Release Notes for Cisco XR 12000 Series Router for Cisco IOS XR Software Release

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

These release notes describe the features provided in the Cisco IOS XR Software Release 4.2.1 for the Cisco XR 12000 Series Router and are updated as needed.

Note For information on the Cisco XR 12000 Series Router running Cisco IOS XR Software Release 4.2.1, see the "Important Notes on Cisco IOS XR Software and Cisco XR 12000 Series Router, on page 34" section.

You can find the most current Cisco IOS XR software documentation at:

http://www.cisco.com/en/US/products/ps6342/tsd_products_support_series_home.html

These electronic documents may contain updates and modifications. For more information on obtaining Cisco documentation, see the "Obtaining Documentation and Submitting a Service Request".

For a list of software caveats that apply to Cisco IOS XR Software Release 4.2.1 , see the "Caveats" section. The caveats are updated for every release and are described at www.cisco.com.

We recommend that you view the field notices for this release located at the following URL to see if your software or hardware platforms are affected:
http://www.cisco.com/en/US/support/tsd_products_field_notice_summary.html

Cisco IOS XR Software running on the Cisco XR 12000 Series 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 (VRRP) features.
- **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), Resource Reservation Protocol (RSVP), Label Distribution Protocol (LDP), Virtual Private LAN Service (VPLS), 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.
- **Quality of Service (QoS)—**This supports QoS mechanisms including policing, marking, queuing, random and hard traffic dropping, and shaping. Additionally, Cisco IOS XR Software also supports modular QoS command-line interface (MQC). MQC is used to configure QoS features.
- **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 messages.
- **Security—**This provides comprehensive network security features including access 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 management plane 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).
- **Craft Works Interface (CWI)—**CWI is a client-side application used to configure and manage Cisco routers. Management and configuration features include fault, configuration, security, and inventory, with an emphasis on speed and efficiency. The CWI provides a context-sensitive graphical representation of the objects in a Cisco router, simplifying the process of configuring and managing the router. The CWI allows you to log in to multiple routers and perform management tasks.
- **Availability—**This supports rich availability features such as fault containment, fault tolerance, fast switchover, link aggregation, nonstop routing for ISIS, LDP, BGP, and OSPF, and nonstop forwarding (NSF).
- **Multicast service delivery in SP NGN—**MVPNv4 support carries multicast traffic over an ISP MPLS core network.
- **IPv6 Provider Edge Router support for IPv6 applications—**This delivers IPv6 traffic over an IPv4/MPLS core with IPv6 provider edge router (6PE) support.
- **IPv6 VPN over MPLS (6VPE) support—**This delivers IPv6 VPN over MPLS (IPv6) VPN traffic over an IPv4 or MPLS core with 6VPE support.
- **6VPE over L2TPv3 support—**This delivers IPv6 VPN traffic over L2TPv3 core with 6VPE support. This feature is also available on Cisco IOS Software.
- **Enhanced core competencies:**
  - IP fast convergence with Fast Reroute (FRR) support for Intermediate System-to-Intermediate System (IS-IS) and OSPF
  - Path Computation Element (PCE) capability for traffic engineering
- **L2TPv3 Tunneling Mechanism—**Service Providers who do not use MPLS in the core, but want to offer VPN services can use the L2TPv3 tunneling mechanism. This feature support includes IPv4 (VPNv4) and IPv6 (6VPE) VPN services using L2TPv3 encapsulation. This L2TPv3 packet is encapsulated in an IPv4 delivery header and is carried across an IPv4 backbone. VPN prefixes are

advertised with BGP labels and resolved over L2TPv3 tunnels. This feature is supported only on the Cisco XR 12000 Series Router.

For more information about new features provided on the Cisco XR 12000 Series Router for Cisco IOS XR Software Release, 4.2.1 see the "New Features in Cisco IOS XR Software Release 4.2.1 " section in this document.

System Requirements

This section describes the system requirements for Cisco IOS XR Software Release 4.2.1 supported on the Cisco XR 12000 Series Router.

To determine the software versions or levels of your current system, see the "Determining Your Software Version, on page 18" section.

The systems requirements include the following information:

Feature Set Table

Cisco IOS XR Software is packaged in *feature sets* (also called *software images*). Each feature set contains a specific set of Cisco IOS XR Software Release 4.2.1 features.

Table 1: Cisco IOS XR Software Release 4.2.1 PIE Files, on page 4 lists the Cisco IOS XR Software feature set matrix (PIE files) and associated filenames available for Cisco IOS XR Software Release 4.2.1 , supported on the Cisco XR 12000 Series Router.

Table 1: Cisco IOS XR Software Release 4.2.1 PIE Files

Feature Set	Filename	Description
Composite Package		
Cisco IOS XR IP Unicast Routing Core Bundle	c12k-mini-pie-4.2.1	Contains the required core packages, including OS, Admin, Base, Forwarding, Routing, SNMP Agent, and Alarm Correlation.
Cisco IOS XR IP Unicast Routing Core Bundle	c12k-mini-vm-4.2.1	Contains the required core packages including OS, Admin, Base, Forwarding, and Routing SNMP Agent, and Alarm Correlation. Contains the required core packages including OS, Admin, Base, Forwarding, and Routing SNMP Agent, and Alarm Correlation.
Optional Individual Packages[1]		
Cisco IOS XR Manageability Package	c12k-mgbl.pie-4.2.1	CORBA[2] agent, XML Parser, and HTTP server packages.
Cisco IOS XR MPLS Package	c12k-mpls.pie-4.2.1	MPLS-TE[3], LDP[4], MPLS Forwarding, MPLS OAM[5], LMP[6], OUNI[7], and RSVP[8].
Cisco IOS XR Multicast Package	c12k-mcast.pie-4.2.1	Multicast Routing Protocols (PIM[9], MSDP[10], IGMP[11], Auto-RP, BSR[12]), Tools (SAP MTraces, MRINFO), and Infrastructure (MRIB[13], MURIB[14], MFWD[15]).
Cisco IOS XR Security Package	c12k-k9sec.pie-4.2.1	Support for Encryption, Decryption, IPSec[16], SSH[17], SSL[18], and PKI[19]. Software based IPSec support: maximum of 500 tunnels
Cisco IOS XR Standby RP Boot Image	mbiprp-rp.vm-4.2.1	Support for booting the Standby RP on a Cisco XR 12000 Series Router.
Cisco IOS XR FPD Package	c12k-fpd.pie-4.2.1	Firmware for shared port adapters (SPA) and for fixed port line cards supported in Cisco IOS XR.

Cisco IOS XR Diagnostic Package	c12k-diags.pie-4.2.1	Diagnostic utilities for Cisco IOS XR routers.
Cisco IOS XR Documentation Package	c12k-doc.pie-4.2.1	.man pages for Cisco IOS XR Software on the Cisco XR 12000 Series Router chassis.
Cisco IOS XR Service Package	c12k-service.pie-4.2.1	Includes binaries to support Booster daughter card.

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

Table 2: Cisco IOS XR Software Release 4.2.1 TAR Files, on page 5 lists the Cisco XR 12000 Series Router TAR files.

Table 2: Cisco IOS XR Software Release 4.2.1 TAR Files

Feature Set	Filename	Description
Cisco IOS XR IP/MPLS Core Software	XR12000-iosxr-4.2.1.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 IP/MPLS Core Software 3DES	XR12000-iosxr-k9-4.2.1.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

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 a Cisco XR 12000 Series Router running Cisco IOS XR Software Release 4.2.1 consist of the following:

- 2-GB route memory on performance route processor 2 (PRP-2)

  However, a 4-GB route memory on PRP-2 is required if BGP is enabled or other applications are running on the router.
- 2-GB or greater ATA flash storage on PRP-2
- 4-GB route memory on performance route processor 3 (PRP-3)
- 2-GB or greater Compact flash storage on PRP-3
- 1-GB line card route memory on all Engine 3 line cards
- 1-GB line card memory on Engine 5-based SPA interface processor (SIP-600)
  - The default route memory on the 12000-SIP-600 is 1GB
- 2-GB line card memory on all Engine 5-based SPA interface processors (SIPs)
  - The default route memory on the 12000-SIP-401, 501, and 601 is 2 GB.

  Note The performance route processor 1 (PRP-1) is not supported in production environments.
- 2-GB PCMCIA Flash Disk

Hardware Supported

The following tables lists the supported hardware components on the Cisco XR 12000 Series Router and the minimum required software versions. For more information, see the "Firmware Support, on page 16" section.

Table 3: Cisco XR 12000 Series Router Supported Hardware and Minimum Software Requirements

Component	Part Number	Support from version
Cisco XR 12000 Series Router Series Router Systems		
Cisco XR 12000 Series 4-slot chassis	XR-12000/4	3.3
Cisco XR 12000 Series 6-slot chassis	XR-12000/6	3.3
Cisco XR 12000 Series 10-slot chassis	XR-12000/10	3.3
Cisco XR 12000 Series 16-slot chassis	XR-12000/16	3.3
Cisco XR 12000 Series Router Chassis Hardware		
4-slot chassis & backplane, 1 Blower, 2 AC	12000/4-AC	3.3
4-slot chassis & backplane, 1 Blower, 2 DC	12000/4-DC	3.3
6-slot chassis & backplane, 2 Alarm, 1 Blower, 2 AC	12000/6-AC	3.3
6-slot chassis & backplane, 2 Alarm, 1 Blower, 2 DC	12000/6-DC	3.3
10-slot chassis & backplane, 2 Alarm, 1 Blower, 2 AC	12000/10-AC	3.3
10-slot chassis & backplane, 2 Alarm, 1 Blower, 2 DC	12000/10-DC	3.3
16-slot chassis & backplane, 2 Alarm, 2 Blower, 3 AC	12000/16-AC3	3.3
16-slot chassis & backplane, 2 Alarm, 2 Blower, 4 DC	12000/16-DC	3.3
16-slot chassis & backplane, 2 Alarm, 2 Blower, 4 AC	12000/16-AC4	3.3
Cisco XR12000 16-slots; 2 Alarms, Advanced 2 Blowers, up to 8 DC	12000E/16-DC	3.8
Cisco XR12000 16-slots; 2 Alarms, Advanced 2 Blowers, up to 8 AC	12000E/16-AC	3.8
Cisco XR 12000 Series Router Fabric Hardware		
Enhanced 20 Gbps Fabric & Alarm card for Cisco 12004	12004E/20	3.6

Enhanced 80 Gbps Fabric & Alarm card for Cisco 12404	12404E/80	3.6
Enhanced 30 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12006	12006E/30	3.6
Enhanced 120 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12406	12406E/120	3.6
Enhanced 50 Gbps Fabric (2xCSC and 5xSFC) for Cisco 12010	12010E/50	3.5.2
Enhanced 200 Gbps Fabric (2xCSC and 5xSFC) for Cisco 12410	12410E/200	3.5.2
Enhanced 800 Gbps Fabric (2xCSC and 5xSFC) for Cisco 12810	12810E/800	3.4
Enhanced 80 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12016	12016E/80	3.5.2
Enhanced 320 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12416	12416E/320	3.5.2
Enhanced 1280 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12816	12816E/1280	3.4
80 Gbps Fabric & Alarm card for Cisco 12404	12404/80	3.3
30 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12006	12006/30	3.3
120 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12406	12406/120	3.3
50 Gbps Fabric (2xCSC and 5xSFC) for Cisco 12010	12010/50	3.3
200 Gbps Fabric (2xCSC and 5xSFC) for Cisco 12410	12410/200	3.3
80 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12016	12016/80	3.3
320 Gbps Fabric (2xCSC and 3xSFC) for Cisco 12416	12416/320	3.3
Cisco XR 12000 Series Route Processor Hardware		
Cisco XR 12000 Series Performance Route Processor 2	PRP-2	3.2
Cisco XR 12000 Series Performance Route Processor 3	PRP-3	3.8
Cisco XR 12000 Series 40 GB Hard Drive Option	HD-PRP2-40G	3.2

Cisco XR 12000 Series PRP-3 80G Hard Drive	HD-PRP3	3.8
Cisco XR 12000 Series General Chassis Hardware		
Cisco XR 12000 Series PCMCIA Flash Disk 1 GB	MEM-FD1G	3.2
Cisco XR 12000 Series PCMCIA Flash Disk 2 GB	MEM-FD2G	3.2
Cisco XR 12000 Series PCMCIA Flash Disk 4 GB	MEM-FD4G	3.8
Cisco XR 12000 Series PRP-3 2GB Compact Flash	FLASH-PRP3-2G	3.8
Cisco XR 12000 Series PRP-3 4GB Compact Flash	FLASH-PRP3-4G	3.8
Cisco XR 12000 Series PRP-3 4GB Memory (2X2GB DIMM)	MEM-PRP3-4G	3.8
Cisco XR 12000 Series PRP-3 8GB Memory (2X4GB DIMM)	MEM-PRP3-8G	3.8
Cisco XR 12000 Series SPA Interface Processor Hardware		
Multirate 2.5G IP Services Engine (Modular)	12000-SIP-401	3.3
Multirate 5G IP Services Engine (Modular)	12000-SIP-501	3.3
Multirate 10G IP Services Engine (Modular)	12000-SIP-601	3.3
Cisco XR 12000 Series SPA Interface Processor 10G	12000-SIP-600	3.2
Cisco XR 12000 Series Router SONET Interface Modules and SPAs		
Cisco XR 12000 Series 4xOC12c/STM4c POS Intermediate Reach Single-Mode optics	4OC12X/POS-I-SC-B	3.2
Cisco XR 12000 Series 4xOC12c/STM4c POS Short Reach Multi-Mode optics	4OC12X/POS-M-SC-B	3.2
Cisco XR 12000 Series 16xOC3c/STM1c POS Short Reach Multi-Mode optics	16OC3X/POS-M-MJ-B	3.2
Cisco XR 12000 Series 16xOC3c/STM1c POS Intermediate Reach Single-Mode optics	16OC3X/POS-I-LC-B	3.2
Cisco XR 12000 Series 8xOC3c/STM1c POS Short Reach Multi-Mode optics	8OC3X/POS-MM-MJ-B	3.2
Cisco XR 12000 Series 8xOC3c/STM1c POS Intermediate Reach Single-Mode optics	8OC3X/POS-IR-LC-B	3.2

Cisco XR 12000 Series 4xOC3c/STM1c POS Short Reach Multi-Mode optics	4OC3X/POS-MM-MJ-B	3.2
Cisco XR 12000 Series 4xOC3c/STM1c POS Intermediate Reach Single-Mode optics	4OC3X/POS-IR-LC-B	3.2
Cisco XR 12000 Series 4xOC3c/STM1c POS Long Reach Single-Mode optics	4OC3X/POS-LR-LC-B	3.2
Cisco XR 12000 Series 1xOC48c/STM16c POS Short Reach Single-Mode optics	OC48X/POS-SR-SC	3.2
Cisco XR 12000 Series 1xOC48c/STM16c POS Long Reach Single-Mode optics	OC48X/POS-LR-SC	3.2
Cisco XR 12000 Series 4-Port OC-3c/STM-1c ATM ISE Line Card, multimode	4OC3X/ATM-MM-SC	3.4
Cisco XR 12000 Series 4-Port OC-3c/STM-1c ATM ISE Line Card, single-mode	4OC3X/ATM-IR-SC	3.4
Cisco XR 12000 Series 4-port OC-12/STM-4 ATM multimode ISE line card with SC connector	4OC12X/ATM-MM-SC	3.4
Cisco XR 12000 Series 4-port OC-12/STM-4 ATM single-mode, intermediate-reach ISE line card with SC Connector	4OC12X/ATM-IR-SC	3.4
Cisco 1-Port OC-192c/STM-64c POS/RPR Shared Port Adapter with VSR Optics	SPA-OC192POS-VSR	3.3
Cisco 1-Port OC-192c/STM-64c POS/RPR Shared Port Adapter with LR Optics	SPA-OC192POS-LR	3.2
Cisco 1-Port OC-192c/STM-64c POS/RPR Shared Port Adapter with XFP Optics	SPA-OC192POS-XFP	3.2
2-Port OC-48/STM16 POS/RPR Shared Port Adapters	SPA-2XOC48POS/RPR	3.3
1-Port Channelized OC-12/DS0 Shared Port Adapters	SPA-1XCHOC12/DS0	3.5
1-Port Channelized STM-1/OC-3 to DS0 Shared Port Adapter	SPA-1XCHSTM1/OC3	3.5
1-Port OC-48c/STM-16 POS/RPR Shared Port Adapter	SPA-1XOC48POS/RPR	3.5
2-Port OC-12c/STM-4 POS Shared Port Adapter	SPA-2XOC12-POS	3.5
4-Port OC-12c/STM-4 POS Shared Port Adapter	SPA-4XOC12-POS	3.5

4-Port OC-3c/STM-1 POS Shared Port Adapter	SPA-4XOC3-POS-V2	3.5
8-Port OC-12c/STM-4 POS Shared Port Adapter	SPA-8XOC12-POS	3.5
8-Port OC-3c/STM-1 POS Shared Port Adapter	SPA-8XOC3-POS	3.5
Cisco 8-Port Channelized T1/E1 Shared Port Adapter	SPA-8XCHT1/E1	3.6
Cisco 1-Port Channelized OC-48/DS3 Optical Packet Processor Shared Port Adapter	SPA-1XCHOC48/DS3	3.6
1-Port Clear Channel OC-3 ATM SPA	SPA-1XOC3-ATM-V2	3.7
3-Port Clear Channel OC-3 ATM SPA	SPA-3XOC3-ATM-V2	3.7
1-Port Clear Channel OC-12 ATM SPA	SPA-1XOC12-ATM-V2	3.7
2-Port Channelized T3/E3 ATM CEoP SPA	SPA-2CHT3-CE-ATM	3.7
24-Port Channelized T1/E1 ATM CEoP SPA	SPA-24CHT1-CE-ATM	4.0.1
1-Port Channelized OC-3 ATM CEoP SPA	SPA-1CHOC3-CE-ATM	4.1.1
Ethernet Interface Modules and SPAs		
Cisco XR 12000 Series 4xGE with SFP optics	4GE-SFP-LC	3.2
Cisco 5-Port Gigabit Ethernet Shared Port Adapter, Version 2	SPA-5X1GE-V2	3.4
Cisco 8-Port Gigabit Ethernet Shared Port Adapter, Version 2	SPA-8X1GE-V2	3.4
Cisco 8-Port 10BASE-T/100BASE-TX Fast Ethernet Shared Port Adapter, Version 2	SPA-8X1FE-TX-V2	3.4
Cisco 8-Port 100BASE-TX Fast Ethernet Shared Port Adapter	SPA-8XFE-TX	3.3
Cisco 10-Port Gigabit Ethernet Shared Port Adapter, Version 2	SPA-10X1GE-V2	3.4
Cisco 1-Port Ten Gigabit Ethernet Shared Port Adapter, Version 2	SPA-1X10GE-L-V2	3.4
Cisco 5-Port Gigabit Ethernet Shared Port Adapter with SFP optics	SPA-5X1GE	3.2
Cisco 10-Port Gigabit Ethernet Shared Port Adapter with SFP optics	SPA-10X1GE	3.2

Cisco 1-Port 10 Gigabit Ethernet Shared Port Adapter with XFP optics	SPA-1XTENGE-XFP	3.2
Cisco 2-Port Gigabit Ethernet Shared Port Adapter, Version 2	SPA-2X1GE-V2	3.4.1
Cisco XR 12000 Series Router T3 and E3 Interface Modules and SPAs		
2-port Channelized T3 to DS0 Shared Port Adapter	SPA-2XCT3/DS0	3.3
4-port Channelized T3 to DS0 Shared Port Adapter	SPA-4XCT3/DS0	3.3
2-port Clear Channel T3/E3 Shared Port Adapter	SPA-2XT3/E3	3.3
4-port Clear Channel T3/E3 Shared Port Adapter	SPA-4XT3/E3	3.3
Cisco XR 12000 Series Router Channelized Line Cards		
Cisco 1-Port Channelized OC-48 line card	CHOC48/DS3-SR-SC	3.6
Cisco 1-Port Channelized OC-12 line card	CHOC12/DS1-SR-SC	3.8
Cisco 4-Port Channelized OC-12 line card	4CHOC12/DS3-I-SCB	3.8

Software Compatibility

Cisco IOS XR Software Release 4.2.1 is compatible with the following Cisco XR 12000 Series Router systems:

- Cisco XR 12004 Router
- Cisco XR 12006 Router
- Cisco XR 12010 Router
- Cisco XR 12016 Router
- Cisco XR 12404 Router
- Cisco XR 12406 Router
- Cisco XR 12410 Router
- Cisco XR 12416 Router
- Cisco XR 12810 Router
- Cisco XR 12816 Router

The following chassis are supported for an existing installed base:

- Cisco XR 12008 Router
- Cisco XR 12010 Router

- Cisco XR 12012 Router

Note If you are running Cisco IOS XR Software on a Cisco XR120xx system with SIP 600, 401, 501, or 601, you must upgrade the fabric cards. For ROMMON, MBUS, and Fabric Downloader versions, see the "Other Firmware Support" section.

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

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

================================ ==============================================
                                          Field Programmable Device Package
                                 ==============================================
                                                                    SW      Min Req   Min Req
Card Type            FPD Description            Type Subtype    Version   SW Ver    HW Vers
==================== ========================== ==== ======= =========== ========  =========
E3-OC12-ATM-4        Mickey FPGA                lc   fpga2   40971.00        0.00       0.0
                     IOB FPGA                   lc   fpga3   41091.00        0.00       0.0
                     SAF 0 FPGA                 lc   fpga4   45586.00        0.00       0.0
                     Mouse FPGA                 lc   fpga1   40977.00        0.00       0.0
-------------------------------------------------------------------------------------------
E3-OC3-ATM-4         Mickey FPGA                lc   fpga2   40971.00        0.00       0.0
                     IOB FPGA                   lc   fpga3   41091.00        0.00       0.0
                     SAF 0 FPGA                 lc   fpga4   45586.00        0.00       0.0
                     Mouse FPGA                 lc   fpga1   40977.00        0.00       0.0
-------------------------------------------------------------------------------------------
12000-ServEngCard    TREX FPGA                  lc   fpga2     162.45        0.00       0.0
                     TREX FPGA                  lc   fpga1     0.41257       0.00       0.0
-------------------------------------------------------------------------------------------
12000-SIP            HABANERO FPGA              lc   fpga2     240.03        0.00       0.0
                     JALAPENO FPGA              lc   fpga5     240.13        0.00       0.0
                     JALAPENO FPGA              lc   fpga5     240.13        0.00       0.0
                     JALAPENO FPGA              lc   fpga1     255.23        0.00       0.0
-------------------------------------------------------------------------------------------
E3-OC12-CH-1         Shiver FPGA                lc   fpga1       1.02        0.00       0.0
-------------------------------------------------------------------------------------------
SPA-IPSEC-2G         Sequoia                    spa  fpga2       1.01        0.00       1.0
                     Lodi                       spa  fpga1       1.22        0.00       1.0
                     SPA PROM                   spa  rommon      1.01        0.00       1.0
-------------------------------------------------------------------------------------------
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-2XT3/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	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-2XCT3/DS0	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-24CHT1-CE-ATM	SPA T3 Subrate FPGA	spa	fpga2	1.10	0.00	1.0
	SPA I/O FPGA	spa	fpga1	2.32	0.00	1.0
	SPA ROMMON	spa	rommon	1.03	0.00	1.0
SPA-2CHT3-CE-ATM	SPA T3 Subrate FPGA	spa	fpga2	1.11	0.00	1.0
	SPA I/O FPGA	spa	fpga1	2.22	0.00	1.0
	SPA ROMMON	spa	rommon	1.04	0.00	1.0
SPA-1CHOC3-CE-ATM	SPA OC3 Subrate FPGA	spa	fpga2	2.23	0.00	2.0
	SPA I/O FPGA	spa	fpga1	2.23	0.00	2.0
	SPA ROMMON	spa	rommon	1.04	0.00	2.0
SPA-IPSEC-2G-2	Sequoia	spa	fpga2	1.01	0.00	1.0
	Lodi	spa	fpga1	1.22	0.00	1.0
	SPA PROM	spa	rommon	1.01	0.00	1.0
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-1XCHOC12/DS0	SPA I/O FPGA	spa	fpga2	1.00	0.00	0.49
	SPA I/O FPGA	spa	fpga1	1.36	0.00	0.49
	SPA ROMMON	spa	rommon	2.02	0.00	0.49
SPA-OC192POS	SPA FPGA swv1.2	spa	fpga1	1.02	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	spa	fpga1	1.02	0.00	0.0
	SPA FPGA swv1.2 hwv2	spa	fpga1	1.02	0.00	2.0
SPA-10X1GE	SPA FPGA swv1.10	spa	fpga1	1.10	0.00	0.0
SPA-5X1GE	SPA FPGA swv1.10	spa	fpga1	1.10	0.00	0.0
SPA-2XOC48POS/RPR	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.0
SPA-4XOC48POS/RPR	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.0
SPA-1XTENGE-XFP	SPA FPGA swv1.11	spa	fpga1	1.11	0.00	0.0
SPA-8X1FE	SPA FPGA swv1.1	spa	fpga1	1.01	0.00	0.0
SPA-1XOC48POS/RPR	SPA FPGA swv1.2	spa	fpga1	1.02	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-8X1GE-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-2X1GE-V2	SPA FPGA swv1.1	spa	fpga1	1.01	0.00	0.0
SPA-1X10GE-L-V2	SPA FPGA swv1.11	spa	fpga1	1.11	0.00	0.0
SPA-8X1FE-V2	SPA FPGA swv1.1	spa	fpga1	1.01	0.00	0.0
SPA-4XOC3-POS-V2	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.5
SPA-1X10GE-L-IT	SPA FPGA swv1.0	spa	fpga1	1.00	0.00	0.0
SPA-1XOC3-ATM-V2	TATM SPA IOFPGA	spa	fpga1	2.02	0.00	0.0
SPA-2XOC3-ATM-V2	SPA TATM IOFPGA	spa	fpga1	2.02	0.00	0.0

```
-----------------------------------------------------------------------------------------------
SPA-3XOC3-ATM-V2     SPA TATM IOFPGA            spa  fpga1       2.02        0.00      0.0
-----------------------------------------------------------------------------------------------
SPA-1XOC12-ATM-V2    SPA TATM IOFPGA            spa  fpga1       2.02        0.00      0.0
-----------------------------------------------------------------------------------------------
```

Firmware Support

The Cisco XR 12000 Series Router supports the following firmware code:

- Line cards (LCs)

  For Engine 3 line card:

  - Maintenance Bus (MBUS) Agent Software-RAM version 4.7, ROM version 4.7
  - ROM Monitor version 19.0
  - Fabric Downloader - RAM version 10.1, ROM version 10.1 (The ROM version will be the same as the RAM version if upgraded.)

  For Engine 5 line card:

  - Maintenance Bus (MBUS) Agent Software-RAM version 4.7, ROM version 4.7
  - ROM Monitor version 19.0
  - Fabric Downloader - RAM version 6.1, ROM version 6.1 (The ROM version will be the same as the RAM version if upgraded.)

- Router processors (RPs)

  For Performance Route Processor 2 (PRP-2):

  - Maintenance Bus (MBUS) Agent Software-RAM version 4.7, ROM version 4.7
  - ROM Monitor version 1.24

  For Performance Route Processor 3 (PRP-3):

  - Maintenance Bus (MBUS) Agent Software-RAM version 4.7, ROM version 4.7
  - ROM Monitor version 1.4.0

Minimum Firmware Requirement

The following table provides the procedures and resources for minimum firmware requirements:

- After completing an RMA the newly-received linecard may not have appropriate IOS XR firmware installed.

  Depending on the type of firmware that needs upgrading the symptoms can vary as follows:

  - ROMMON needs updating the linecard will not boot up

- MBUS needs updating the linecard may fail to boot or keeps reloading
- Fabric Loader needs updating the linecard will take long time to boot
- FPD needs updating the linecard experiences packet corruption / drop

Note The FPD PIE has to be installed in order to upgrade to the latest FPD image. Refer to the *Upgrading FPD on Cisco IOS XR Software* chapter of the *Cisco IOS XR System Management Command Reference for the Cisco XR 12000 Router* online.

RMA Card Firmware Upgrade Procedure

To upgrade the fabric-downloader, ROMMON, Mbus, and current field-programmable device (FPD) image package on a single RMA linecard or on all modules installed in a router, use the **upgrade all** command in the admin mode.

upgrade all location {*node-id* | **all**} [**force**]

Where **location** *node-id* specifies that all ROM images will be upgraded on the physical location of the line card received through RMA defined by the *node-id* argument. The *node-id* argument is entered in the rack/slot/module notation.

The **upgrade all location all** command upgrades all ROM images on all line cards (LCs) that are installed in the router.

For an RMA linecard firmware upgrade you'll want to use the **upgrade all location** {*node-id*} command

The optional force parameter skips the version check and forces an upgrade.

- The list of minimum supported firmware versions is available online in this matrix which contains links to PDF copies of the IOS XR Firmware Upgrade Guides which are available online here :

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

- Refer to the *Hardware Redundancy and Node Administration Commands on Cisco IOS XR Software* chapter of the *Cisco IOS XR System Management Command Reference* for the *Cisco XR 12000 Router* for the **upgrade all** command syntaxhttp://www.cisco.com/en/US/docs/routers/xr12000/software/xr12k_r4.0/system_management/command/reference/b_yr40xr12k_chapter_0111.html.

Requirement of Cisco IOS Image Level and Boot Helper Version for Migration

If you are migrating from Cisco IOS to Cisco IOS XR Software on the Cisco XR 12000 Series Router, you must have the following minimum Cisco IOS image level and Boothelper version to support Release 4.2.1:

- Cisco IOS image—12.0(32)S
- Cisco IOS Boothelper—12.0(32)S0a

If you have an earlier version of this system, you must upgrade to the minimum supported level before performing a migration. Otherwise, your migration fails. For more information, see *Migrating from Cisco IOS to Cisco IOS XR Software on the Cisco XR 12000 Series Router* document.

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:

Procedure

Step 1 Establish a Telnet session with the router.

Step 2 Enter **show version** command from EXEC mode.

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

Cisco IOS XR Software, Version 4.2.1[Default]
Copyright (c) 2012 by Cisco Systems, Inc.

ROM: System Bootstrap, Version 12.00(20101111:181729) [karangan-rommon 2.4dev(0.67)]
DEVELOPMENT SOFTWARE
Copyright (c) 1994-2010 by cisco Systems,  Inc.

irace-c12k1-r1 uptime is 22 minutes
System image file is "disk0:c12k-os-mbi-4.2.1/mbiprp-rp.vm"

cisco 12416/PRP (7457) processor with 2621440K bytes of memory.
7457 processor at 1266Mhz, Revision 1.2
Cisco 12416 320 Gbps

1 4 Port ISE Packet Over SONET OC-12c/STM-4 Controller (4 POS)
2 1 Port ISE Packet Over SONET OC-48c/STM-16 Controllers (2 POS)
1 Cisco 12000 Series SPA Interface Processor-601/501/401
1 8 port ISE OC3 Controller (8 POS)
1 Cisco 12000 Series SPA Interface Processor-600
1 Cisco 12000 4 Port Gigabit Ethernet Controller (4 GigabitEthernet)
1 Cisco 12000 Series Performance Route Processor
3 Management Ethernet
7 PLIM_QOS
8 T3
4 Serial network interface(s)
20 GigabitEthernet/IEEE 802.3 interface(s)
8 FastEthernet
1 MgmtMultilink
16 SONET/SDH
16 Packet over SONET/SDH
1018k bytes of non-volatile configuration memory.
2052768k bytes of disk0: (Sector size 512 bytes).
1000432k bytes of disk1: (Sector size 512 bytes).
65536k bytes of Flash internal SIMM (Sector size 256k).

Boot device on node 0/0/CPU0 is mem:
Package active on node 0/0/CPU0:
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie
```

```
c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

Boot device on node 0/1/CPU0 is mem:
Package active on node 0/1/CPU0:
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
```

```
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

Boot device on node 0/2/CPU0 is mem:
Package active on node 0/2/CPU0:
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

Boot device on node 0/3/CPU0 is mem:
Package active on node 0/3/CPU0:
```

```
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

Boot device on node 0/4/CPU0 is mem:
Package active on node 0/4/CPU0:
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
```

```
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

Boot device on node 0/5/CPU0 is mem:
Package active on node 0/5/CPU0:
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
```

```
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

Boot device on node 0/6/CPU0 is mem:
Package active on node 0/6/CPU0:
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

Configuration register on node 0/7/CPU0 is 0x102
Boot device on node 0/7/CPU0 is disk0:
Package active on node 0/7/CPU0:
c12k-ce, V 4.2.1[00], Cisco Systems, at disk0:c12k-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-fwding, V 4.2.1[00], Cisco Systems, at disk0:c12k-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

c12k-base, V 4.2.1[00], Cisco Systems, at disk0:c12k-base-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie
```

```
c12k-os-mbi, V 4.2.1[00], Cisco Systems, at disk0:c12k-os-mbi-4.2.1
    Built on Sun May 27 08:01:29 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-ce, V 4.2.1[00], Cisco Systems, at disk0:iosxr-ce-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-diags, V 4.2.1[00], Cisco Systems, at disk0:iosxr-diags-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-routing, V 4.2.1[00], Cisco Systems, at disk0:iosxr-routing-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-fwding, V 4.2.1[00], Cisco Systems, at disk0:iosxr-fwding-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie

iosxr-infra, V 4.2.1[00], Cisco Systems, at disk0:iosxr-infra-4.2.1
    Built on Sun May 27 07:59:37 UTC 2012
    By iox-bld3 in /auto/srcarchive6/production/4.2.1/all/workspace for pie
```

Features Introduced in Cisco IOS XR Software Release 4.2.1

MVPN Bidirectional Overview

MVPN Bidirectional (BIDIR) uses GRE or MLDP MS-PMSI (Partitioned MDT) to support BIDIR in MVPN. This functionality allows each RP-PE to announce a BGP AD route with a unique core group that is used by the RP-PE for its partitioned MDT traffic. The core group is also configured and each PE that has the RP mapping for the RP joins this group. All BIDIR sources are sending traffic to a group G along with encapsulated source traffic as its own address. The group G of the partitioned-MDT corresponds to the correct RP-PE (the PE via which the RP is reachable). Since there may be more than one partitioned-MDTs carrying traffic for group G, receiver-PEs need to implement a strict RPF check based on the core group address G of the partitioned-MDT.

The root of the partitioned-MDT (RP-PE) acts as the Designated Forwarders (DF) on its tree. BIDIR uses the concept of Designated Forwarders (DF) for forwarding. A single DF for a particular PIM-BIDIR group exists on every link within a PIM domain. DF is the router on the link with the best Unicast route to the RP.

The partitioned-MDT picks up the traffic from the partitioned-tree to forward to the RP. No DF election is needed on the MDT in this scheme. Routers that do not understand the new BIDIR AD route do not join the BIDIR partitioned-MDT.

Note There are no interoperability issues even if there are PE routers in the network that do not support BIDIR.

PIM-Bidirectional Mode

PIM BIDIR is a variant of the Protocol Independent Multicast (PIM) suite of routing protocols for IP multicast. In PIM, packet traffic for a multicast group is routed according to the rules of the mode configured for that multicast group. In bidirectional mode, traffic is only routed along a bidirectional shared tree that is rooted at the rendezvous point (RP) for the group. In PIM-BIDIR, the IP address of the RP acts as the key to having all routers establish a loop-free spanning tree topology rooted in that IP address. This IP address does not need to be a router, but can be any unassigned IP address on a network that is reachable throughout the PIM domain. Using this technique is the preferred configuration for establishing a redundant RP configuration for PIM-BIDIR.

Note In Cisco IOS XR Release 4.2.1, Anycast RP is not supported on PIM Bidirectional mode.

PIM-BIDIR is designed to be used for many-to-many applications within individual PIM domains. Multicast groups in bidirectional mode can scale to an arbitrary number of sources without incurring overhead due to the number of sources. PIM-BIDIR is derived from the mechanisms of PIM-sparse mode (PIM-SM) and shares many SPT operations. PIM-BIDIR also has unconditional forwarding of source traffic toward the RP upstream on the shared tree, but no registering process for sources as in PIM-SM. These modifications are necessary and sufficient to allow forwarding of traffic in all routers solely based on the (*, G) multicast routing entries. This feature eliminates any source-specific state and allows scaling capability to an arbitrary number of sources.

The traditional PIM protocols (dense-mode and sparse-mode) provided two models for forwarding multicast packets, source trees and shared trees. Source trees are rooted at the source of the traffic while shared trees are rooted at the rendezvous point. Source trees achieve the optimum path between each receiver and the source at the expense of additional routing information: an (S,G) routing entry per source in the multicast routing table. The shared tree provides a single distribution tree for all of the active sources. This means that traffic from different sources traverse the same distribution tree to reach the interested receivers, therefore reducing the amount of routing state in the network. This shared tree needs to be rooted somewhere, and the location of this root is the rendezvous point. PIM BIDIR uses shared trees as their main forwarding mechanism.

The algorithm to elect the designated forwarder is straightforward, all the PIM neighbors in a subnet advertise their unicast route to the rendezvous point and the router with the best route is elected. This effectively builds a shortest path between every subnet and the rendezvous point without consuming any multicast routing state (no (S,G) entries are generated). The designated forwarder election mechanism expects all of the PIM neighbors to be BIDIR enabled. In the case where one of more of the neighbors is not a BIDIR capable router, the election fails and BIDIR is disabled in that subnet.

clear qos counters interface

To clear QoS counters for a specified interface, use the **clear qos counters interface** command in EXEC mode.

clear qos counters interface *type interface-path-id* [**input**| **output**]

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Either a physical interface instance or a virtual interface instance as follows: • Physical interface instance. Naming notation is *rack/slot/module/port* and a slash between values is required as part of the notation. ◦ *rack* : Chassis number of the rack. ◦ *slot* : Physical slot number of the modular services card or line card. ◦ *module* : Module number. A physical layer interface module (PLIM) is always 0. ◦ *port* : Physical port number of the interface. **Note** In references to a Management Ethernet interface located on a route processor card, the physical slot number is alphanumeric (RSP0RP0 or RP1) and the module is CPU0. Example: interface MgmtEth0/RSP0RP1/CPU0/0. • Virtual interface instance. Number range varies depending on interface type. For more information about the syntax for the router, use the question mark (?) online help function.
input	(Optional) Clears input QoS counters that are attached to the specified interface.
output	(Optional) Clears output QoS counters that are attached to the specified interface.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.9.0	The **interface** keyword was added.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **clear qos counters interface** command clears all input and output QoS counters that are attached to a specified interface, unless the **input** or **output** keyword is specified. If the **input** or **output** keyword is specified, only counters attached to the interface in a specified direction are cleared.

The MIB counters are not reset with this command.

Task ID

Task ID	Operations
qos	read, write

The following example shows how to clear QoS counters attached to Gigabit Ethernet interface 0/1/0/9:

```
RP/0/0/CPU0:router# clear qos counters interface gigabitethernet 0/1/0/9
```

The following example shows how to clear output QoS counters attached to POS interface 0/7/0/3:

```
RP/0/0/CPU0:router# clear qos counters interface pos 0/7/0/3 output
```

Pseudowire Headend eBGP and IPv6 Support

This feature unblocks the path for all control packets (including eBGP) over pw-Ether interfaces for IPv4 and IPV6 traffic, and pw-iw interfaces for IPv4 only.

Multiple Logical Routers

The Multiple Logical Routers (MLR) feature supports multiple logical routers within single chassis on Cisco XR 12000 Series Routers. The MLR support overcomes these limitations in the IOS XR Secure Domain Routing (SDR) implementation:

- Cisco IOS XR Software versions are managed by owner SDR.
- All software is installed on the owner SDR and then replicated to other modules, requiring same software version to be run on all SDRs.
- Any failure of the shared resources affects all SDRs.
- Software packages are distributed from the admin plane and are applied to entire system.
- Only up to seven SDRs are supported.

In the MLR solution, each of the logical router acts as an independent router. The solution enables these capabilities:

- Form MLR configuration by saving the existing SDR configuration.
- SDR to MLR upgrade happens with a single reload.
- Each logical router independently manages line cards.
- Each logical router can be independently upgraded with different software images.
- MBUS/Fabric failure in root logical router should not impact services of other logical routers.

Implementing the MLR feature does not affect the Cisco IOS XR SDR framework. MLR feature supports multiple logical routers only on a single Cisco XR 12000 Series Routers chassis with Performance Route Processor 3 (PRP-3).

MLR Configuration

Logical routers can be formed out using an existing SDR configuration. This example shows how to configure a MLR:

```
RP/0/0/CPU0:router(admin)#sh run mlr
mlr rr2
 location 0/4/CPU0
 location 0/5/CPU0
!
mlr rr3
 location 0/6/CPU0
 location 0/7/CPU0
!
mlr backup
 location 0/8/CPU0
 location 0/9/CPU0
 location 0/10/CPU0
!
mlr rr5
 location 0/1/CPU0
 location 0/11/CPU0
!
mlr rr6
 location 0/12/CPU0
 location 0/13/CPU0
!
mlr rr7
 location 0/14/CPU0
 location 0/15/CPU0
!
mlr root
 location 0/0/CPU0
 location 0/2/CPU0
 location 0/3/CPU0
!

RP/0/0/CPU0:router(admin)#
```

The root keyword specifies that the logical router acts as the root MLR.

Provisioning MLR

These sections explain different MLR deployment scenarios:

Non-MLR to MLR mode:

- Remove any SDR configuration (if any) and bring down all the RPs to rommon mode.
- Turboboot Single Active-rp on router.
- Configure required LR's (with preferred root and backup).
- Reload location all over single active RP and bring up Root-LR alone first.
- Turboboot Backup LR after Root-LR brought up.
- Turboboot all other LR's simultaneously.
- Ensure that even a single RP is booted in non-MLR mode along with MLR configs.

MLR-mode to non-MLR-mode

- Remove Autoboot mode on Active-RP or Standby-RP of all LR's .
- Remove entire MLR configuration from root MLR.
- Turboboot any RP which should come up as non-mlr chassis active RP.

RP from an MLR chassis to non-MLR chassis Or one MLR Chassis to Another MLR chassis

- First erase NVRAM using **erase nvram** command.
- Insert the RP in the chassis (existing or new non-mlr chassis or new mlr chassis).

Reload SMU Upgrade Or New Image upgrade, on all LR's including Root-LR

- Install and upgrade reload SMU's or new image on all non-root LRs.
- Install and upgrade reload SMU or new Image on Root-LR, which triggers LR switchover.
- Reload entire chassis for making Root-LR as the designated LR.

Preferred Root MLR Or Preferred Backup MLR

- If more than one MLR are configured, user cannot delete only the ‘mlr root’.
- All locations from ‘mlr root’ cannot be removed in single commit.
- Reconfigure the MLR, if you want to remove all the LC from ‘mlr root’ and replace with other LCs.

MLR to SDR Downgrade

- In each LR, set config-register to 0x0.
- On root LR, remove mlr configuration for non root lrs, keep the configuration of root intact, ensure all non roots reload and go to rommon. The root will still be up, now remove the configuration for root. This will reload the root and bring it to rommon.
- Turboboot the root LR with 4.1.2 c12k-mini.vm
- Configure SDR. This ill cause the rest of the LR to reload. Since the config-register is to 0x0, it will stay at rommon.
- Manually boot rest of the LR –mbiprp-rp.vm of the 4.1.2 image from TFTP or disk.

Frame Relay Network to Network Support (FR-NNI)

The Network to Network Interface (NNI) is designed to provide an efficient interface between two frame relay sub-networks or like where network equipment is required to interact between two independent Frame Relay networks.

UNI LMI type (DTE/DCE) modes are one sided in nature. The task for generating the Status Enquiry message is that of the user end/DTE end and similarly the task for the corresponding STATUS message is that of the network/DCE end. This may be good for many applications, but a balanced protocol is preferable, so that a

legitimate symmetry is held between the two sides of the interface and each side can preserve the state of availability(pvc's) of the other end.This is achieved in NNI by its bidirectional procedures.

The kind of bidirectional procedures in NNI differs in only one method to that from the UNI. The Status Enquiry message is issued from both sides of the interface, and their corresponding Status message response is also generated from both sides. Hence in NNI, both sides of the FR interfaces behave in the manner of both the user(DTE) and the network(DCE) and by this balance neither side will be considered as 'user' end.

To make a frame relay encapsulated interface to work in NNI interface mode, use the command **frame-relay intf-type nni**.

BGP Prefix Origin Validation Based on RPKI

A BGP route associates an address prefix with a set of autonomous systems (AS) that identify the interdomain path the prefix has traversed in the form of BGP announcements. This set is represented as the AS_PATH attribute in BGP and starts with the AS that originated the prefix.

To help reduce well-known threats against BGP including prefix mis-announcing and monkey-in-the-middle attacks, one of the security requirements is the ability to validate the origination AS of BGP routes. The AS number claiming to originate an address prefix (as derived from the AS_PATH attribute of the BGP route) needs to be verified and authorized by the prefix holder.

The Resource Public Key Infrastructure (RPKI) is an approach to build a formally verifiable database of IP addresses and AS numbers as resources. The RPKI is a globally distributed database containing, among other things, information mapping BGP (internet) prefixes to their authorized origin-AS numbers. Routers running BGP can connect to the RPKI to validate the origin-AS of BGP paths.

BGP Prefix Independent Convergence for RIB and FIB

BGP PIC for RIB and FIB adds support for static recursive as PE-CE and faster backup activation by using fast re-route trigger.

The BGP PIC for RIB and FIB feature supports:

- FRR-like trigger for faster PE-CE link down detection, to further reduce the convergence time (Fast PIC-edge activation).
- PIC-edge for static recursive routes.
- BFD single-hop trigger for PIC-Edge without any explicit /32 static route configuration.
- Recursive PIC activation at third level and beyond, on failure trigger at the first (IGP) level.
- BGP path recursion constraints in FIB to ensure that FIB is in sync with BGP with respect to BGP next-hop resolution.

OSPF SPF Prefix Prioritization

The OSPF SPF Prefix Prioritization feature enables an administrator to converge, in a faster mode, important prefixes during route installation.

When a large number of prefixes must be installed in the Routing Information Base (RIB) and the Forwarding Information Base (FIB), the update duration between the first and last prefix, during SPF, can be significant.

In networks where time-sensitive traffic (for example, VoIP) may transit to the same router along with other traffic flows, it is important to prioritize RIB and FIB updates during SPF for these time-sensitive prefixes.

The OSPF SPF Prefix Prioritization feature provides the administrator with the ability to prioritize important prefixes to be installed, into the RIB during SPF calculations. Important prefixes converge faster among prefixes of the same route type per area. Before RIB and FIB installation, routes and prefixes are assigned to various priority batch queues in the OSPF local RIB, based on specified route policy. The RIB priority batch queues are classified as "critical," "high," "medium," and "low," in the order of decreasing priority.

When enabled, prefix alters the sequence of updating the RIB with this prefix priority:

Critical > High > Medium > Low

As soon as prefix priority is configured, /32 prefixes are no longer preferred by default; they are placed in the low-priority queue, if they are not matched with higher-priority policies. Route policies must be devised to retain /32s in the higher-priority queues (high-priority or medium-priority queues).

Priority is specified using route policy, which can be matched based on IP addresses or route tags. During SPF, a prefix is checked against the specified route policy and is assigned to the appropriate RIB batch priority queue.

These are examples of this scenario:

- If only high-priority route policy is specified, and no route policy is configured for a medium priority:
  - Permitted prefixes are assigned to a high-priority queue.
  - Unmatched prefixes, including /32s, are placed in a low-priority queue.
- If both high-priority and medium-priority route policies are specified, and no maps are specified for critical priority:
  - Permitted prefixes matching high-priority route policy are assigned to a high-priority queue.
  - Permitted prefixes matching medium-priority route policy are placed in a medium-priority queue.
  - Unmatched prefixes, including /32s, are moved to a low-priority queue.
- If both critical-priority and high-priority route policies are specified, and no maps are specified for medium priority:
  - Permitted prefixes matching critical-priority route policy are assigned to a critical-priority queue.
  - Permitted prefixes matching high-priority route policy are assigned to a high-priority queue.
  - Unmatched prefixes, including /32s, are placed in a low-priority queue.
- If only medium-priority route policy is specified and no maps are specified for high priority or critical priority:
  - Permitted prefixes matching medium-priority route policy are assigned to a medium-priority queue.
  - Unmatched prefixes, including /32s, are placed in a low-priority queue.

  Use the **[no] spf prefix-priority route-policy** *rpl* command to prioritize OSPF prefix installation into the global RIB during SPF.

  SPF prefix prioritization is disabled by default. In disabled mode, /32 prefixes are installed into the global RIB, before other prefixes. If SPF prioritization is enabled, routes are matched against the

route-policy criteria and are assigned to the appropriate priority queue based on the SPF priority set. Unmatched prefixes, including /32s, are placed in the low-priority queue.

If all /32s are desired in the high-priority queue or medium-priority queue, configure this single route map:

```
prefix-set ospf-medium-prefixes
  0.0.0.0/0 ge 32
  end-set
```

Management Information Base (MIB) for OSPFv3

Cisco IOS XR supports full MIBs and traps for OSPFv3, as defined in RFC 5643. The RFC 5643 defines objects of the Management Information Base (MIB) for use with the Open Shortest Path First (OSPF) Routing Protocol for IPv6 (OSPF version 3).

The OSPFv3 MIB implementation is based on the IETF draft *Management Information Base for OSPFv3 (draft-ietf-ospf-ospfv3-mib-8)*. Users need to update the NMS application to pick up the new MIB when upgraded to RFC 5643.

Refer to the *Cisco Carrier Routing System and Cisco XR 12000 Series Router MIB Support Guide* for more information on Cisco IOS XR MIB support.

Multiple OSPFv3 Instances

SNMPv3 supports "contexts" that can be used to implement MIB views on multiple OSPFv3 instances, in the same system.

Nested Wildcard Apply Policy

The hierarchical constructs of Routing Policy Language (RPL) allows one policy to refer to another policy. The referred or called policy is known as a child policy. The policy from which another policy is referred is called calling or parent policy. A calling or parent policy can nest multiple child policies for attachment to a common set of BGP neighbors. The nested wildcard apply policy allows wildcard (*) based apply nesting. The wildcard operation permits declaration of a generic apply statement that calls all policies that contain a specific defined set of alphanumeric characters, defined on the router.

A wildcard is specified by placing an asterisk (*) at the end of the policy name in an apply statement. Passing parameters to wildcard policy is not supported. The wildcard indicates that any value for that portion of the apply policy matches.

To illustrate nested wildcard apply policy, consider this policy hierarchy:

```
route-policy Nested_Wilcard
apply service_policy_customer*
end-policy

route-policy service_policy_customer_a
if destination in prfx_set_customer_a  then
set extcommunity rt (1:1) additive
endif
end-policy

route-policy service_policy_customer_b
if destination in prfx_set_customer_b then
set extcommunity rt (1:1) additive
endif
end-policy
```

```
route-policy service_policy_customer_c
if destination in prfx_set_customer_c then
set extcommunity rt (1:1) additive
endif
end-policy
```

Here, a single parent apply statement (apply service_policy_customer*) calls (inherits) all child polices that contain the identified character string "service_policy_customer". As each child policy is defined globally, the parent dynamically nests the child policies based on the policy name. The parent is configured once and inherits each child policy on demand. There is no direct association between the parent and the child policies beyond the wildcard match statement.

InterAS Support on Multicast VPN

The Multicast VPN Inter-AS Support feature enables service providers to provide multicast connectivity to VPN sites that span across multiple autonomous systems. This feature enables Multicast Distribution Trees (MDTs), used for Multicast VPNs (MVPNs), to span multiple autonomous systems.

There are two types of MVPN inter-AS deployment scenarios:

- Single-Provider Inter-AS—A service provider whose internal network consists of multiple autonomous systems.
- Intra-Provider Inter-AS—Multiple service providers that need to coordinate their networks to provide inter-AS support.

To establish a Multicast VPN between two autonomous systems, a MDT-default tunnel must be setup between the two PE routers. The PE routers accomplish this by joining the configured MDT-default group. This MDT-default group is configured on the PE router and is unique for each VPN. The PIM sends the join based on the mode of the groups, which can be PIM SSM, or sparse mode.

For more information about the InterAS Support on MVPN, see the *Cisco IOS XR Multicast Configuration Guide for the Cisco XR 12000 Series Router*.

Enhanced Object Tracking for HSRP and IP Static

A failure between the active router and the core network cannot be detected using standard HSRP failure detection mechanisms. Object tracking is used to detect such failures. When such a failure occurs, the active router applies a priority decrement to its HSRP session. If this causes its priority to fall below that of the standby router, it will detect this from the HSRP control traffic, and then use this as a trigger to preempt and take over the active role.

The enhanced object tracking for HSRP and IP Static feature provides first-hop redundancy as well as default gateway selection based on IP Service Level Agreement (IPSLA).

See the *Cisco IOS XR Routing Configuration Guide for the Cisco XR 12000 Series Router*, for more information about enhanced object tracking for static routes.

New Hardware Features on the Cisco XR 12000 Series Router

There are no new hardware features introduced in Cisco IOS XR Software Release 4.2.1 for the XR 12000 Router.

Important Notes on Cisco IOS XR Software and Cisco XR 12000 Series Router

- **Default timestamp setting—**The timestamp prompt that precedes console output is enabled by default. To disable the timestamp prompt, use the **no service timestamp** command. For more information, refer to the *Cisco IOS XR System Management Command Reference for the Cisco XR 12000 Series Router*.
- From Cisco IOS XR Software Release 3.6.0, WRED statements are collapsed in that if different random-detect statements using the same match types (EXP, DSCP, Prec, and so forth) are entered with identical minimum and maximum threshold values, a single configuration line is shown in the output of **show running config**. This reduces the length of the configuration but creates a problem with backward compatibility with previous releases. In such a situation, on rollback, the QoS policy is rejected and must be manually entered again.

  Configuration prior to Cisco IOS XR Software Release 3.6.0:

```
Policy-map wred_example
   Class class-default
       random-detect exp 0 384 packets 484 packets
       random-detect exp 1 384 packets 484 packets
       random-detect exp 2 384 packets 484 packets
       random-detect exp 3 484 packets 584 packets
       random-detect exp 4 484 packets 584 packets
       random-detect discard-class 0 384 packets 484 packets
      random-detect discard-class 1 384 packets 484 packets
      random-detect discard-class 2 484 packets 584 packets
      bandwidth remaining percent 20
```

  Cisco IOS XR Software Release 3.6.0 and later releases:

```
 policy-map wred_example
 class class-default
  random-detect exp 0,1,2 384 packets 484 packets
  random-detect exp 3,4 484 packets 584 packets
  random-detect discard-class 0,1 384 packets 484 packets
  random-detect discard-class 2 484 packets 584 packets
  bandwidth remaining percent 20
 !
 end-policy-map
!
end
```

  In Cisco IOS XR Software Release 3.6.0 and later releases, the implicitly assigned QoS class class-default must have at least 1 percent bandwidth made available to it. This can be done either by assigning at least 1 percent explicitly (bandwidth remaining percent 1) or by ensuring that the total bandwidth assigned to all other classes in the policy is a maximum of 99 percent, leaving 1 percent available for the class-default. A QoS policy that does not have any bandwidth for class-default is rejected when upgrading to Cisco IOS XR Software Release 3.6.0 or later releases.

- **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.
- **Migrating from Cisco IOS to Cisco IOS XR Software on the Cisco XR 12000 Series Router—**When migrating a Cisco XR 12000 Series Router from Cisco IOS to Cisco IOS XR Software, follow the instructions provided in *Migrating from Cisco IOS to Cisco IOS XR Software on the Cisco XR 12000 Series Router*.

- **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 IOS XR Getting Started Guide for the Cisco XR 12000 Series Router* 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.
- **More power required for Cisco SIP line cards (SIP-401/501/600/601) on the Cisco XR 12000 Series Router—**These line cards draw more power than previous generation line cards. Depending on the exact configuration of power entry modules (PEMs) and other cards in the chassis, there may not be enough power available when inserting a new card or removing a PEM. Before you insert a new card or remove a PEM, run the following command in **admin** mode:

```
RP/0/4/CPU0:router(admin)#show environment power-supply table
Mon Sep 24 00:56:28.054 UTC
                    48V       Current
R/S/I     Module    (V)         (A)
0/24/*    PEM1        0          0       12000/6-AC-PEM= Intelligent AC PS
          PEM2       52         11       12000/6-AC-PEM= Intelligent AC PS
0/25/*    PEM1        0          0       12000/6-AC-PEM= Intelligent AC PS
          PEM2       52          9       12000/6-AC-PEM= Intelligent AC PS
```

To display the power used or total power or remaining power in chassis. Use the command **show power-mgr detail** command in EXEC mode.

```
RP/0/4/CPU0:router#show power-mgr detail
Mon Sep 24 00:53:54.518 UTC


Power management summary
------------------------
Powershelf type: AC Power Supplies
Operating phase: RUNNING_PHASE
Feature state  : Enabled
Operating mode : NON-REDUNDANT

       Total supply power: 1900 W
         Route processors: 60   W
                Linecards: 240  W
       Chassis components: 477  W
        Total inuse power: 777  W
                Remaining: 1123 W


PEM1 present, but unpowered
PEM2 present, supplying up to 1900 watts: uptime 0d01h39m

Slot   Cardtype                  Watts  Status
----   --------                 -----  ------
  1    12000-SIP-601=             240  powered
  4    PRP=                        60  powered
  16   GSR6-CSC=                   56  powered
  17   GSR6-CSC=                   56  powered
  18   GSR6-SFC=                   45  powered
  19   GSR6-SFC=                   45  powered
  20   GSR6-SFC=                   45  powered
  24   GSR6-ALRM=                  26  powered
  25   GSR6-ALRM=                  26  powered
  28   GSR6-BLOWER=               178  powered
```

If you plan to insert a new card, locate the entry for the card to be inserted and note the power consumed by it. If this power is less than the figure given in Worst Case Redundant Power Available (the figure is displayed in the **show environment power-supply table** command output), the card can be safely inserted. As long as the Worst Case Redundant Power Available is not zero, a PEM can be powered down for replacement without impact.

Note No alerts are issued if more cards are inserted than the PEMs can support. It is your responsibility to determine your power budget for the chassis before making any changes to it. Exceeding the power budget may result in the PEM being overloaded and cards powering down due to insufficient power being provided.

- **Per-interface Internet Control Message Protocol (ICMP) disable** feature is not supported on the Cisco XR 12000 Series Router.
- **Online Diagnostics is not supported on the Cisco XR 12000 Series Router—** If you execute the diagnostic command, an error appears stating that there is no online diagnostics process running on the router.
- The **rp mgmtethernet forwarding** command is not supported on the Cisco XR 12000 Series Router.
- Enabling the Lawful Interface feature triggers the L2-PRECAM-2-HW_RESOURCE_FAILURE message on Engine-3 linecards. This error reflects that your configuration has used up all available look-up registers (LUREGs).

  There is no direct workaround for this issue as its a hardware limitation. Only way to recover from this issue is to reduce feature scale. You need to identify the features which use LUREG at PreCAM1 and remove one or more of the features depending on LUREG requirements of the feature being added.

- **mpls traffic engineering igp-intact** command—This command must be used only when policy based tunnel selection is configured for all tunnels originating on the device. This CLI needs to be turned on under IGP (OSPF/ISIS) under the respective AFI.

- **Disable/Enable RSVP Message Checksum** Starting with C isco IOS XR Software Release 4.0.2, RSVP will, by default, compute and set the checksum field in all outgoing RSVP messages. Also, RSVP will verify the checksum field on all RSVP messages received to insure RSVP message integrity.

  A CLI is provided to override this Cisco IOS XR Software Release 4.0.2 default behavior and go back to pre Cisco IOS XR Software Release 4.0.2 behavior such that RSVP neither computes/sets the RSVP checksum on outgoing RSVP messages, nor verifies the checksum on received RSVP messages. The command to execute to revert to the pre- Cisco IOS XR Software Release 4.0.2 behavior is:

  ```
  Router(config)#rsvp signalling checksum disable
  ```

  Note When the rsvp signalling checksum disable command is configured, RSVP sets a zero checksum in all outgoing RSVP messages, and ignores the checksum field on all received RSVP incoming messages.

- Starting from Cisco IOS XR Software Release 4.0.0, the **hw-module location <LOC> reload warm** command is disabled. As a result, the warm reload feature also has been disabled.

- On rare occasions, 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.

- The following error messages appear when one or multiple SDRs are configured on the chassis

```
SP/0/3/SP:May  1 14:28:49.073 : sysmgr[79]: %OS-SYSMGR-7-DEBUG :
sysmgr_admin_plane_check:SYSMGR_PLANE_ADMIN Notification sent.
SP/0/SM6/SP:May  1 14:29:35.092 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
s3/0/SM6/SP/0 HP NQ Err: msc-dest: M1- 4;
SP/0/SM7/SP:May  1 14:29:35.096 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
s3/0/SM7/SP/1 HP NQ Err: msc-dest: M1- 4;
SP/0/SM3/SP:May  1 14:29:37.392 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
s3/0/SM3/SP/2 HP NQ Err: msc-dest: M3- 14;
SP/0/SM2/SP:May  1 14:29:37.392 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
s3/0/SM2/SP/2 HP NQ Err: msc-dest: M3- 14;
SP/0/SM0/SP:May  1 14:29:39.108 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
s3/0/SM0/SP/1 HP NQ Err: msc-dest: M1- 4;
SP/0/SM1/SP:May  1 14:29:39.103 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
s3/0/SM1/SP/0 HP NQ Err: msc-dest: M1- 4;
RP/0/RP1/CPU0:May  1 14:29:42.334 : online_diag_rp[341]: %DIAG-XR_DIAG-3-ERROR :
(U) Fabric Ping Failure, 2 of 7 nodes failed(L): 0/0/CPU0, 0/1/CPU0
SP/0/SM5/SP:May  1 14:29:47.143 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
s3/0/SM5/SP/1 HP NQ Err: msc-dest: M1- 4;
SP/0/SM4/SP:May  1 14:29:47.136 : sfe_drvr[130]:
%FABRIC-FABRIC_DRVR-3-ERRRATE_EXCEED_SLOW :
 s3/0/SM4/SP/0 HP NQ Err: msc-dest: M1- 4;
RP/0/RP1/CPU0:May  1 14:29:47.670 : online_diag_rp[341]: %DIAG-XR_DIAG-3-ERROR :
(U) Fabric Ping Failure - destination node (Level 2) in 0/0/CPU0
RP/0/RP1/CPU0:May  1 14:29:47.673 : online_diag_rp[341]: %DIAG-XR_DIAG-3-ERROR :
(U) Fabric Ping Failure - destination node (Level 2) in 0/1/CPU0
RP/0/RP1/CPU0:May  1 14:29:48.061 : online_diag_rp[341]: %DIAG-XR_DIAG-3-ERROR :
(U) FIM: multi-nodes failure detected
```

Minimum Flash Disk Requirements When Upgrading to Release 4.2.1

Cisco IOS XR Software Release requires a 2-GB Flash Disk as a minimum. If your Cisco XR 12000 Series Router currently uses a 1-GB Flash Disk, you must upgrade it to 2-GB before upgrading to Cisco IOS XR Software Release . The PCMCIA 1-GB Flash Disk was the default size for the Cisco XR 12000 Series Router running Cisco IOS XR Software Release 3.6 and earlier.

In Cisco IOS XR Software Release 3.6 and later releases, disk partitioning is supported. Partitioning of a 2-GB disk is possible but not required. Partitioning of a 4-GB disk is required.

A 4-GB Flash Disk can be installed instead of the 2-GB for greater disk storage.

To upgrade from a 1-GB flash disk to a 2-GB or greater flash disk, refer to the Flash Disk Upgrade Tasks link on the following Cisco XR 12000 Series Router Installation and Upgrade URL:

http://www.cisco.com/en/US/products/ps6342/prod_installation_guides_list.html

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 contains caveats that are generic to the Cisco IOS XR Release 4.2.1 software and those specific to the Cisco XR 12000 Series Router.

Cisco IOS XR Caveats

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

- **CSCtz92323**

  Basic Description:

  dllmgr crashes continuously when the text segment limit is reached.

  Symptom

  The problem is hit when 1100+ dlls are loaded in the system. Dllmgr text segment memory (64MB) is getting exhausted due to the large number of dlls being loaded.

  Workaround:

  Contact Cisco TAC when the problem appears.

- **CSCtx28724**

  Basic Description:

  ICL Change in Single commit results in configuration failure.

  Symptom

  - Scenario 1: When user tries to change Inter Chassis Link from one physical interface to the other in a single commit, configuration will not be applied due to internal race condition.
  - Scenario 2: User tries to delete Inter Chassis Link without removing satellite interface configuration. System Impact for this is configuration commit timeout or apply failures for satellite configuration and ICL configuration.
  - Reason: Race condition between sysdb_svr_local, cfgmgr_lc, ifo_ma and ifmgr.

  Workaround:

  Step 1: User needs to take the backup of all satellite interface configuration manually.

  Step 2: Remove all the satellite interface which are configured.

  Step 3: Change the ICL configuration from one physical interface to the other.

  Step 4: Apply the satellite configuration from the backup file which was done in step 1.

- **CSCua01836**

  Basic Description:

  Commit fails when child policy of a wildcard policy is deleted.

  Symptom:

  Commit fails on deleting child policy matching wildcard policy attached on some attach-point.

  Conditions:

  Deleting policy matching wildcard policy.

  Workaround:

  Instead of deleting the child policy, customer can rewrite the policy with empty body.

- **CSCtz87361**

Basic Description:

Huge mibd_interface memleak on mib walk: Component: ethernet-lldp.

Symptom:

Memory leak could be seen for the mibd_interface process.

Conditions:

Memory leak is seen when LLDB-MIB is polled and the size of the memory leak is 450KB per polling iteration.

Workaround:

Restart the mibd_interface process.

- **CSCtx81095**

Basic Description:

Incorrect behaviour of traceroute ipv6.

Symptom:

When loopack is configured between two end points with ipv6 address and traceroute to the remote loopback address is sent, traceroute brings the ipaddress of loopback interface as against the interface ip address. In the case of ipv4, the traceroute fetches egress interface ip address and the "icmp ipv6 source vrf/rfc" command has no effect .

Conditions:

Not specified.

Workaround

None

Caveats Specific to the Cisco XR 12000 Series Router

- **CSCtz38821**

Basic Description:

MLR: sh mlr trace error.

Symptom:

Some non-error messages are displayed in the output of **show mlr trace error**.

Conditions:

While configuring the Multiple Logical Router (MLR), some non-error messages are shown in the output of **show mlr trace error**.

Workaround:

None.

Recovery:

Not Applicable.

- **CSCtx64099**

Basic Description:

Traffic loss on pw-ether v6 for few seconds on doing RPFO.

Symptom:

In a PRP3 system with 1500 PWHE interfaces, ipv6 traffic drop is seen on few PW-Ether interfaces (which are part of static or eBGP) during RPFO.

Conditions:

In a scale of 1500 PWHE interfaces, during RPFO, ipv6 traffic passing through some of the PW-Ether interfaces may experience traffic drop for few seconds.

Workaround:

None. Traffic will resume after few seconds.

Recovery:

None.

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.

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 IOS XR Troubleshooting Guide for the Cisco XR 12000 Series Router* and the *Cisco IOS XR Getting Started Guide for the Cisco XR 12000 Series Router.*

Related Documentation

The most current Cisco XR 12000 Series Router hardware documentation is located at the following URL:

http://www.cisco.com/en/US/products/ps6342/prod_installation_guides_list.html

The Cisco IOS XR Software documentation set includes the Cisco IOS XR software configuration guides and command references, as well as a getting started guide.

The most current Cisco XR 12000 router software documentation is located at the following URL:

http://www.cisco.com/en/US/products/ps5763/tsd_products_support_series_home.html

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

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS version 2.0.