCtrl RSP3              lc   fpga1     0.09      0.00    0.1
                   ROMMONB RSP3              lc   rommon    0.46      0.00    0.1
--------------------------------------------------------------------------------
SPA-4XT3/E3        SPA E3 Subrate FPGA       spa  fpga2     1.04      0.00    0.0
                   SPA T3 Subrate FPGA       spa  fpga3     1.04      0.00    0.0
                   SPA I/O FPGA              spa  fpga1     1.01      0.00    0.0
                   SPA ROMMON                spa  rommon    2.12      0.00    0.0
--------------------------------------------------------------------------------
```

SPA-4XCT3/DS0	SPA T3 Subrate FPGA	spa	fpga2	0.11	0.00	
0.100						
	SPA T3 Subrate FPGA	spa	fpga2	1.04	0.00	
0.200						
	SPA I/O FPGA	spa	fpga1	2.08	0.00	0.100
	SPA ROMMON	spa	rommon	2.12	0.00	0.100
SPA-1XCHSTM1/OC3	SPA T3 Subrate FPGA	spa	fpga2	1.04	0.00	0.0
	SPA I/O FPGA	spa	fpga1	1.08	0.00	0.0
	SPA ROMMON	spa	rommon	2.12	0.00	0.0
SPA-1CHOC3-CE-ATM	SPA OC3 Subrate FPGA	spa	fpga2	2.23	0.00	0.0
	SPA I/O FPGA	spa	fpga1	2.23	0.00	2.0
	SPA ROMMON	spa	rommon	1.04	0.00	0.0
SPA-1XCHOC48/DS3	SPA I/O FPGA	spa	fpga2	1.00	0.00	0.49
	SPA I/O FPGA	spa	fpga3	1.00	0.00	0.52
	SPA I/O FPGA	spa	fpga1	1.36	0.00	0.49
	SPA ROMMON	spa	rommon	2.02	0.00	0.49
SPA-2XCHOC12/DS0	SPA FPGA2 swv1.00	spa	fpga2	1.00	0.00	0.0
	SPA FPGA swv1.36	spa	fpga1	1.36	0.00	0.49
	SPA ROMMON swv2.2	spa	rommon	2.02	0.00	0.49
A9K-MPA-20X1GE	EP I/O FPGA	spa	fpga3	0.08	0.00	0.0
A9K-MPA-2X10GE	EP I/O FPGA	spa	fpga6	0.09	0.00	0.0
A9K-MPA-4X10GE	EP I/O FPGA	spa	fpga6	0.09	0.00	0.0
SPA-8XOC12-POS	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.5
SPA-8XCHT1/E1	SPA I/O FPGA	spa	fpga1	2.08	0.00	0.0
	SPA ROMMON	spa	rommon	2.12	0.00	0.140
SPA-OC192POS-XFP	SPA FPGA swv1.2 hwv2	spa	fpga1	1.02	0.00	2.0
SPA-2XOC48POS/RPR	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.0
SPA-8XOC3-POS	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.5
SPA-2XOC12-POS	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.5
SPA-4XOC12-POS	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.5
SPA-10X1GE-V2	SPA FPGA swv1.10	spa	fpga1	1.10	0.00	0.0
SPA-5X1GE-V2	SPA FPGA swv1.10	spa	fpga1	1.10	0.00	0.0
SPA-1X10GE-L-V2	SPA FPGA swv1.9	spa	fpga1	1.09	0.00	0.0
SPA-4XOC3-POS-V2	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.5
SPA-1X10GE-WL-V2	SPA FPGA swv1.9	spa	fpga1	1.09	0.00	0.0
SPA-1XOC3-ATM-V2	SPA FPGA swv1.2	spa	fpga1	2.02	0.00	0.0
SPA-2XOC3-ATM-V2	SPA FPGA swv1.2	spa	fpga1	2.02	0.00	0.0
SPA-3XOC3-ATM-V2	SPA FPGA swv1.2	spa	fpga1	2.02	0.00	0.0
SPA-1XOC12-ATM-V2	SPA FPGA swv1.2	spa	fpga1	2.02	0.00	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#sh version
Tue Dec 20 15:25:57.747 PST

Cisco IOS XR Software, Version 4.2.0[Default]
Copyright (c) 2011 by Cisco Systems, Inc.

ROM: System Bootstrap, Version 0.46(c) 1994-2011 by Cisco Systems,  Inc.

Router uptime is 35 minutes
System image file is "disk0:asr9k-os-mbi-4.2.0/0x100305/mbiasr9k-rsp3.vm"

cisco ASR9K Series (Intel 686 F6M14S4) processor with 6291456K bytes of memory.
Intel 686 F6M14S4 processor at 2127MHz, Revision 2.174
ASR-9010 AC Chassis

4 Management Ethernet
30 TenGigE
30 DWDM controller(s)
30 WANPHY controller(s)
20 GigabitEthernet
1 MgmtMultilink
5 SONET/SDH
3 Packet over SONET/SDH
1 T3
1 Serial network interface(s)
503k bytes of non-volatile configuration memory.
3109M bytes of hard disk.
10998768k bytes of disk0: (Sector size 512 bytes).
10998768k bytes of disk1: (Sector size 512 bytes).

Configuration register on node 0/RSP0/CPU0 is 0x1922
Boot device on node 0/RSP0/CPU0 is disk0:
Package active on node 0/RSP0/CPU0:
iosxr-ce, V 4.2.0[00], Cisco Systems, at disk0:iosxr-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-adv-video, V 4.2.0[00], Cisco Systems, at disk0:iosxr-adv-video-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fwding, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-cpp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-cpp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie
```

```
asr9k-ce, V 4.2.0[00], Cisco Systems, at disk0:asr9k-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-scfclient, V 4.2.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-security, V 4.2.0[00], Cisco Systems, at disk0:iosxr-security-4.2.0
    Built on Mon Dec 19 03:44:01 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mpls, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mpls-4.2.0
    Built on Mon Dec 19 03:43:06 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mgbl, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mgbl-4.2.0
    Built on Mon Dec 19 03:43:45 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mcast, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mcast-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-routing, V 4.2.0[00], Cisco Systems, at disk0:iosxr-routing-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-infra, V 4.2.0[00], Cisco Systems, at disk0:iosxr-infra-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-fwding, V 4.2.0[00], Cisco Systems, at disk0:iosxr-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-diags, V 4.2.0[00], Cisco Systems, at disk0:iosxr-diags-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-adv-video-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fpd, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fpd-4.2.0
    Built on Mon Dec 19 03:44:20 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-diags-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-k9sec-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-k9sec-supp-4.2.0
    Built on Mon Dec 19 03:44:01 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mgbl-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mgbl-supp-4.2.0
    Built on Mon Dec 19 03:43:45 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mcast-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie
```

```
asr9k-base, V 4.2.0[00], Cisco Systems, at disk0:asr9k-base-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-os-mbi, V 4.2.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.2.0
    Built on Mon Dec 19 03:38:27 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie


Configuration register on node 0/RSP1/CPU0 is 0x1922
Boot device on node 0/RSP1/CPU0 is disk0:
Package active on node 0/RSP1/CPU0:
iosxr-ce, V 4.2.0[00], Cisco Systems, at disk0:iosxr-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-adv-video, V 4.2.0[00], Cisco Systems, at disk0:iosxr-adv-video-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fwding, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-cpp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-cpp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-ce, V 4.2.0[00], Cisco Systems, at disk0:asr9k-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-scfclient, V 4.2.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-security, V 4.2.0[00], Cisco Systems, at disk0:iosxr-security-4.2.0
    Built on Mon Dec 19 03:44:01 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mpls, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mpls-4.2.0
    Built on Mon Dec 19 03:43:06 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mgbl, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mgbl-4.2.0
    Built on Mon Dec 19 03:43:45 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mcast, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mcast-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-routing, V 4.2.0[00], Cisco Systems, at disk0:iosxr-routing-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-infra, V 4.2.0[00], Cisco Systems, at disk0:iosxr-infra-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-fwding, V 4.2.0[00], Cisco Systems, at disk0:iosxr-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-diags, V 4.2.0[00], Cisco Systems, at disk0:iosxr-diags-4.2.0
```

```
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-adv-video-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.2.0
        Built on Mon Dec 19 03:45:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fpd, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fpd-4.2.0
        Built on Mon Dec 19 03:44:20 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-diags-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.2.0
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-k9sec-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-k9sec-supp-4.2.0
        Built on Mon Dec 19 03:44:01 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mgbl-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mgbl-supp-4.2.0
        Built on Mon Dec 19 03:43:45 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mcast-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.2.0
        Built on Mon Dec 19 03:43:23 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-base, V 4.2.0[00], Cisco Systems, at disk0:asr9k-base-4.2.0
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-os-mbi, V 4.2.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.2.0
        Built on Mon Dec 19 03:38:27 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

Boot device on node 0/0/CPU0 is mem:
Package active on node 0/0/CPU0:
iosxr-ce, V 4.2.0[00], Cisco Systems, at disk0:iosxr-ce-4.2.0
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-adv-video, V 4.2.0[00], Cisco Systems, at disk0:iosxr-adv-video-4.2.0
        Built on Mon Dec 19 03:45:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fwding, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fwding-4.2.0
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-cpp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-cpp-4.2.0
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-ce, V 4.2.0[00], Cisco Systems, at disk0:asr9k-ce-4.2.0
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-scfclient, V 4.2.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.2.0
        Built on Mon Dec 19 03:36:31 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mpls, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mpls-4.2.0
        Built on Mon Dec 19 03:43:06 PST 2011
        By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie
```

```
iosxr-mcast, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mcast-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-routing, V 4.2.0[00], Cisco Systems, at disk0:iosxr-routing-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-infra, V 4.2.0[00], Cisco Systems, at disk0:iosxr-infra-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-fwding, V 4.2.0[00], Cisco Systems, at disk0:iosxr-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-diags, V 4.2.0[00], Cisco Systems, at disk0:iosxr-diags-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-adv-video-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-diags-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mcast-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-base, V 4.2.0[00], Cisco Systems, at disk0:asr9k-base-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-os-mbi, V 4.2.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.2.0
    Built on Mon Dec 19 03:38:27 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

Boot device on node 0/3/CPU0 is mem:
Package active on node 0/3/CPU0:
iosxr-ce, V 4.2.0[00], Cisco Systems, at disk0:iosxr-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-adv-video, V 4.2.0[00], Cisco Systems, at disk0:iosxr-adv-video-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fwding, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-cpp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-cpp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-ce, V 4.2.0[00], Cisco Systems, at disk0:asr9k-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-scfclient, V 4.2.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.2.0
```

```
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mpls, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mpls-4.2.0
    Built on Mon Dec 19 03:43:06 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mcast, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mcast-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-routing, V 4.2.0[00], Cisco Systems, at disk0:iosxr-routing-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-infra, V 4.2.0[00], Cisco Systems, at disk0:iosxr-infra-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-fwding, V 4.2.0[00], Cisco Systems, at disk0:iosxr-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-diags, V 4.2.0[00], Cisco Systems, at disk0:iosxr-diags-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-adv-video-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-diags-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mcast-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-base, V 4.2.0[00], Cisco Systems, at disk0:asr9k-base-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-os-mbi, V 4.2.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.2.0
    Built on Mon Dec 19 03:38:27 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

Boot device on node 0/5/CPU0 is mem:
Package active on node 0/5/CPU0:
iosxr-ce, V 4.2.0[00], Cisco Systems, at disk0:iosxr-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-adv-video, V 4.2.0[00], Cisco Systems, at disk0:iosxr-adv-video-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fwding, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-cpp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-cpp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie
```

```
asr9k-ce, V 4.2.0[00], Cisco Systems, at disk0:asr9k-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-scfclient, V 4.2.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mpls, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mpls-4.2.0
    Built on Mon Dec 19 03:43:06 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mcast, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mcast-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-routing, V 4.2.0[00], Cisco Systems, at disk0:iosxr-routing-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-infra, V 4.2.0[00], Cisco Systems, at disk0:iosxr-infra-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-fwding, V 4.2.0[00], Cisco Systems, at disk0:iosxr-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-diags, V 4.2.0[00], Cisco Systems, at disk0:iosxr-diags-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-adv-video-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-diags-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mcast-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-base, V 4.2.0[00], Cisco Systems, at disk0:asr9k-base-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-os-mbi, V 4.2.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.2.0
    Built on Mon Dec 19 03:38:27 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

Boot device on node 0/6/CPU0 is mem:
Package active on node 0/6/CPU0:
iosxr-ce, V 4.2.0[00], Cisco Systems, at disk0:iosxr-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-adv-video, V 4.2.0[00], Cisco Systems, at disk0:iosxr-adv-video-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fwding, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fwding-4.2.0
```

```
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-cpp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-cpp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-ce, V 4.2.0[00], Cisco Systems, at disk0:asr9k-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-scfclient, V 4.2.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mpls, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mpls-4.2.0
    Built on Mon Dec 19 03:43:06 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mcast, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mcast-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-routing, V 4.2.0[00], Cisco Systems, at disk0:iosxr-routing-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-infra, V 4.2.0[00], Cisco Systems, at disk0:iosxr-infra-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-fwding, V 4.2.0[00], Cisco Systems, at disk0:iosxr-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-diags, V 4.2.0[00], Cisco Systems, at disk0:iosxr-diags-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-adv-video-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-diags-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mcast-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-base, V 4.2.0[00], Cisco Systems, at disk0:asr9k-base-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-os-mbi, V 4.2.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.2.0
    Built on Mon Dec 19 03:38:27 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

Boot device on node 0/7/CPU0 is mem:
Package active on node 0/7/CPU0:
iosxr-ce, V 4.2.0[00], Cisco Systems, at disk0:iosxr-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie
```

```
iosxr-adv-video, V 4.2.0[00], Cisco Systems, at disk0:iosxr-adv-video-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-fwding, V 4.2.0[00], Cisco Systems, at disk0:asr9k-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-cpp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-cpp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-ce, V 4.2.0[00], Cisco Systems, at disk0:asr9k-ce-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-scfclient, V 4.2.0[00], Cisco Systems, at disk0:asr9k-scfclient-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mpls, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mpls-4.2.0
    Built on Mon Dec 19 03:43:06 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-mcast, V 4.2.0[00], Cisco Systems, at disk0:iosxr-mcast-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-routing, V 4.2.0[00], Cisco Systems, at disk0:iosxr-routing-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-infra, V 4.2.0[00], Cisco Systems, at disk0:iosxr-infra-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-fwding, V 4.2.0[00], Cisco Systems, at disk0:iosxr-fwding-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

iosxr-diags, V 4.2.0[00], Cisco Systems, at disk0:iosxr-diags-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-adv-video-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-adv-video-supp-4.2.0
    Built on Mon Dec 19 03:45:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-diags-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-diags-supp-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-mcast-supp, V 4.2.0[00], Cisco Systems, at disk0:asr9k-mcast-supp-4.2.0
    Built on Mon Dec 19 03:43:23 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-base, V 4.2.0[00], Cisco Systems, at disk0:asr9k-base-4.2.0
    Built on Mon Dec 19 03:36:31 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie

asr9k-os-mbi, V 4.2.0[00], Cisco Systems, at disk0:asr9k-os-mbi-4.2.0
    Built on Mon Dec 19 03:38:27 PST 2011
    By iox-bld2 in /auto/srcarchive6/production/4.2.0/all/workspace for pie
```

Features Supported on the Cisco ASR 9000 Series Aggregation Services Router

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

- Features Introduced in Cisco IOS XR Software Release 4.2
- 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 Aggregation Services Router platform is not supported on Cisco IOS XR Software Release 3.8.0.

Features Introduced in Cisco IOS XR Software Release 4.2

The following sections contain information on new features and enhancements in Cisco IOS XR Software Release 4.2:

- Software Features Introduced in Cisco IOS XR Software Release 4.2 for the Cisco ASR 9000 Series Router, page 31
- Hardware Features Introduced in Cisco IOS XR Software Release 4.2 for the Cisco ASR 9000 Series Router, page 39

Software Features Introduced in Cisco IOS XR Software Release 4.2 for the Cisco ASR 9000 Series Router

The following new software features were introduced in Cisco IOS XR Software Release 4.2 on the Cisco ASR 9000 Series Router platform:

- SNMP over IPv6—The Cisco IOS XR Software Release 4.2 supports Simple Network Management Protocol (SNMP) over IPv6 on the Cisco ASR 9000 Series Aggregation Services Router. The following SNMP commands are provided with IPv6 support in the Cisco IOS XR Software Release 4.2:
  - snmp-server host

- snmp-server target-list

- snmp-server vrf

- snmp-server engineid remote

For more information about SNMP server commands, see the *SNMP Server Commands on Cisco IOS XR Software* section in Cisco *IOS XR System Management Command Reference*.

- IEEE 1588 (Precision Time Protocol)—The Cisco IOS XR Software Release 4.2 provides support for IEEE 1588 Precision Time Protocol on the Cisco IOS XR ASR 9000 Series Aggregation Services Routers. IEEE 1588 standard defines a method for distributing time around a network, using the Precision Time Protocol (PTP) that allows precise synchronization of devices on a network. The protocol synchronizes real-time clocks in the nodes of a distributed system that communicate using a network to a common time based with nanosecond accuracy. This protocol consists of two parts:

  - The Port State Machine and Best Master Clock Algorithm, which provides a scheme for determining, which ports in the network should run as master that provides time to other clocks to the network, which as slave that receives time from other clocks in the network, and which should be passive (neither master or slave).

  - Mechanisms for slave ports to calculate the difference between the time of its own clock and the time of its master clock. PTP defines two methods to achieve this, the Delay Request-Response mechanism and the Peer Delay mechanism.

This feature requires RSP3 and Typhoon cards. The following interfaces are configured to run as PTP ports:

- All line card IEEE 802.3 Ethernet interfaces.

- DOT1Q VLAN interfaces and QinQ interfaces.

- L2 Attachment Circuits.

PTP is supported over two different transport media - Ethernet and UDP over IPv4.

- 1-Port Channelized OC-3 ATM CEoP SPA — The physical layer interface for the 1-Port Channelized OC-3 Asynchronous Transfer Mode Circuit Emulation over Packets Shared Port Adapters (ATM CEoP SPA) is Optical Carrier-3 (OC-3). This SPA provides one 155.52 Mbps OC-3 network interface for all supported platforms. The single SPA port accepts an Small Form-Factor Pluggable (SFP) module with a duplex LC-type receptacle that allows connection to optical fibre. For more information about this SPA, see the *Cisco ASR 9000 Series Aggregation Services Router SIP and SPA Hardware Installation Guide*.

- NAT44 on ISM—Cis co Carrier-Grade IPv6 (CGv6) solution is a complete suite of applications to help user transitioning from IPv4 to IPv6. NAT44 (Network Address Translation) is one of the applications available in the CGv6 suite and is supported from Release 4.2 onwards. NAT44 (Network Address Translation) is supported on ISM line cards on Cisco ASR 9000 Series Aggregation Services Routers starting from the Cisco IOS XR Software Release 4.2. NAT44 is a large Network Address Translation that is capable of providing private IPv4 to public IPv4 address translation in the order of millions of translations to support a large number of subscribers, and at least 10 Gbps of (inside-to-outside and outside-to-inside) I-MIX traffic per ISM card.

NAT44 on CGv6 offers a way for service provider subscribers and content providers to implement a seamless transition to IPv6. NAT44 on CGv6 employs a network address and port translation (NAPT) methods to aggregate many private IP addresses in to fewer public IPv4 addresses.

The following references can be used for information on CGV6 configuration and commands:

- *Cisco ASR 9000 Series Aggregation Services Router Carrier Grade IPv6 (CGv6) Configuration Guide, Release 4.2.0*—Implementing the CGv6 on Cisco IOS XR Software section of this guide provides information about CGv6 configuration.

- *Cisco ASR 9000 Series Aggregation Services Router Carrier Grade IPv6 (CGv6) Command Reference, Release 4.2.0*—CGv6 Commands on Cisco IOS XR Software section of this guide provides information about the commands used for the CGv6 implementation and operation.

- IPv4/IPv6 VRF-aware ABF—The IPv4/IPv6 VRF-aware ABF feature supports next-hop VRF and IPv4/IPv6 address based on the access control entries (ACE) rule for packet forwarding. It supports up to three next-hops or default next-hops in IPv4/IPv6 ACE configuration each specifying optional VRF name and IPv4/IPv6 address. For more information about IPv4/IPv6 VRF-aware ABF feature, see the Implementing Access Lists and Prefix Lists module in the *Cisco ASR 9000 Series Aggregation Services Router IP Address and Services Configuration Guide*. For complete command reference of the access list commands, see the Access List Commands chapter in the *Cisco ASR 9000 Series Aggregation Services Router IP Address and Services Command Reference*.

- IPv6 Lawful Intercept—An additional support to intercept IPv6 packets based on flow ID has been introduced on the Cisco ASR 9000 Aggregation Services Router to further extend filtration criteria for IPv6 packets. Based on the fields in the IPv6 header that comprises numerous fields defined in IPv6 Header Field Details table, all IPv6 packets are intercepted. The filtration criteria to intercept packets matching a particular flow ID is defined in the tap configuration file. The intercepted mapped flow IDs are sent to the next hop, specified in the MD (Mediation Device) configuration file and the intercepted packets are replicated and sent to the MD, from the line card. The ideal replicate rate on MSC-40 is 100 Mbps depending on packet size and features configured on the router.

- BFD Multihop Global TTL Check—BFD (Bidirectional Forwarding Detection) provides low-overhead, short duration detection of failures in the path between adjacent forwarding engines. BFD Multihop is a BFD session between two addresses that are not on the same interface. BFD can have one global configurable minimum TTL value to drop packets in hardware. Using a peer-router TTL threshold, BFD packets can be sent with a TTL value of 255 and packets received with a TTL smaller than N are discarded. Although, this is a weak security, it is relatively simple to implement in the Network processor.

- BFD Multihop support for BGP—The first application that makes use of BFD multihop will be BGP (Border Gateway Protocol). BFD for BGP can be enabled on a neighbor router and a neighbor router configuration is supported for BGP only. For more information about the configuration of BFD Multihop on a BGP, see the *Configuring Bidirectional Forwarding Detection on the Cisco ASR 9000 Series Router Guide*.

- BFD Multihop support for IPv4—In a BFD Multihop session, BFD control packets on IPv4 are used to confirm the liveness of the remote peer. It also detects interruptions of the forwarding path between two BFD peers based on the detection time used for a BFD Multihop session. During the BFD session bring-up phase, the source IP address and destination IP address pair of an incoming packet along with its VRF context is used to identify a particular BFD Multihop session, until the discriminators of both BFD speakers are exchanged. This method is used for multihop sessions requested from routing protocols.

- CEM (Circuit Emulation over Packet Switched Network over MPLS)—Circuit Emulation over Packet (CEoP) is a way to carry TDM circuits over packet switched network and is the imitation of a physical connection. CEoP replaces leased lines and legacy time-division multiplex (TDM) networks putting TDM bits into packets, encapsulates them into appropriate header and sends through public switched network (PSN). The Cisco IOS XR Release 4.2 supports CEM functionality only on the SPA, 1-port Channelized OC3 SPA [SPA-1xOC3-CE-ATM]. For more information

about CEM, see the *Configuring Circuit Emulation over Packet on the Cisco ASR 9000 Series Router/Cisco IOS XR Software* chapter in *Cisco ASR 9000 Series Interfaces and Hardware component Configuration Guide*.

- Link Bundling for POS Interfaces—Link Bundling is used to group multiple point-to-point links together into one logical link to provide higher bidirectional bandwidth, redundancy, and load balancing between two routers. The Cisco ASR 9000 Series Router supports bundling for POS interfaces on the ASR 9000 SIP-700 line card. The line card can physically accommodate up to 32 POS link bundles provided that all of them have the same speed.

  A bundled POS interface can be created by configuring both the bundle and the member interfaces. For ethernet link bundling, links within a single bundle must be at the same speed. For POS link bundling, links within a single bundle can have mixed speed and bandwidth rate up to 4x among links is supported. POS link bundles does not support IPv6, LACP, ACL, VPLS and Multicast for Release 4.2. For more information about the POS link bundles, see the *Configuring Link Bundling on the Cisco ASR 9000 Series Router Guide*.

- Unidirectional Link Detection Protocol (UDLD)—UDLD is a single-hop physical link protocol used to monitor an ethernet link, such as point-to-point and shared media links. It detects link problems that are not detected at the physical layer and is used especially in situations, where there can be a mismatch between the transmitting and receiving connections of a port during possible wiring errors, when using unbundled fiber links. UDLD works by exchanging protocol packets between the neighboring devices based on the condition that both the devices on the link must support UDLD and have it enabled on respective ports.

  For more information about UDLD operation, see the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide*.

- IPv4 Generic Routing Encapsulation (GRE)—GRE is a tunneling protocol used to encapsulate many types of packets to enable data transmission using a tunnel. For more information about GRE, see the Cisco ASR 9000 Series Aggregation Services Router MPLS Layer 3 VPN Configuration Guide

- Local Connect Redundancy—Local Connect Redundancy (LCR) addresses the local switching limitation of Multi-Chassis Link Aggregation (MC-LAG) implementation in Cisco IOS XR Software Release 4.0. The LCS solution provides Loose Coupling between the DHDs. If one of the DHDs is switched and the second DHD is not be switched, yet the loop is closed by providing a path for traffic between the two PoAs. This approach is used to protect the XC with a backup interface going to the other PoA. The backup interface will become active in case of failures.

- MPLS Transport Profile—Pseudowires (PWs) use MPLS transport profile (MPLS-TP) tunnels as a transport mechanism within the MPLS-TP environment to provide the transport network service layer for the IP and MPLS traffic to traverse over it. MPLS-TP tunnels provide Transport networks functionality through statistically provisioned bidirectional label switched paths (LSPs). MPLS-TP supports static-static, static-dynamic, and dynamic-static multisegment pseudowires.

  For more information about MPLS-TP, see the *Cisco ASR 9000 Series Aggregation Services Router L2VPN and Ethernet Services Guide*.

- QoS Policy Propagation using Border Gateway Protocol (QPPB)—Quality-of-Service Policy Propagation Using Border Gateway Protocol (QPPB) helps to classify packets by QoS Group ID, based on Access control lists (ACLs), Border Gateway Protocol (BGP) community lists, BGP autonomous system (AS) paths, Source Prefix address, or Destination Prefix address. After packet classification, other QoS features such as policing and weighted random early detection (WRED) can be used to specify and enforce policies to fit a specific business model. QPPB also allows the user to map BGP prefixes and attributes to Cisco Express Forwarding (CEF) parameters that can be used to enforce traffic policing.

- QoS for POS link bundling—For POS link bundles, bandwidth is used in terms of percentage for policers and output queues. The queue limit for output queues is based on time. As queuing is not supported for input QoS, bandwidth is used for policer only. With input QoS configured, the aggregate bundle bandwidth for the affected line card changes, as a member link is added or removed from a bundle. One input Qos policy instance is assigned for each SIP 700 line card in POS link bundle. When a member link is added to a bundle with output QoS configured, the policy map of the bundle is applied to the member link.

- QoS for BNG—The Broadband Network Gateway (BNG) provides Session Aware Ethernet services for PPPoE subscribers. Quality-of-Service for BNG requires new QoS parameters to be included and existing parameters to be changed in a broadband subscriber management, since quick activation, deactivation and modifications of QoS policies are necessary.

  For more information about QoS for BNG, see the *Configuring QoS for Broadband Network Gateways on Cisco ASR 9000 Series Routers Guide*.

- ACL Based Forwarding—ACL Based Forwarding (ABF) is used by specifying the next-hop address in ACL configurations, so that the configured next-hop address from ACL is used for forwarding packet towards its destination instead of routing packet-based destination address lookup. ABF helps to choose service from multiple providers for broadcast TV over IP, IP telephony, data, and so on. Internet service providers can divert user traffic to various content provides through ABF functionality.

- Selective VRF (Virtual Routing and Forwarding) Download—SVD is an architectural solution to alleviate scalability and convergence problems with L3VPN technologies. This solution is sued to download only those prefixes and lables to a line card that are actively required to forward traffic through that line card. SVD is enabled by default. The solution tries to optimize the table and route download to cards by classifying line cards by SVD card role and routes by SVD route type. For more information about SVD, see the *Selective Virtual Routing and Forwarding Table Download: A solution to increase Layer3 VPN scale* white paper at http://www.cisco.com/en/US/technologies/collateral/tk648/tk365/white_paper_c11-681649.html

- Video Monitoring Unicast—Video Monitoring, which is implemented on the routers, improves video quality and QoE, enabling network operators to measure and track video transport performance on a per-flow basis. Video Monitoring monitors the flows with unicast destination addresses. Video Monitoring support for unicast flows provides backward compatibility to Trident LC and is also available on Typhoon LC. For more information about the Video Monitoring feature, see the *Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide*.

- BNG—Broadband Network Gateway (BNG) has a range of capabilities to improve the service provider's ability to control a subscriber's services and to simplify overall network operations. The BNG features provide subscriber management at a logical aggregation point in the network. The service provider can control the user experience through identification, address assignment, authentication, authorization, accounting, and various other features such as security, QoS, and subscriber forwarding. For more information about BNG and its configuration, see the *Cisco ASR 9000 Broadband Network Gateway Configuration Guide*.

- High Availability for Lawful Intercept—The high availability for lawful intercept is a feature enabled by default from Release 4.2 onwards. It provides operational continuity of the TAP flows and provisioned MD (Mediation Device) tables to reduce loss of information due to route processor fail over (RPFO).

  When RPFO is detected, MDs are required to re-provision all the rows related to CISCO-TAP2-MIB, CISCO-IP-TAP-MIB and CISCO-USER-CONNECTION-TAP-MIB, to synchronize database view across RP and MD. The replay timer, an internal timeout is used to

re-provision TAP entries smoothly while maintaining existing TAP flows. For more information about high availability for lawful intercept, see the *Cisco ASR 9000 Series Aggregation Services Router System Security Configuration Guide.*

- CISCO-IP-STAT-MIB—The CISCO-IP-STAT-MIB incorporates objects to provide support for the Cisco IP statistics as implemented in command interfaces. cipPrecendenceTable, cipMacTable, cipMacFreeTable, cipPrecedenceXTable, cipMacXTable are the tables available in CISCO-IP-STAT-MIB. For more information about the tables, see the *Cisco ASR 9000 Series Aggregation Services Routers MIB Specifications Guide.*

- IF-MIB Congestion Control Support—A packet from ingress interface traverses through various internal queues before reaching the egress interface. Packets can be dropped when any of these queues cannot hold them, either due to the full queue or based on some policies or priorities. The respective queue or device drivers like ASIC drivers, interface drivers, platform manager, QoS EA, etc. can track the drop of the packets.

  CISCO-IF-EXTENSION-MIB consists of two objects, cieIfInOctetRate and cieIfOutOctetRate for reporting number of bytes of data transferred from or to the interface within 5 minutes. The other two objects, cieIfInputQueueDrops and cieIfOutputQueueDrops are used for reporting packet drops in queues available through Stats Infrastructure. While configuring an interface for congestion control, a callback is registered with interface manager to get the bandwidth change and also notified to update rising threshold or falling threshold. All the interface types supported for packet loss configuration are also applicable to congestion control configurations.

- CISCO-USER-CONNECTION-TAP-MIB—The ASR 9000 Series Aggregation Services Router supports CISCO-USER-CONNECTION-TAP-MIB. This MIB provides the mechanism to provision for lawful interception of Broadband Network Gateway (BNG) subscribers. For more information about this MIB, see the *Cisco ASR 9000 Broadband Network Gateway Configuration Guide.*

- CISCO-SELECTIVE-VRF-DOWNLOAD-MIB—This MIBmodule defines objects describing selective VRF download. To know more about the selective VRF download (SVD) feature, see the feature description in this section. For more information about CISCO-SELECTIVE-VRF-DOWNLOAD-MIB, see the *Cisco ASR 9000 Series Aggregation Services Routers MIB Specifications Guide.*

- IF-MIB Congestion Control Trap—When congestion control goes above upper threshold, a SNMP trap is generated to indicate that an event is set. When congestion control goes below lower threshold, another SNMP trap is generated to indicate that an event is cleared. mteTriggerThreshold table contains the details on threshold values for congestion control. The following provides sample trap information:

```
Received SNMPv2c Trap:
Community: public
From: 12.25.20.9
sysUpTimeInstance = 618943
snmpTrapOID.0 = mteTriggerFalling
ifType.87 = hdlc(118)
ifName.87 = POS0/2/0/0
mteHotValue.0 = 3500
mteHotOID.0 = [cieIfInOctetRate.87 | cieIfInputQueueDrops.87]
mteHotContextName.0 =
mteHotTargetName.0 =
mteHotTrigger.0 = POS0_2_0_0-ingress

Received SNMPv2c Trap:
Community: public
From: 12.25.20.9
sysUpTimeInstance = 619943
snmpTrapOID.0 = mteTriggerRising
ifType.87 = hdlc(118)
```

```
ifName.87 = POS0/2/0/0
mteHotValue.0 = 4000
mteHotOID.0 = [cieIfOutOctetRate.87 | cieIfOutputQueueDrops.87]
mteHotContextName.0 =
mteHotTargetName.0 =
mteHotTrigger.0 = POS0_2_0_0-egress
```

- Multiple Group Optimization (MGO) for HSRP—By running the Hot Standby Router Protocol (HSRP) control traffic for just one of the sessions, MGO reduces control traffic in a deployment consisting of many subinterfaces with identical redundancy requirements. All other sessions that become slaves of this session inherit their state from this session. For more information on MGO, see the *Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide*.

- Redundancy Manageability Improvements—This feature supports configuration, control and monitoring of redundancy protection for various kinds of components on Cisco managed devices. It is a generic approach to handle basic redundancy control and monitoring for many types of redundant member components and redundancy architectures as long as there is an Entity MIB entPhysicalIntex and entPhysicalVendorType assigned to each member component. For more information about this feature, see the *Cisco ASR 9000 Series Aggregation Services Routers MIB Specifications Guide*.

- Security Hardening—In Cisco IOS XR LPTS, as part of for-us packet delivery process, the rate at which packets are delivered are selectively monitored to avoid overwhelming the CPU. LPTS filters and polices the packets based on the defined flow-type rate in hardware before punting to the software. Today, some of the control protocols have a configured peer or source interface in some way, but the protocol (application) and/or LPTS ignores the peer configuration or has a single policer rate for all known and unknown (default) connections. This restricts the user's ability to police the rates for known peers differently than for unknown peers.

  Cisco IOS XR security system needs a granular protocol traffic classification based on the configured peers and ingress interfaces. To classify and distinguish the traffic accurately, the protocol or application needs to have new flow-types and policer rates in hardware. New flow-types such as DNS, RADIUS, TACACS, NTP KNOWN, RSVP KNOWN and PIM MULTICAST KNOWN are added to the configuration. The user gets the new flow types by running the following command:

  ```
  show lpts pifib hardware police location 0/3/CPU0
  ```

  ```
  76 DNS 101 0/0
  77 RADIUS 1000 0/0
  78 TACACS 101 0/0
  79 (null) 101 0/0
  ```

  For more information about LPTS commands, see the *Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Command Reference*.

- SNMP context/view improvements—The CISCO-CONTEXT-MAPPING-MIB provides an option to associate an SNMP context to a feature package group. This MIB allows manageability of license MIB objects specific to a feature package group. For more information about this feature, see the *Cisco ASR 9000 Series Aggregation Services Routers MIB Specifications Guide*.

- VRF-aware IF-MIB—The IF-MIB describes the attributes of physical and logical interface. This MIB is made VRF-aware to provide access to information on selected interfaces stored in IF-MIB table to a user. VRF-aware IF-MIB makes management of IF-MIB table for VRF based network more secure. The ifTable and ifXTable are VRF-aware tables. For more information about this feature, see the *Cisco ASR 9000 Series Aggregation Services Routers MIB Specifications Guide*.

- VRF Aware IP-FORWARD-MIB—The IP-FORWARD-MIB contains objects to control the display of Classless Interdomain Routing (CIDR) multipath IP routes. The IP-FORWARD-MIB is made VRF-aware to provide selective access to information stored in IP forwarding table to user. This makes management of IP forwarding table for VRF based networks more secure. ipForwardTable is a VRF-aware table. For more information about this feature, see the *Cisco ASR 9000 Series Aggregation Services Routers MIB Specifications Guide*.

- BGP Multi-Instance/Multi-AS— BGP (Border Gateway Protocol) Multi-Instance/Multi-AS feature allows BPM to directly interact with BGP speakers and sends configuration information using the AIPC channels. The Async IPC (AIPC) is a point-to-point communication channel that can be used to read and write bi-directionally. The Cisco IOS XR Software Release 4.2 supports multiple BGP instances running:

    - Different address families within an unit under test(UUT).

    - Different ASes within an UUT with each AS running different address families.

    - VPNVX unicast address family with mutually exclusive VRFs with an UUT.

  The constraint is that each BGP speaker process must run mutually exclusive address family or VRFs due to the underlying shared RIB/FIB infrastructure. The Cisco IOS XR Software Release 4.2 also facilitates migration of configuration republishing mechanism between BPM process and BGP speaker process(es) from sysdb to Async IPC for filtered configuration publication for each BGP speaker process as well as for reducing load to sysdb.

- OSPFv2 Per-Prefix LFA IPFRR & SRLG support—Per-prefix LFA computation is used to find the backup path for each individual path to the prefix that is subject to the computation based on the user configuration. The computation finds out a neighbor to which traffic for prefix can be sent in case of a primary link failure. This guarantees that the traffic is not sent back to the calculation node. Users can limit the amount of prefixes, for which per-prefix LFA computation is done, thus by associating the minimum prefix priority with the per-prefix LFA computation. Per-prefix LFA considers the local SRLG values during the backup computation. SRLG integration with per-prefix LFA is done through the tiebreaker approach, where SRLG disjoint is used as one of the tiebreakers.

- OSPFv3 Non-Stop Routing (NSR) support—The Cisco IOS XR Software Release 4.2 supports NSR functionality for OSPFv3 processes. When NSR is enabled (disabled by default), OSPFv3 processes on the active RP, synchronizes all necessary data, and states with the OSPFv3 process on the standby RP. During the switchover, OSPFv3 processes on the newly active RP has all the necessary data and states to continue running, and does not require any help from its neighbors.

- Route Consistency Checker (RCC) and Label Consistency Checker (LCC)—RCC and LCC are used to verify consistency periodically in the background, as well as on-demand from the CLI, between control plane and data plane route and label programming in a Cisco IOS XR Software. Any detected inconsistencies are re-verified to ensure no false positives, and the detection mechanism uses an adaptive algorithm to ensure that route and label convergence are not affected in any way. For more information on how to use the RCC and LCC, see the *Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide*.

- Hierarchical RPL—Hierarchical Routing Policy Language (RPL) enables apply condition policies to specify a route policy in the **if** statement of another route policy. It also enables route policies to be applied for configurations based on hierarchical policies. Cisco IOS XR RPL supports apply condition policies that can be used with various types of Boolean operators along with various other matching statements. Apply conditions can also be used with parameters and are supported on all attach points and on all clients. Hierarchical apply conditions can be used without any constraints on cascaded level.

- System-wide Route and Label Prioritization—System-wide Route and Label Prioritization feature provides faster and more consistent Interior Gateway Protocol (IGP) convergence due to router or network events. For more information on how to prioritize and download the critical routes and labels, see the *Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide*.

- MPLS Traffic Engineering (TE) Soft Preemption—Multiprotocol Label Switching (MPLS) TE Soft Preemption is an extension to the Resource ReSerVation Protocol Traffic Engineering (RSVP-TE) protocol to minimize or eliminate the traffic disruption over the preempted Label Switched Paths (LSPs). For more information on how to achieve zero traffic loss, see the *Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide*.

- MPLS Traffic Engineering (TE) Path-Option Attributes—MPLS TE path option attributes are configurable through a template configuration. This template named attribute-set, is configured globally in the MPLS TE mode. For more information on how to implement path option attributes, see the *Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide*.

Hardware Features Introduced in Cisco IOS XR Software Release 4.2 for the Cisco ASR 9000 Series Router

The following hardware features are supported for the Cisco IOS XR Software Release 4.2 on the Cisco ASR 9000 Series Aggregation Services Router platform:

- 1-Port Channelized OC-3 ATM CEoP SPA. For more about this feature, see the Software Features Introduced in Cisco IOS XR Software Release 4.2 for the Cisco ASR 9000 Series Router section in this document and the *Cisco ASR 9000 Series Aggregation Services Router SIP and SPA Hardware Installation Guide* online.

- 1-Port and 3-Port Clear Channel OC-3 ATM SPA. For more information about this SPA hardware, refer to the *Cisco ASR 9000 Series Aggregation Services Router SIP and SPA Hardware Installation Guide* online.

- 1-Port Clear Channel OC-12 ATM SPA. For more information about this SPA hardware, refer to the *Cisco ASR 9000 Series Aggregation Services Router SIP and SPA Hardware Installation Guide* online.

- RSP-440 Route Processor card.

  For more information about the ASR 9000 RSP-440 Route Processor card hardware, refer to the *Cisco ASR 9000 Series Aggregation Services Router Overview and Reference Guide* and the *Cisco ASR 9000 Series Aggregation Services Router Hardware Installation Guide* online.

- Cisco IOS XR Software Release 4.2 introduces support for the following ASR 9000 Enhanced Ethernet Line Cards:

  - 24-Port 10GE DX Line Card, Packet Transport Optimized with SFP+ optics
  - 24-Port 10GE DX Line Card, Service Edge Optimized with SFP+ optics
  - 2-Port 100GE DX Line Card, Packet Transport Optimized with CFP optics
  - 2-Port 100GE DX Line Card, Service Edge Optimized with CFP optics
  - 80 Gigabyte Modular Line Card, Packet Transport Optimized
  - 80 Gigabyte Modular Line Card, Service Edge Optimized
  - 20-Port GE Modular Port Adapter (MPA) with SFP optics
  - 4-Port 10GE Modular Port Adapter (MPA) with SFP+ optics

For more information about this ASR 9000 Enhanced Ethernet Line Card hardware, refer to the *Cisco ASR 9000 Series Aggregation Services Router Overview and Reference Guide* and the *Cisco ASR 9000 Series Aggregation Services Router Hardware Installation Guide* online.

- Integrated Routing and Bridging— 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). The BVI is a virtual interface within the router that acts like a normal routed interface. BVI only acts as a gateway for the corresponding bridge-domain to a routed interface within the router. In addition to supporting a configurable MAC address, BVI supports only Layer 3 attributes. IRB is suppported on the ASR 9000 Enhanced Ethernet Line Cards introduced in Release 4.2.0.

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

  For information about IRB commands, see the *Integrated Routing and Bridging Commands on the Cisco ASR 9000 Series Router* chapter of the *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Command Reference*.

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 Aggregration Services Router Router

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

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

The following new software features were introduced in Cisco IOS XR Software Release 4.0.1 on the Cisco ASR 9000 Series Aggregration Services Router 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services Router 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 and 32x BGP ECMP—This feature supports dynamic configuration of ECMP paths ranging from 1 to 32 IGP paths and 8-32 ECMP paths for BGP prefixes. The ASR 9000 Enhanced Ethernet Line Card supports 32 ECMP paths for BGP prefixes and the ASR 9000 Ethernet Line Card supports 8 ECMP paths for BGP prefixes.

- 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 Aggregation Services Router 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 Aggregration Services Router 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 Aggregation Services Router Router

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

- New Software Features Supported on all Platforms, page 50
- Cisco ASR 9000 Series Aggregation Services Router-Specific Software Features, page 51
- Cisco ASR 9000 Series Aggregation Services Router Hardware Features Introduced in Cisco IOS XR Software Release 4.0.0, page 53

> ✎
>
> **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 Aggregration Services Router-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 Aggregation Services Router 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services Router, Release 4.0.*

Cisco ASR 9000 Series Aggregation Services Router 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 Aggregation Services 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 Aggregation Services Router SIP and SPA Hardware Installation Guide*
- *Cisco Interface and Hardware Component Configuration Guide for the Cisco ASR 9000 Series Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services Router platform for the SSH remote command
  execution feature. This feature allows an operator to execute a command on the
  Cisco ASR 9000 Series Aggregation Services Router without logging into the
  Cisco ASR 9000 Series Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services Routers in Cisco IOS XR Software Release 4.2). 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 Aggregation Services 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 Aggregation Services 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 <Interface 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 Aggregation Services Router platform:

- ANCP over IP Unnumbered Interfaces

    Cisco IOS XR Software Release 3.9.0 added support on the Cisco ASR 9000 Series Aggregation Services 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 Aggregation Services Router platform.

- 100ms LACP

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

- Cisco ASR 9000 Series Aggregration Services Router 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 4.2.

- L2 Multicast Limit

Cisco IOS XR Software Release 3.9.0 added support on the
Cisco ASR 9000 Series Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services Router platform:

- MSTAG Enhancements

  Cisco IOS XR Software Release 3.7.3 added support on the
  Cisco ASR 9000 Series Aggregation Services 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 Aggregation Services 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 Aggregration Services Router 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 Aggregation Services 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 Aggregration Services Router 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 Aggregation Services 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 Aggregration Services Router 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/mcasr9kigsn.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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 ,4.2 the Cisco ASR 9000 Series Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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 Aggregation Services 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.

- On rare occassions, during Cisco IOS XR Software Release 4.2.0 testing, we have observed issues while making bulk configuration changes (1000+ lines) in a single configuration (Using copy (remote) running, commit replace and rollback.) We recommend that you archive configurations before executing bulk configuration changes on this scale in Cisco IOS XR Software Release 4.2.0. This way you can easily retry or compare results.

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 Aggregation Services Router Software Release 4.2 and the Cisco ASR 9000 Series Aggregration Services Router platform.

Open Cisco IOS XR Software Release 4.2 Caveats

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

- **CSCtw80900**

   Basic Description:

   420-PSI: After router reload, new configuration is not applied.

   Symptom:

   1. When performing a commit replace, a syslog similar to the following is displayed:

   ```
   RP/0/RSP0/CPU0:Dec 20 05:02:45.555 : sysdb_mc[399]: %SYSDB-SMC-7-TIMEOUT : Message
   #0x200088ed state:0x13fe5326, gid(1009),destined for all local, timed out having
   received 7 of 8 expected responses: returning received responses to client config.
   Check for potential transport issues within the system, or deadlocked SysDB processes.
   ```

   2. Following a router reload or LC OIR, configuration that had been previously removed by the commit replace operation reappears in the active running configuration.

   Conditions:

   The following two conditions are the reasons:

   1. The configuration that is being replaced is either,

   a. larger than 20MB (ASCII), or

   b. over 100,000 interfaces on a single LC

   2. The configuration changes involves a Viking RSP3 LC with the following types:

   ```
   0/1/CPU0        A9K-MOD80-SE           IOS XR RUN        PWR,NSHUT,NMON
   0/5/CPU0        A9K-24x10GE-SE         IOS XR RUN        PWR,NSHUT,MON
   0/0/CPU0        A9K-8T/4-E             IOS XR RUN        PWR,NSHUT,MON
   0/4/CPU0        A9K-2T20GE-E           IOS XR RUN        PWR,NSHUT,MON
   0/5/CPU0        A9K-2x100GE-TR         IOS XR RUN        PWR,NSHUT,MON
   0/6/CPU0        A9K-24x10GE-SE         IOS XR RUN        PWR,NSHUT,MON
   0/7/CPU0        A9K-4T-E               IOS XR RUN        PWR,NSHUT,MON
   ```

   Workaround:

- If you see the SYSDB-SMC-7-TIMEOUT error message described in Symptom 1 above, and have not yet performed any additional commits,and have not yet performed a router reload or LC OIR:

   – Repeat the original **commit replace** command, until you do not see the sysdb_mc syslog any more.

- If you see the SYSDB-SMC-7-TIMEOUT error message described in Symptom 1 above, and you have performed some addtional configuration commits, and have not yet performed a router reload or LC OIR:

   1. Execute **show running** and verify that the running configuration is what you want.

   2. Execute **cfs check** twice to make sure the running and saved configurations are now in sync and saved properly.

- If you have already performed a router reload or LC OIR and see only old configuration:

   You have two options:

Option 1:

1. rollback to the point where you see the sysdb_mc syslog.

2. repeat the original commit replace operation.

3. repeat any subsequent configuration changes.

Option 2: wipe out all the configuration via **commit replace** and re-apply the settings you want to apply.

After doing Option 1 or Option 2:

1. Execute **show running** and verify that the running configuration meets your needs.

2. Execute **cfs check** twice to make sure that the running and saved configuration are now in sync and saved properly.

Recovery:

None.

- **CSCtt92490**

   Basic Description:

   xml_tty_agent procedure crash when xml help is requested.

   Symptom:

   Help for CLI over XML does not work. XML agent process does not respond after the request for returning help on CLI show command.

   Conditions:

   When ACT software sends an XML request to the router for help hints, the XML agent did not respond and ACT was blocked. In addition, the Help hints returned were not correct.

   Workaround:

   None. When this is observed on a setup, it can be safely ignored assuming that the hardware under test is functioning good.

   Recovery:

   None.

- **CSCtu31007**

   Basic Description:

   IPv6 LPTS entry was missing for some bundle interfaces. The IPv6 ND packets did not go through and IPv6 traffic was dropped at affected bundle interfaces.

   Symptom:

   IPv6 protocol peering neighbor sessions flapping; IPv6 traffic could not pass.

   Conditions:

   The bundle interfaces are on CRS-3 linecards. The issue may happen after scaled configuration is restored by either **commit replace** or router reload.

   Workaround:

   Restart pifibm_server_lc process on the bundle member linecards.

   Recovery:

   None.

- **CSCtt38345**

Basic Description:

The SNMP duplicate request dropping feature is not working.

Symptom:

SNMP duplicate request dropping feature is supposed to drop requests from the same NMS and port with the same request ID, and if the number of requests in queue is greater than 20. This feature is not working in 4.2.

Conditions:

SNMP duplicate request dropping feature is supposed to drop requests from the same NMS and port with the same request ID and if the number of requests in queue is greater than 20.

Workaround:

None.

Recovery:

None.

- **CSCtt30049**

  Basic Description:

  Slow SNMP response issue when polling IFMIBs with random-order.

  Symptom:

  Slowing down of SNMP response time is seen and the rate drops to about 45 packets/second under certain conditions.

  Conditions:

  1. When SNMP requests are sent from one NMS/ source IP at a rate greater than 3,000 packets/sec

  2. When SNMP requests are sent from 18 source IPs / 18 NMS stations at a rate of 500 packets/sec or more

  3. When CLI commands (for example, config, show commands) are being run while SNMP requests are being sent by NMS, even at a rate of about 500 packets/sec

  4. SNMP response is slow when polling ifmibs in random-order

  Workaround:

  The above conditions may not be normal scenarios and could be avoided. For example, limit the number of NMSes to 15 or less and their polling frequency. When this is observed on a setup, the hardware under test is assumed to be functionally good in routing/switching.

  Recovery:

  Avoid concurrently running heavy CLI commands/processing and sending high rate of SNMP requests from NMS. Avoid the above conditions if the system gets into a state of slow response to SNMP requests.

- **CSCtw81342**

  Basic Description:

  Alternate path is used for Inter-AS P2MP TE forwarding after LC reload.

  Symptom:

  After LC OIR affecting egress interface for a P2MP midpoint sub-lsp, the tunnel sub-lsp gets signaled over a path different from one specified at head. Traffic is not impacted.

Conditions:

1. Inter-AS P2MP tunnel.

2. LC OIR affects egress interface for the sub-LSP.

3. RIB does not withdraw the route to the next-hop address (in down state)- this is timing issue related.

Workaround:

1. At head (for affected destination), create a higher preference path-option (lower index) with same properties, and force reoptimization of the tunnel.

2. Shut/no shut the p2mp tunnel recovers the sub-LSP on the correct path.

or,

3. Disable/no disable the p2mp destinatio at head.

Recovery:

None.

- **CSCtt31599**

Basic Description:

Incorrect pw-type after configuration rollback due to configuration failure.

Symptom:

After a configuration reject, the pw-type changes from Ethernet-VLAN to Ethernet.

Conditions:

The issue is seen with the following sequence of config steps:

1. Start with

```
l2vpn
logging
pseudowire
!
pw-class c1
encapsulation mpls
control-word
transport-mode vlan
```

2. Now configure

```
l2vpn
logging
pseudowire
!
pw-class mpls_class
encapsulation l2tpv3
transport-mode vlan
```

3. This configuration gets rejected and the configuration applied in step 2 is rolledback.

4. All the PWs that are using this class now have the pw-type as Ethernet instead of Ethernet-vlan.

Workaround:

To recover, re-apply configuration from step1, though the running configuration after step 4 shows the same as in step 1.

Recovery:

None.

- **CSCtt39429**

   Basic Description:

   420: Copy of 4K static route shown fail, although successful.

   Symptom:

   Copying of 4K static route shows error, although successful.

   Conditions:

   When trying to copy 4k static route configuration to running configuration, an error appears stating, "Failed to commit one or more configuration items". However, there is no failure.

   Workaround:

   None.

   Recovery:

   None.

- **CSCtw62111**

   Basic Description:

   Running RCMD diag script may lead to RP Reload.

   Symptom:

   In one specific manifestation, the GSP process could crash with the following message:

   ```
   gsp[238]: %OS-gsp-3-MUTEX_OP_FAILED : get_sgrp_gid: Mutex op cond_wait failed on mutex
   grp_cond (RDS_CGRP_/etc/eem_rdsfs_1) : Connection timed out : pkg/bin/gsp :
   (PID=627769708)
   ```

   There are other possible manifestations for other infra process restarts or deadlocks.

   Conditions:

   When RCMD diagnostics mode is enabled using the following CLI, the RCMD EEM diagnostics script collects debug information from various components within the router.

   ```
   config
     router-convergence
       collect-diagnostics <>
     event manager policy rcmd_diags.tcl username <>
   ```

   In certain scenarios, where the CPU utilization is high (100%) over a period of time and the diagnostics script gets triggered, it could create race conditions which causes deadlocks and some processes to restart, leading to reload of the RP.

   Workaround:

   Disable the RCMD diagnostics script by not registering the EEM policy.

   Remove the following CLI:

   ```
   config
     router-convergence
       collect-diagnostics <>
     event manager policy rcmd_diags.tcl username <>
   ```

   Recovery:

   None.

Further Problem Description:

It is recommended not to use the RCMD diagnostics feature in 4.2.0 in the production deployment, due to possible delays and deadlocks in the XR infrastructure in certain race conditions while CPU is running at 100% for an extended period.

- **CSCtw47793**

   Basic Description:

   IP/LDP LFA does not choose TE Tunnel as backup with use-candidate-only.

   Symptom:

   TE Tunnel may not be chosen as IP/LDP LFA FRR back-up route.

   Conditions:

   The defect is seen when ISIS has a directly connected neighbor and also a TE tunnel to the directly connected neighbor. If the 'use-candidate-only' is configured with the TE tunnel as the only candidate, the back-up is not calculated.

   Workaround:

   Do not to use the use-candidate-only feature in this scenario. Instead, use explicit exclude statements for excluding interfaces from being used as a back-up.

   Note that this defect would not occur if the Tunnel destination was multiple hops away from ISIS or if ISIS does not have a direct adjacency with the tunnel destination.

   Recovery:

   None.

- **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 Aggregation Services Router Router

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

- **CSCts69912**

   Basic Description:

420-UI: ipv4-mfwd-partner trace back following a crash after night run.

Symptom:

An ipv4-mfwd-partner process crash is observed on the SIP-700 LC on the ASR9K system in an overnight traffic test.

Conditions:

This problem is observed after the initial router reload and after an extended traffic test, typically in an overnight test. The ipv4_mfwd_partner process crashes on the SIP-700 and recovers by itself. There is no impact of multicast traffic when this crash is observed. Once the process recovers, no subsequent crashes have been observed in a longevity test.

Workaround:

None.

Recovery:

Recovers on its own. If NSF is configured for multicast then there is no impact on traffic. The process restarts and recovers.

- **CSCtw44911**

  Basic Description:

  420-SIT: PTP master configuration is deleted on slave in case of partial delete.

  Symptom:

  After setting up multiple PTP masters in the master table of an interface or profile, attempting to delete one master from the table results in the deletion of the entire table.

  Conditions:

  After setting up masters, for example,

  ```
  RP/0/0/CPU0:ios#config
  RP/0/0/CPU0:ios(config)#interface gigabitEthernet 0/2/0/1
  RP/0/0/CPU0:ios(config-if)#ptp
  RP/0/0/CPU0:ios(config-if-ptp)#master ipv4 10.0.0.2
  RP/0/0/CPU0:ios(config-if-ptp)#master ipv4 10.0.0.3
  RP/0/0/CPU0:ios(config-if-ptp)#master ethernet AB34.657D.8970
  RP/0/0/CPU0:ios(config-if-ptp)#master ipv6 11::AF
  ```

  Trying to delete one of these masters will result in the entire table being deleted, for example,

  ```
  RP/0/0/CPU0:ios#config
  RP/0/0/CPU0:ios(config)#interface gigabitEthernet 0/2/0/1
  RP/0/0/CPU0:ios(config-if)#ptp
  RP/0/0/CPU0:ios(config-if-ptp)#no master ipv6 11::AF
  ```

  If the above command is executed, the entire master table will be deleted, not just the IPv6 entry. This issue only affects the 4.2.0 release.

  Workaround:

  None.

  Recovery:

  If this is observed, all PTP masters for that interface or profile must be re-entered.

- **CSCtw85241**

  Basic Description:

  420-UI: TM latency> 50 millisec causing Tail Drops on Trident for l2vpn.

Symptom:

On trident LC, observed packet drop in l2vpn traffic stream.

Conditions:

On steady state, on Trident LC, traffic drop is observed on l2vpn traffic stream, approximately every 5 to 15 minutes.

Workaround:

There is no known workaround.

Recovery:

There is no known recovery.

- **CSCtw93296**

  Basic Description:

  Not all MCAST traffic is replicated towards the egress LC.

  Symptom:

  Not all MCAST traffic is replicated towards the egress LC.

  Conditions:

  On RSP3/Colossus system, not all MCAST traffic is replicated towards egress LC.

  Condition is observed with at least 64K OLE configured on 1 NP.

  Workaround:

  Problem is not seen when egress line rate fallS below 94%.

  Recovery:

  None.

- **CSCtw80943**

  Basic Description:

  Ethernet SLA not working over bundle-efp: DMM packet malformed.

  Symptom:

  SLA DMM packets are being corrupted when configured on Bundles EFPs. Corrupt packet can be seen using the following CLI output:

  show ethernet cfm interfaces statistics

  BEXYZ   2759   0 DMM Packet malformed - TLV offset is either too small or is beyond the end of the packet

  Conditions:

  Issue is seen only when Ethernet SLA is configured on Bundle EFPs on RSP3.

  Workaround:

  None.

  Recovery:

  None.

- **CSCtw79456**

  Basic Description:

Port Location is the same for two ports under two different modules.

Symptom:

The same name TenGig port is appearing under both the modules with the same location under A9K-MPA-2X10GE & A9K-MOD160-TR in entityMib.

Conditions:

Observed only with A9k-MOD160-XX cards in the ASR9k chassis having Ethernet Plugs inserted.

Workaround:

None.

Recovery:

None.

- **CSCtw66664**

 Basic Description:

 CFM results differ whether obtained from RSP2 or RSP3 based routers.

 Symptom:

 Onthe RSP3 system, the Link trace message did not reach MEP.

 Conditions:

 The issue occurs when MIP is configured on the core facing bundle interface and the AC is a sub-interface (MEP). The MIP and MEP should be from two different EPs or two different linecards to see this issue of link trace failing. The linktrace reaches the MIP and will fail to reach the MEP.

 Workaround:

 There is no known workaround.

 Recovery:

 None.

- **CSCtw75983**

 Basic Description:

 MWR flaps multiple times between Holdover and Acquire on asr9k reload.

 Symptom:

 MWR flaps multiple times between Holdover and Acquire on asr9k reload.

 Conditions:

 When the asr9k node is reloaded, the MWR which is slaving off the asr9k toggles multiple times between holdover and acquire before phase-lock. Following are the syslog messages observed:

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to
up
%TOP_MODULE-6-CLK_STATUS_CHANGE: Recovered clock status changed to ACQUIRING
%TOP_MODULE-6-CLK_STATUS_CHANGE: Recovered clock status changed to HOLDOVER
```

 Workaround:

 None.

 Recovery:

 It recovers on its own.

- **CSCtw76496**

Basic Description:

Static macs are not displayed properly under **show l2v forwar br mac**.

Symptom:

Static mac entry still shows as a dynamic mac entry after the conversion of a dynamic mac entry to a static one via user configuration.

Conditions:

When the user creates a static mac for an already existing dynamic mac entry, or vice versa, the output of **show l2vpn forwarding <>** does not reflect this change. It continues to show the entry as a dynamic mac instead of a static mac entry. This is a show command display issue only and does not impact the feature or functionality.

Workaround:

None.

Recovery:

No recovery is required. It is a display only issue.

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 Aggregation Services Router Software feature set matrix (PIE files) and associated filenames available for the Cisco IOS XR Software Release 4.2 supported on the Cisco ASR 9000 Series Aggregation Services 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:router# run nvgen -F 1
```

   b. Create a dummy config commit:

```
RP/0/RSP0/CPU0:router# config
RP/0/RSP0/CPU0:router(config)# hostname <hostname>
RP/0/RSP0/CPU0:rotuer(config)# commit
RP/0/RSP0/CPU0:router(config)# end
```

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

```
RP/0/RSP0/CPU0:router# 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:router# 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, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

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