



# Release Notes for Cisco XR 12000 Series Router for Cisco IOS XR Software Release 5.1.1

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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 5.1.1 for the Cisco XR 12000 Series Router and are updated as needed.



## Note

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For information on the Cisco XR 12000 Series Router running Cisco IOS XR Software Release , see the [Important Notes, on page 32](#) section.

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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](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, on page 38](#) section.

For a list of software caveats that apply to Cisco IOS XR Software Release 5.1.1, see the Caveats section. The caveats are updated for every release and are described at <http://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](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, see the New Features in Cisco IOS XR Software Release 5.1.1 section in this document.

- [System Requirements, page 3](#)
- [Determining Your Software Version, page 20](#)
- [Software Features Introduced in Cisco IOS XR Software Release 5.1.1, page 28](#)
- [New Hardware Features on the Cisco XR 12000 Series Router, page 31](#)
- [Important Notes, page 32](#)
- [Caveats, page 34](#)
- [Upgrading Cisco IOS XR Software, page 37](#)
- [Troubleshooting, page 38](#)
- [Related Documentation, page 38](#)
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## System Requirements

This section describes the system requirements for Cisco IOS XR Software Release 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](#) section.

## 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 5.1.1 features.

[Table 1: Cisco IOS XR Software Release 5.1.1 PIE Files, on page 3](#) lists the Cisco IOS XR Software feature set matrix (PIE files) and associated filenames available for Cisco IOS XR Software Release 5.1.1, supported on the Cisco XR 12000 Series Router.

**Table 1: Cisco IOS XR Software Release 5.1.1 PIE Files**

Feature Set	Filename	Description
<b>Composite Package</b>		

Cisco IOS XR IP Unicast Routing Core Bundle	c12k-mini-pie-5.1.0	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-5.1.0	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.
<b>Optional Individual Packages</b> (Packages are installed individually)		
Cisco IOS XR Manageability Package	c12k-mgbl.pie-5.1.0	Common Object Request Broker Architecture (CORBA) agent, Extensible Markup Language (XML) Parser, and HTTP server packages.
Cisco IOS XR MPLS Package	c12k-mpls.pie-5.1.0	MPLS Traffic Engineering (MPLS-TE), Label Distribution Protocol (LDP), MPLS Forwarding, MPLS Operations, Administration, and Maintenance (OAM), Link Manager Protocol (LMP), Optical User Network Interface (OUNI), Resource Reservation Protocol (RSVP), and Layer-3 VPN.
Cisco IOS XR Multicast Package	c12k-mcast.pie-5.1.0	Multicast Routing Protocols (PIM, Multicast Source Discovery Protocol [MSDP], Internet Group Management Protocol [IGMP], Auto-RP), Tools (SAP, MTrace), and Infrastructure [(Multicast Routing Information Base [MRIB], Multicast-Unicast RIB [MURIB], Multicast forwarding [MFWD]), and Bidirectional Protocol Independent Multicast (BIDIR-PIM).

Cisco IOS XR Security Package	c12k-k9sec.pie-5.1.0	Support for Encryption, Decryption, IP Security (IPSec), Secure Shell (SSH), Secure Socket Layer (SSL), and Public-key infrastructure (PKI) (Software based IPSec support—maximum of 500 tunnels)
Cisco IOS XR Standby RP Boot Image	mbiprp-rp.vm-5.1.0	Support for booting the Standby RP from ROMMON on a Cisco XR 12000 Series Router.
Cisco IOS XR FPD Package	c12k-fpd.pie-5.1.0	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-5.1.0	Diagnostic utilities for Cisco IOS XR routers.
Cisco IOS XR Documentation Package	c12k-doc.pie-5.1.0	.man pages for Cisco IOS XR Software on the Cisco XR 12000 Series Router chassis.
Cisco IOS XR Service Package	c12k-service.pie-5.1.0	Includes binaries to support Booster daughter card.
Cisco IOS XR Video Package	c12k-video.pie-5.1.0	Includes firmware for the advanced video feature.
Cisco IOS XR Boothelper Package	c12kprp-boot-mz.120-32.SY5	Supports downloading the Cisco IOS XR image from tftp.
Cisco IOS XR Upgrade package	c12k-upgrade.pie-5.1.0	Supports a major release upgrade, such as 3.x to 4.x releases. Once the upgrade is completed, the upgrade pie must be deactivated and removed.

Feature Set	Filename	Description
<b>Composite Package</b>		
Cisco IOS XR IP Unicast Routing Core Bundle	c12k-mini-pie-5.1.1	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-5.1.1	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.
<b>Optional Individual Packages</b> (Packages are installed individually)		
Cisco IOS XR Manageability Package	c12k-mgbl.pie-5.1.1	Common Object Request Broker Architecture (CORBA) agent, Extensible Markup Language (XML) Parser, and HTTP server packages.
Cisco IOS XR MPLS Package	c12k-mpls.pie-5.1.1	MPLS Traffic Engineering (MPLS-TE), Label Distribution Protocol (LDP), MPLS Forwarding, MPLS Operations, Administration, and Maintenance (OAM), Link Manager Protocol (LMP), Optical User Network Interface (OUNI), Resource Reservation Protocol (RSVP), and Layer-3 VPN.
Cisco IOS XR Multicast Package	c12k-mcast.pie-5.1.1	Multicast Routing Protocols (PIM), Multicast Source Discovery Protocol [MSDP], Internet Group Management Protocol [IGMP], Auto-RP), Tools (SAP, MTrace), and Infrastructure [(Multicast Routing Information Base [MRIB], Multicast-Unicast RIB [MURIB], Multicast forwarding [MFWD]), and Bidirectional Protocol Independent Multicast (BIDIR-PIM).
Cisco IOS XR Security Package	c12k-k9sec.pie-5.1.1	Support for Encryption, Decryption, IP Security (IPSec), Secure Shell (SSH), Secure Socket Layer (SSL), and Public-key infrastructure (PKI) (Software based IPSec support—maximum of 500 tunnels)

Cisco IOS XR Standby RP Boot Image	mbiprp-rp.vm-5.1.1	Support for booting the Standby RP from ROMMON on a Cisco XR 12000 Series Router.
Cisco IOS XR FPD Package	c12k-fpd.pie-5.1.1	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-5.1.1	Diagnostic utilities for Cisco IOS XR routers.
Cisco IOS XR Documentation Package	c12k-doc.pie-5.1.1	.man pages for Cisco IOS XR Software on the Cisco XR 12000 Series Router chassis.
Cisco IOS XR Service Package	c12k-service.pie-5.1.1	Includes binaries to support Booster daughter card.
Cisco IOS XR Video Package	c12k-video.pie-5.1.1	Includes firmware for the advanced video feature.
Cisco IOS XR Boothelper Package	c12kprp-boot-mz.120-32.SY5	Supports downloading the Cisco IOS XR image from tftp.
Cisco IOS XR Lawful Intercept (LI) Package	c12k-li.pie-5.1.1	Includes LI software images.
Cisco IOS XR Upgrade package	c12k-upgrade.pie-5.1.1	Supports a major release upgrade, such as 4.x to 5.x releases. Once the upgrade is completed, the upgrade pie must be deactivated and removed.

This table lists the Cisco XR 12000 Series Router TAR files.

**Table 2: Cisco IOS XR Software Release 5.1.1 TAR Files**

Feature Set	Filename	Description
Cisco IOS XR IP/MPLS Core Software	XR12000-iosxr-5.1.1.tar	<ul style="list-style-type: none"> <li>• Cisco IOS XR IP Unicast Routing Core Bundle</li> <li>• Cisco IOS XR Manageability Package</li> <li>• Cisco IOS XR MPLS Package</li> <li>• Cisco IOS XR Multicast Package</li> <li>• Cisco IOS XR Lawful Intercept Package</li> </ul>
Cisco IOS XR IP/MPLS Core Software 3DES	XR12000-iosxr-k9-5.1.1.tar	<ul style="list-style-type: none"> <li>• Cisco IOS XR IP Unicast Routing Core Bundle</li> <li>• Cisco IOS XR Manageability Package</li> <li>• Cisco IOS XR MPLS Package</li> <li>• Cisco IOS XR Multicast Package</li> <li>• Cisco IOS XR Security Package</li> <li>• Cisco IOS XR Lawful Intercept Package</li> </ul>

## 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 5.1.1 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 1 GB
- 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

## Supported Hardware

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](#) section.

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

Component	Part Number	Support from version
<b>Cisco XR 12000 Series Router Series Router Systems</b>		
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
<b>Cisco XR 12000 Series Router Chassis Hardware</b>		
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
<b>Cisco XR 12000 Series Router Fabric Hardware</b>		
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
<b>Cisco XR 12000 Series Route Processor Hardware</b>		
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
<b>Cisco XR 12000 Series General Chassis Hardware</b>		
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
<b>Cisco XR 12000 Series SPA Interface Processor Hardware</b>		
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
<b>Cisco XR 12000 Series Router SONET Interface Modules and SPAs</b>		
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
<b>Ethernet Interface Modules and SPAs</b>		
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
<b>Cisco XR 12000 Series Router T3 and E3 Interface Modules and SPAs</b>		
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
<b>Cisco XR 12000 Series Router Channelized Line Cards</b>		
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 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.

## Firmware Support

To check the firmware code running on the Cisco XR 12000 Series Router, run the **show fpd package** command in admin mode.

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

```
=====
                          Field Programmable Device Package
                          =====
Card Type                FPD Description                Type Subtype    SW      Min Req  Min Req
=====                =====                =====
E3-OC12-ATM-4           Mickey FPGA                    1c  fpga2    40971.00      0.00    0.0
                        IOB FPGA                       1c  fpga3    41091.00      0.00    0.0
                        SAF 0 FPGA                     1c  fpga4    45586.00      0.00    0.0
                        Mouse FPGA                    1c  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-OC192POS-XFP	SPA FPGA swv1.1 hww3	spa	fpga2	1.101	0.00	3.0
	SPA FPGA swv1.2	spa	fpga1	1.02	0.00	0.0
	SPA FPGA swv1.2 hww2	spa	fpga1	1.02	0.00	2.0
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-1XOC48POS/RPR	SPA FPGA swv1.1 hwv3	spa fpga2	1.101	0.00	3.0
	SPA FPGA swv1.2	spa fpga1	1.02	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-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-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-1X10GE-WL-V2	SPA FPGA swv1.11	spa fpga1	1.11	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
SPA-8XCHT1/E1-V2	SPA I/O FPGA	spa fpga1	1.02	0.00	0.0
	SPA ROMMON	spa rommon	1.00	0.00	0.140

- 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 2.4

For Performance Route Processor 3 (PRP-3):

- Maintenance Bus (MBUS) Agent Software-RAM version 4.7, ROM version 4.7
- ROM Monitor version 1.5.0

## Minimum Firmware Requirement

- 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 line card may fail to boot or keeps reloading
- Fabric Loader needs updating the line card will take long time to boot
- FPD needs updating the line card 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](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 syntax [http://www.cisco.com/en/US/docs/routers/xr12000/software/xr12k\\_r4.0/system\\_management/command/reference/b\\_yr40xr12k\\_chapter\\_0111.html](http://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 :

- 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 5.1.1[Default]
Copyright (c) 2014 by Cisco Systems, Inc.
```

```
ROM: ROMMON System Bootstrap, Version 1.05(0), DEVELOPMENT SOFTWARE
```

```
gps10-PE1 uptime is 1 hour, 15 minutes
System image file is "disk0:c12k-os-mpi-5.1.1/mbiprp-rp.vm"
```

cisco 12410/PRP (8641D) processor with 4194304K bytes of memory.  
8641D processor at 1330Mhz, Revision 2.1  
GSR 12410 200 Gbps

2 Cisco 12000 Series Performance Route Processor 3s  
3 Cisco 12000 Series SPA Interface Processor-601/501/401  
1 4 port ISE OC3 Controller (4 POS)  
1 Cisco 12000 4-Port ISE ATM Over SONET OC3/STM-1 Controller (4 ATM)  
1 1 Port ISE Packet Over SONET OC-48c/STM-16 Controller (1 POS)  
2 Management Ethernet  
12 PLIM\_QOS  
10 GigabitEthernet/IEEE 802.3 interface(s)  
8 T3  
10 SONET/SDH  
6 Packet over SONET/SDH  
4 Serial network interface(s)  
4 Asynchronous Transfer Mode  
8 FastEthernet  
1 MgmtMultilink  
895k bytes of non-volatile configuration memory.  
3515M bytes of compact flash card.  
76170M bytes of hard disk.  
3600048k bytes of disk0: (Sector size 512 bytes).

Configuration register on node 0/0/CPU0 is 0x102

Boot device on node 0/0/CPU0 is disk0:

Package active on node 0/0/CPU0:

c12k-fpd-suppl, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-suppl-5.1.1  
Built on Mon Feb 3 08:20:39 UTC 2014  
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fpd-p, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-p-5.1.1  
Built on Mon Feb 3 08:20:54 UTC 2014  
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-infra, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-infra-5.1.1  
Built on Mon Feb 3 06:22:57 UTC 2014  
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-fwding, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-fwding-5.1.1  
Built on Mon Feb 3 06:22:57 UTC 2014  
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-routing, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-routing-5.1.1  
Built on Mon Feb 3 06:22:57 UTC 2014  
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-diags, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-diags-5.1.1  
Built on Mon Feb 3 06:22:57 UTC 2014  
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-ce, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-ce-5.1.1  
Built on Mon Feb 3 06:22:57 UTC 2014  
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

```
c12k-os-mpi, V 5.1.1[Default], Cisco Systems, at disk0:c12k-os-mpi-5.1.1
  Built on Mon Feb  3 06:24:33 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-base, V 5.1.1[Default], Cisco Systems, at disk0:c12k-base-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fwding, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fwding-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-ce, V 5.1.1[Default], Cisco Systems, at disk0:c12k-ce-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-mini, V 5.1.1[Default], Cisco Systems, at disk0:c12k-mini-5.1.1
  Built on Mon Feb  3 06:24:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

Boot device on node 0/2/CPU0 is mem:
Package active on node 0/2/CPU0:
c12k-fpd-sup, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-sup-5.1.1
  Built on Mon Feb  3 08:20:39 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fpd-p, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-p-5.1.1
  Built on Mon Feb  3 08:20:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-infra, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-infra-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-fwding, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-fwding-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-routing, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-routing-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-diags, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-diags-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-ce, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-ce-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-os-mpi, V 5.1.1[Default], Cisco Systems, at disk0:c12k-os-mpi-5.1.1
  Built on Mon Feb  3 06:24:33 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
```

```
c12k-base, V 5.1.1[Default], Cisco Systems, at disk0:c12k-base-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fwding, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fwding-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-ce, V 5.1.1[Default], Cisco Systems, at disk0:c12k-ce-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-mini, V 5.1.1[Default], Cisco Systems, at disk0:c12k-mini-5.1.1
  Built on Mon Feb  3 06:24:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

Boot device on node 0/3/CPU0 is mem:
Package active on node 0/3/CPU0:
c12k-fpd-sup, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-sup-5.1.1
  Built on Mon Feb  3 08:20:39 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fpd-p, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-p-5.1.1
  Built on Mon Feb  3 08:20:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-infra, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-infra-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-fwding, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-fwding-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-routing, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-routing-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-diags, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-diags-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-ce, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-ce-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-os-mpi, V 5.1.1[Default], Cisco Systems, at disk0:c12k-os-mpi-5.1.1
  Built on Mon Feb  3 06:24:33 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-base, V 5.1.1[Default], Cisco Systems, at disk0:c12k-base-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fwding, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fwding-5.1.1
```

```
Built on Mon Feb  3 06:22:59 UTC 2014
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-ce, V 5.1.1[Default], Cisco Systems, at disk0:c12k-ce-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-mini, V 5.1.1[Default], Cisco Systems, at disk0:c12k-mini-5.1.1
  Built on Mon Feb  3 06:24:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

Boot device on node 0/4/CPU0 is mem:
Package active on node 0/4/CPU0:
c12k-fpd-suppl, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-suppl-5.1.1
  Built on Mon Feb  3 08:20:39 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fpd-p, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-p-5.1.1
  Built on Mon Feb  3 08:20:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-infra, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-infra-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-fwding, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-fwding-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-routing, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-routing-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-diags, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-diags-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-ce, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-ce-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-os-mpi, V 5.1.1[Default], Cisco Systems, at disk0:c12k-os-mpi-5.1.1
  Built on Mon Feb  3 06:24:33 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-base, V 5.1.1[Default], Cisco Systems, at disk0:c12k-base-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fwding, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fwding-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-ce, V 5.1.1[Default], Cisco Systems, at disk0:c12k-ce-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
```



```
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
c12k-mini, V 5.1.1[Default], Cisco Systems, at disk0:c12k-mini-5.1.1
  Built on Mon Feb  3 06:24:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

Boot device on node 0/5/CPU0 is mem:
Package active on node 0/5/CPU0:
c12k-fpd-suppl, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-suppl-5.1.1
  Built on Mon Feb  3 08:20:39 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fpd-p, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-p-5.1.1
  Built on Mon Feb  3 08:20:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-infra, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-infra-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-fwding, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-fwding-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-routing, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-routing-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-diags, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-diags-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-ce, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-ce-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-os-mpi, V 5.1.1[Default], Cisco Systems, at disk0:c12k-os-mpi-5.1.1
  Built on Mon Feb  3 06:24:33 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-base, V 5.1.1[Default], Cisco Systems, at disk0:c12k-base-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fwding, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fwding-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-ce, V 5.1.1[Default], Cisco Systems, at disk0:c12k-ce-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-mini, V 5.1.1[Default], Cisco Systems, at disk0:c12k-mini-5.1.1
  Built on Mon Feb  3 06:24:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
```

```
Boot device on node 0/6/CPU0 is mem:
Package active on node 0/6/CPU0:
c12k-fpd-suppl, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-suppl-5.1.1
    Built on Mon Feb  3 08:20:39 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fpd-pl, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-pl-5.1.1
    Built on Mon Feb  3 08:20:54 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-infra, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-infra-5.1.1
    Built on Mon Feb  3 06:22:57 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-fwding, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-fwding-5.1.1
    Built on Mon Feb  3 06:22:57 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-routing, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-routing-5.1.1
    Built on Mon Feb  3 06:22:57 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-diags, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-diags-5.1.1
    Built on Mon Feb  3 06:22:57 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

iosxr-ce, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-ce-5.1.1
    Built on Mon Feb  3 06:22:57 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-os-mpi, V 5.1.1[Default], Cisco Systems, at disk0:c12k-os-mpi-5.1.1
    Built on Mon Feb  3 06:24:33 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-base, V 5.1.1[Default], Cisco Systems, at disk0:c12k-base-5.1.1
    Built on Mon Feb  3 06:22:57 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-fwding, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fwding-5.1.1
    Built on Mon Feb  3 06:22:59 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-ce, V 5.1.1[Default], Cisco Systems, at disk0:c12k-ce-5.1.1
    Built on Mon Feb  3 06:22:59 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

c12k-mini, V 5.1.1[Default], Cisco Systems, at disk0:c12k-mini-5.1.1
    Built on Mon Feb  3 06:24:54 UTC 2014
    By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie

Boot device on node 0/7/CPU0 is mem:
Package active on node 0/7/CPU0:
c12k-fpd-suppl, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-suppl-5.1.1
    Built on Mon Feb  3 08:20:39 UTC 2014
```

```
By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
c12k-fpd-p, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fpd-p-5.1.1
  Built on Mon Feb  3 08:20:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
iosxr-infra, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-infra-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
iosxr-fwding, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-fwding-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
iosxr-routing, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-routing-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
iosxr-diags, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-diags-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
iosxr-ce, V 5.1.1[Default], Cisco Systems, at disk0:iosxr-ce-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
c12k-os-mpi, V 5.1.1[Default], Cisco Systems, at disk0:c12k-os-mpi-5.1.1
  Built on Mon Feb  3 06:24:33 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
c12k-base, V 5.1.1[Default], Cisco Systems, at disk0:c12k-base-5.1.1
  Built on Mon Feb  3 06:22:57 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
c12k-fwding, V 5.1.1[Default], Cisco Systems, at disk0:c12k-fwding-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
c12k-ce, V 5.1.1[Default], Cisco Systems, at disk0:c12k-ce-5.1.1
  Built on Mon Feb  3 06:22:59 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
c12k-mini, V 5.1.1[Default], Cisco Systems, at disk0:c12k-mini-5.1.1
  Built on Mon Feb  3 06:24:54 UTC 2014
  By iox-bld5 in /auto/srcarchive9/production/5.1.1/all/workspace for pie
```

---

# Software Features Introduced in Cisco IOS XR Software Release 5.1.1

## ACL Support in RPL Prefix Sets

Access Control List (ACL) type prefix set entries holds IPv4 or IPv6 prefix match specifications, each of which has an address and a wildcard mask. The address and wildcard mask is a standard dotted-decimal IPv4 or colon-separated hexadecimal IPv6 address. The set of bits to be matched are provided in the form of wildcard also called as inverted mask in which a binary 0 means a mandatory match and binary 1 means a do not match condition. The prefix set allows to specify contiguous and non-contiguous set of bits that should be matched in any route.

For more information on ACL Support in RPL Prefix Sets, see the *Implementing Routing Policy* chapter in the *Cisco IOS XR Routing Configuration Guide for the Cisco XR 12000 Series Router*. For more information on ACL Support in RPL Prefix Sets commands, see the *Routing Policy Language Commands* chapter in the *Cisco IOS XR Routing Command Reference for the Cisco XR 12000 Series Router*.

## BGP Link-State

BGP Link-State (LS) is an Address Family Identifier (AFI) and Sub-address Family Identifier (SAFI) defined to carry interior gateway protocol (IGP) link-state database through BGP. BGP LS delivers network topology information to topology servers and Application Layer Traffic Optimization (ALTO) servers. BGP LS allows policy-based control to aggregation, information-hiding, and abstraction. BGP LS supports IS-IS and OSPFv2.

**Note**

---

IGPs do not use BGP LS data from remote peers. BGP does not download the received BGP LS data to any other component on the router.

---

For more information on BGP LS, see the *Implementing BGP* chapter in the *Cisco IOS XR Routing Configuration Guide for the Cisco XR 12000 Series Router*. For more information on BGP LS commands, see the *Border Gateway Protocol Commands* chapter in the *Cisco IOS XR Routing Command Reference for the Cisco XR 12000 Series Router*.

## BGP Multi-Instance Multi-AS Enhancement

The BGP Multi-Instance Multi-AS supports hosting of multicast-enabled VPNs, Multicast Distribution Tree sub-address family identifier (MDT-SAFI), Multicast Virtual Private Network sub-address family identifier (MVPN-SAFI), and Multicast Source Discovery Protocol (MSDP) queries on multiple BGP instances.

## BGP Permanent Network

BGP permanent network feature supports static routing through BGP. BGP routes to IPv4 or IPv6 destinations (identified by a route-policy) can be administratively created and selectively advertised to BGP peers. These routes remain in the routing table until they are administratively removed.

For more information on BGP LS, see the *Implementing BGP* chapter in the *Cisco IOS XR Routing Configuration Guide for the Cisco XR 12000 Series Router*. For more information on BGP LS commands, see the *Border Gateway Protocol Commands* chapter in the *Cisco IOS XR Routing Command Reference for the Cisco XR 12000 Series Router*.

## Auto-IP

In ring topology, when a device is inserted into the ring, the neighboring node interfaces require manual reconfiguration. The auto-IP feature addresses the problem of manually reconfiguring nodes during insertion, deletion, and movement of nodes within the ring. The auto-IP feature automatically provides IP addresses to the nodes inserted into the ring.

## MPLS Static

The MPLS Static feature introduces ability to statically allocate MPLS label resources and provision static label switched paths (LSPs). MPLS static feature allows a user to:

- Enable MPLS feature on a interface
- Assign a label to a prefix or a VRF
- Create a MPLS LSP

For information on MPLS Static configuration, refer *Implementing MPLS Static* module in *Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router*. For information on the commands used for MPLS Static configuration, refer *MPLS Static Commands* module in *Cisco IOS XR MPLS Command Reference for the Cisco XR 12000 Series Router*.

## MPLS TE Extended Admin Groups

The MPLS TE extended admin groups (EAG) configuration assigns EAG/AG name to bit-position and associates affinity-names with TE links. The configuration extends to assign names, up to 256, to TE links over the selected interface and assigns 32 names per attribute-set and index.

For more information on MPLS TE Extended Admin Groups, see the *Implementing MPLS Traffic Engineering* chapter in the *Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router*. For more information on MPLS TE Extended Admin Groups commands, see the *MPLS Traffic Engineering Commands* chapter in the *Cisco IOS XR MPLS Command Reference for the Cisco XR 12000 Series Router*.

## MPLS TE IPv6 Autoroute

The MPLS TE IPv6 Autoroute feature enables IPv4 and IPv6 routing over the same MPLS TEv4 tunnels in the core. This is done by exposing the IPv4 MPLS TE tunnels into the IPv6 IGP (IS-IS) topology as IPv6 forwarding adjacencies or autoroute announced tunnels (IGP shortcuts).

For more information on MPLS TE IPv6 Autoroute, see the *Implementing MPLS Traffic Engineering* chapter in the *Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router*. For more information on MPLS TE IPv6 Autoroute commands, see the *MPLS Traffic Engineering Commands* chapter in the *Cisco IOS XR MPLS Command Reference for the Cisco XR 12000 Series Router*.

## MPLS TE Usability Enhancements

MPLS traffic engineering command line interface and logging output messages are enhanced as follows:

- The **show mpls traffic engineering** commands display **signaled-name** and supports **signaled-name** filter.
- Ability to allow immediate teardown of all labelled switched paths ( LSPs) of the specified tunnel and to create new LSPs.
- Default behavior when affinity check fails at head-end is to reoptimize all LSP types.
- Logging output messages include MPLS TE tunnel signaled name.
- Logging of path change events and available bandwidth on the new for all auto-bandwidth operations.
- Auto-bandwidth logging output includes signaled name.

## MPLS TE SRLG Scale Enhancements

MPLS Traffic Engineering Shared Risk Link Groups (SRLG) feature has been enhanced to support:

- Increase from 32 to 64 (59 for ISIS) groups.
- Increase from 250 to 500 interfaces.

## Stateful Path Computation Element

The stateful path computation element (PCE) describes a set of procedures by which a path computation client ( PCC) can report and delegate control of head-end tunnels sourced from the PCC to a PCE peer. The PCE peer can request the PCC to update and modify parameters of label switched paths (LSPs) it controls. The stateful model also enables a PCC to allow the PCE to initiate computations allowing the PCE to perform network-wide orchestration.

For more information on Stateful PCE, see the *Implementing MPLS Traffic Engineering* chapter in the *Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router*. For more information on Stateful PCE commands, see the *MPLS Traffic Engineering Commands* chapter in the *Cisco IOS XR MPLS Command Reference for the Cisco XR 12000 Series Router*.

## VRF Redirection to MPLS TE Tunnels

The VRF redirection to MPLS TE tunnels feature adds automatic route with IGP metric over the MPLS TE tunnels through autoroute destination configuration. The VRF redirection to MPLS TE tunnels maps VRF prefixes over TE tunnels in the core to reach the same egress provider edge (PE). This enables to load-balance prefix traffic on multiple tunnels based on equal cost multi-path (ECMP). VRF redirection also updates metric changes so that BGP can pickup the best next-hop based on installed route metric.

VRF redirection supports:

- automatic static routing of traffic over TE tunnel

- intra and inter-area/AS tunnels and installing multiple IPv4 routes in the routing information base (RIB) over tunnel, and a route to the tunnel's destination
- implicit /32 mask for each route
- high availability, RP failover, and non-stop forwarding (NSF)

VRF redirection does not support:

- routes in non-default table and non-default VRF
- IPv6 routes

For more information on VRF Redirection to MPLS TE Tunnels, see the *Implementing MPLS Traffic Engineering* chapter in the *Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router*. For more information on VRF Redirection to MPLS TE Tunnels commands, see the *MPLS Traffic Engineering Commands* chapter in the *Cisco IOS XR MPLS Command Reference for the Cisco XR 12000 Series Router*.

## PE-PE Ingress Replication

The ingress PE replicates a C-multicast data packet belonging to a particular MVPN and sends a copy to all or a subset of the PEs that belong to the MVPN. A copy of the packet is tunneled to a remote PE over a Unicast Tunnel to the remote PE.

IR-MDT represents a tunnel that uses IR as the forwarding method. It is usually, one IR-MDT per VRF, with multiple labeled switch paths (LSP) under the tunnel.

When PIM learns of Joins over the MDT (using either PIM or BGP C-multicast Routing), it downloads IP S,G routes to the VRF table in MRIB, with IR-MDT forwarding interfaces. Each IR-MDT forwarding interface has a LSM-ID allocated by PIM. Currently, LSM-ID is managed by mLDP and can range from 0 to 0xFFFFF (20-bits). For IR, the LSM-ID space is partitioned between mLDP and IR. For IR tunnels, the top (20th) bit is always be set, leading to a range of 0x80000 to 0xFFFFF. mLDP's limit is 0 to 0x7FFFF.

## Software Feature Enhancements

These software feature enhancements are introduced in Cisco IOS XR Software Release 5.1.1.

- ROMMON updates

Refer *Software/Firmware Compatibility Matrix* information at [http://www.cisco.com/web/Cisco\\_IOS\\_XR\\_Software/index.html](http://www.cisco.com/web/Cisco_IOS_XR_Software/index.html) link, for details of minimum ROMMON requirements and for the firmware version of new SPAs. For more information about upgrading and downgrading ROMMON firmware, see the *Upgrading and Downgrading ROM Monitor and Boothelper* chapter in *Cisco IOS XR ROM Monitor Guide for the Cisco XR 12000 Series Router*.

## New Hardware Features on the Cisco XR 12000 Series Router

There is no new hardware feature added in the Cisco IOS XR Software Release 5.1.1 for the Cisco XR 12000 Series Router platform.

## Important Notes

- **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*.
- **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 Cisco 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.

## Minimum Flash Disk Requirements When Upgrading to Release

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](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 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:

- **CSCuh97547**

**Basic Description:**

BGP process crash @ bgp\_fwentry\_info on heavy route flaps.

**Symptom**

BGP process crash observed when router undergoes route churn. Route churn as a result of triggers like **clear bgp** command may also hit this issue.

**Conditions:**

Router running Cisco IOS XR Software Release 5.1.1 software with label RPF feature configured AND BGP undergoes heavy route churn with prefix scale of around 420K v4 and 60k v6 routes.

**Workaround:**

None.

**• CSCuj77052****Basic Description:**

IPv6 sessions with ND framed prefix delegation go down post RPFO.

**Symptom**

Immediately after an RPFO, IPv6 PPPoE sessions are brought down by the router and IPv6 traffic stops flowing on the sessions.

This is accompanied by the following error message on the console (where addresses displayed will depend on the router's configuration):

```
%ROUTING-RIB-3-ECMP_ERR_ADD : Path add exceed max number of paths supported by protocol.  
Table 0xXXXXXXXX, prefix XXXX:X:X::/64, protocol subscriber, intf 0xXXXXXXXX, tunnelid 0,  
nexthop_table 0xXXXXXXXX, nexthop fe80::XXX:XXXX:XXXX:XXX
```

**Conditions:**

This issue occurs with IPv6-only or dual stack PPPoE subscriber sessions when the ipv6\_rib process is restarted or following an RP failover.

This is observed when "ipv6 nd framed-prefix-pool" is used to delegate the prefix.

**Workaround:**

None.

**• CSCul82815****Basic Description:**

VTY\_disconnect is not able to clear allocated TTY.

**Symptom**

VTY line not getting cleared up on child channel exit. New child channel allocates a next available VTY line and very soon all VTY lines would be exhausted.

**Conditions:**

Using SSH client which support multichannel (openssh 5.0 or higher version).

**Workaround:**

- Exiting master channel will clear the VTY lines which were allocated for child channels.
- If the above does not clear the VTY lines, restart devc-vty process.

**• CSCum59810****Basic Description:**

qos\_ma crash if input Satellite QoS offload configured under ICL.

**Symptom**

qos\_ma process crash observed during router boot-up. This happens with an incorrect service-policy configuration on an ICL interface (interface connected to Satellite).

**Conditions:**

The following mis-configuration can cause this crash:

```
interface TenGigE0/7/0/8
  cdp
  nv
  service-policy input Sat-QoS-Offload
  satellite-fabric-link satellite 100
```

**Workaround:**

Configure as below:

```
interface TenGigE0/7/0/8
  cdp
  nv
  satellite-fabric-link satellite 100
```

• **CSCum70594**

**Basic Description:**

Self-originated External LSA counter underflow.

**Symptom**

In some situations, the counter that keeps the number of redistributed prefixes can be decremented multiple times for a given prefix when prefix is not redistributed anymore. The following may occur:

- Router may redistribute more prefixes than the configured limit.
- The below message is observed:

```
%ROUTING-OSPFv3-3-INTERNALERR : Internal error:
Self-originated External LSA counter underflow
```

**Conditions:**

Double decrement of the counter happens if the prefix that has been redistributed by OPFv3 changes the source protocol in RIB first, which is followed by the RIB removal of the prefix. Both of these need to happen in a very short period of time.

**Workaround:**

Restart the OSPFv3 process.

• **CSCum71861**

**Basic Description:**

The **show ospf vrf xxx** command output routes summary shows negative intra-area.

**Symptom**

**show ospf vrf route summary** command output may sometime show negative path counter value.

**Conditions:**

Router may show negative value for intra-Area path counter maintained by OSPF. Intermittently, observed this issue showing up after clearing OSPF session for VRFs.

**Workaround:**

None.

• **CSCum11308**

**Basic Description:**

L2fab-DH: Satellite stuck in "probing" after changing encapsulation type.

**Symptom**

After changing the encaps type of an L2 satellite-fabric-link, the state of the interface (as displayed in show nv satellite protocol discovery) is Probing.

**Conditions:**

Changing the encapsulation type of the L2 satellite-fabric-link without shutting the interface or removing the nV ICPE configuration.

**Workaround:**

Shut down the interface (or remove the nv ICPE configuration) before changing the encapsulation type of an L2 fabric satellite-fabric-link.

**• CSCum42969****Basic Description:**

Policy-map configured through XML has value mismatch.

**Symptom**

After configuring policy-map discard-class through XML request, user may notice mismatch in the value shown under **show running-config**.

**Conditions:**

Configuring policy-map discard-class using XML on a router running Cisco IOS XR Software Release 5.1.1.

**Workaround:**

Use CLI instead of XML to configure policy-map discard-class.

## Caveats Specific to the Cisco XR 12000 Series Router

There are no caveats specific to the Cisco XR 12000 Series Router in this release.

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

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