# Release Notes for Cisco CRS for Cisco IOS XR Software Release 5.3.2

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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.

This release notes describe the features provided in the Cisco IOS XR Software Release 5.3.2 for the Cisco CRS router and are updated as needed.

**Note** For information on the Cisco CRS router running Cisco IOS XR Software Release 5.3.2, see the Important Notes, on page 24.

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

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

This 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 32 section.

For a list of software caveats that apply to Cisco IOS XR Software Release see the Caveats section.

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/c/en/us/support/routers/carrier-routing-system/products-field-notices-list.html

Cisco IOS XR Software running on the Cisco CRS 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), Layer 2 Virtual Private Network (L2VPN), 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, and Bidirectional Protocol Independent Multicast (BIDIR-PIM).

- **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).
- **Availability—**This supports rich availability features such as fault containment, fault tolerance, fast switchover, link aggregation, nonstop routing for ISIS, LDP, BGP, 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.
- **IPv6 VPN over IP —**This delivers IPv6 VPN over IP traffic.

**Note** IPv6 VPN over MPLS and IPv6 VPN over IP won't co-exist

- **Carrier Grade Network Address Translation (CGN)—**This enables services providers to execute orderly transitions to IPv6 through mixed IPv4 and IPv6 networks. CGN provides address family translation but is not limited to just translation within one address family. CGN delivers a comprehensive solution suite for IP address management and IPv6 transition.
- **Enhanced core competencies:**
  - IP fast convergence with Fast reroute (FRR) support for Intermediate System-to-Intermediate System (IS-IS) and OSPF
  - Traffic engineering support for unequal load balancing
  - Traffic engineering over generic routing encapsulation (GRE) tunnel interfaces—LDP, L2VPN, and L3VPN over TE over GRE are supported. VPN routes over TE and over GRE, require a labelled path for path resolution
  - VRF support for GRE tunnel interfaces—This support includes GRE tunnel interfaces under a VRF, however the GRE tunnel source and destination are in the global table
  - RSVP support over GRE tunnels
  - Path Computation Element (PCE) capability for traffic engineering

For more information about new features provided on the Cisco CRS router for Cisco IOS XR Software Release, see the Software Features Introduced in Cisco IOS XR Software Release 5.3.2 section in this document.

# System Requirements

This section describes the system requirements for Cisco IOS XR Software Release 5.3.2 supported on the Cisco CRS Router.

To determine the software versions or levels of your current system, see the *Determining Your Software Version* section.

## Feature Set Table

This table lists the Cisco IOS XR Software feature set matrix (PIE files) and associated filenames available for the Cisco IOS XR Software Release 5.3.3 supported on the Cisco CRS router.

***Table 1: Cisco IOS XR Software Release 5.3.2 PIE Files***

| Feature Set | Filename | Description |
|---|---|---|
| **Composite Package** | | |
| Cisco IOS XR IP Unicast Routing Core Bundle | hfr-mini-px.pie-5.3.2 | Contains the required core packages, including OS, Admin, Base, Forwarding, Modular Services Card, Routing, SNMP Agent, and Alarm Correlation. |
| Cisco IOS XR IP Unicast Routing Core Bundle | hfr-mini-px.vm-5.3.2 | Contains the required core packages including OS, Admin, Base, Forwarding, Modular Services Card, Routing, SNMP Agent, and Alarm Correlation. |
| **Optional Individual Packages** (Packages are installed individually) | | |
| Cisco IOS XR Manageability Package | hfr-mgbl-px.pie-5.3.2 | Common Object Request Broker Architecture (CORBA) agent, Extensible Markup Language (XML) Parser, and HTTP server packages. |

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|---|---|---|
| Cisco IOS XR MPLS Package | hfr-mpls-px.pie-5.3.2 | 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 | hfr-mcast-px.pie-5.3.2 | 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 | hfr-k9sec-px.pie-5.3.2 | 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 Services Package | hfr-services-px.pie-5.3.2 | Includes binaries to support CGSE and CGSE PLUS cards. |
| Cisco IOS XR FPD Package | hfr-fpd-px.pie-5.3.2 | Firmware for Fixed Physical layer interface module (PLIM) and Shared port adapters (SPA) modules as well as ROM monitor (ROMMON) images for Cisco CRS chassis. |
| Cisco IOS XR Diagnostic Package | hfr-diags-px.pie-5.3.2 | Diagnostic utilities for Cisco IOS XR routers. |
| Cisco IOS XR Documentation Package | hfr-doc-px.pie-5.3.2 | .man pages for Cisco IOS XR Software on the Cisco CRS chassis. |
| Cisco IOS XR Video Package | hfr-video-px.pie-5.3.2 | Support for Video Monitoring on Cisco CRS routers. |

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|---|---|---|
| Cisco IOS XR Carrier Grade Services Engine Package | hfr-services-px.pie-5.3.2 | Support for Carrier Grade NAT and Cloud Centric Networking on Cisco CRS routers. |
| Cisco IOS XR Satellite Package | hfr-asr9000v-nV-px.pie-5.3.2 | Includes binaries to support Cisco ASR9000v Series Router Software. |
| Cisco IOS XR Lawful Intercept (LI) Package | hfr-li-px.pie-5.3.2 | Includes LI software images. |

This table lists the Cisco IOS XR Software feature set matrix (TAR files) and associated filenames available for the Cisco IOS XR Software Release 5.3.2 supported on the Cisco CRS router.

***Table 2: Cisco IOS XR Software Release 5.3.2 TAR Files***

| Feature Set | Filename | Description |
|---|---|---|
| Cisco IOS XR IP/MPLS Core Software | CRS-iosxr-px-5.3.2.tar | • Cisco IOS XR IP Unicast Routing Core Bundle<br>• Cisco IOS XR Manageability Package<br>• Cisco IOS MPLS Package<br>• Cisco IOS XR Multicast Package<br>• Cisco IOS XR Diagnostic Package<br>• Cisco IOS XR FPD Package<br>• Cisco IOS XR Lawful Intercept Package |

| Feature Set | Filename | Description |
|---|---|---|
| Cisco IOS XR IP/MPLS Core Software 3DES | CRS-iosxr-px-k9-5.3.2.tar | • Cisco IOS XR IP Unicast Routing Core Bundle<br>• Cisco IOS XR Manageability Package<br>• Cisco IOS XR MPLS Package<br>• Cisco IOS XR Multicast Package<br>• Cisco IOS XR Security Package<br>• Cisco IOS XR Diagnostic Package<br>• Cisco IOS XR FPD Package<br>• Cisco IOS XR Lawful Intercept 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 CRS running Cisco IOS XR Software Release 5.3.2 consist of the following:

- 6 GB memory on Performance Route Processors (PRPs)

## Supported Hardware

The following tables lists the supported hardware components on the Cisco CRS Router and the minimum required software versions. For more information, see the *Firmware Support* section.

All hardware features are supported on Cisco IOS XR Software, subject to the memory requirements specified in the *Memory Requirements* section.

***Table 3: Cisco CRS Supported Hardware and Minimum Software Requirements***

| Component | Part Number | Support from version |
|---|---|---|
| **Cisco CRS Series 16-Slot Line Card Chassis** | | |

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|---|---|---|
| Cisco CRS 16-Slot Line Card Chassis | CRS-16-LCC | 3.2 |
| Cisco CRS Fan Tray for 16-Slot LCC | CRS-16-LCC-FAN-TR | 3.2 |
| Cisco CRS Fan Controller for 16-Slot Line Card Chassis | CRS-16-LCC-FAN-CT | 3.2 |
| Cisco CRS 16-Slot Alarm Board | CRS-16-ALARM | 3.2 |
| Cisco CRS AC Delta Power Shelf for 16-Slot LCC | CRS-16-LCC-PS-ACD | 3.2 |
| Cisco CRS AC Wye Power Shelf for 16-Slot LCC | CRS-16-LCC-PS-ACW | 3.2 |
| Cisco CRS DC Power Shelf for 16-Slot LCC | CRS-16-LCC-PS-DC | 3.2 |
| Cisco CRS LCC Front AC Power Panel | CRS-16-ACGRILLE | 3.2 |
| Cisco CRS LCC Front DC Power Panel | CRS-16-DCGRILLE | 3.2 |
| Cisco CRS Line Card Chassis Front Doors | CRS-16-LCC-DRS-F | 3.2 |
| Cisco CRS Line Card Chassis Front Cable Mgmt | CRS-16-LCC-FRNT | 3.2 |
| Cisco CRS LCC Expanded Front Cable Mgmt | CRS-16-LCC-FRNT-E | 3.2 |
| Cisco CRS Line Card Chassis Rear Cable Mgmt | CRS-16-LCC-BCK-CM | 3.2 |
| Cisco CRS Line Card Chassis Rear Doors | CRS-16-LCC-DRS-R | 3.2 |
| Cisco CRS Lift for LCC 16 and FCC | CRS-16-LIFT/B | 3.2 |
| Cisco CRS DC PEM for 16 slot LCC and FCC | CRS-16-DC-PEM | 3.2 |
| Cisco CRS 16 Slot System Reduced-Noise DC PEM | CRS-16-DC-PEM-B | 3.8 |
| Cisco CRS 16 Slot System Reduced-Noise Fan Tray | CRS-16-LCC-FNTR-B | 3.8 |
| Cisco CRS Series LC Chassis Fan Controller | CRS-16-LCC-F-CT-B | 4.0.1PX |
| Cisco CRS 16-Slot Enhanced Line Card Chassis | CRS-16-LCC-B | 4.0.3 |
| Cisco CRS Modular Power Alarm for 16 slots and FCC | CRS-16-ALARM-C | 3.9 |
| Cisco CRS Modular Power Grill For 16 Slots and FCC | CRS-16-PW-GRILL | 3.9 |

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|---|---|---|
| Cisco CRS Modular DC Power Shelf for 16 slots LCC | CRS-16LCC-PSH-DC | 3.9 |
| Cisco CRS Modular AC Power Shelf for 16 slots LCC | CRS-16LCC-PSH-AC | 3.9 |
| Cisco CRS Modular AC Power Module | CRS-PM-AC | 3.9 |
| **Cisco CRS Series 8-Slot Line Card Chassis** | | |
| Cisco CRS 8-Slot Install Kit | CRS-8-INSTALL-KT | N/A |
| Cisco CRS 8-Slot Fork Lift Tube | CRS-8-LIFT-TUBE | N/A |
| Cisco CRS 8-Slot Front Badge Panel | CRS-8-BDG-PANEL | N/A |
| Cisco CRS 8-Slot Front Inlet Grill | CRS-8-FRNT-GRILL | N/A |
| Cisco CRS 8-Slot Horizontal Install Rails | CRS-8-HRZ-RAILS | N/A |
| Cisco CRS 8-Slot Line Card Chassis | CRS-8-LCC | 3.2 |
| Cisco CRS Fan Tray for 8-Slot Line Card Chassis | CRS-8-LCC-FAN-TR | 3.2 |
| Cisco CRS Line Card Chassis Filter Pack | CRS-8-LCC-FILTER | 3.2 |
| Cisco CRS AC Pwr Rectifier for 8-Slot LCC | CRS-8-AC-RECT | 3.2 |
| Cisco CRS DC Power Entry Module for 8-Slot LCC | CRS-8-DC-PEM | 3.2 |
| Cisco CRS AC & DC Power Module Filter for 8-Slot LCC | CRS-8-PWR-FILTER | 3.2 |
| Cisco CRS AC Delta PDU for CRS-8 LCC | CRS-8-LCC-PDU-ACD | 3.2 |
| Cisco CRS AC Wye PDU for CRS-8 LCC | CRS-8-LCC-PDU-ACW | 3.2 |
| Cisco CRS DC PDU for CRS-8 LCC | CRS-8-LCC-PDU-DC | 3.2 |
| Cisco CRS 8-Slot Enhanced Line Card Chassis | CRS-8-LCC-B<br>You must use CRS-8-FANTRAY-B fan tray when CRS-MSC-X, CRS-LSP-X and CRS-FP-X line cards are installed. | 4.2.0 |
| Cisco CRS Modular DC Power Shelf for 8 slots Chassis | CRS-8-PSH-DC | 3.9 |

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| Cisco CRS Modular DC Power Module | CRS-PM-DC | 3.9 |
| Cisco CRS Modular AC Power Shelf for 8 slots Chassis | CRS-8-PSH-AC | 3.9 |
| Cisco CRS Modular AC Power Module | CRS-PM-AC | 3.9 |
| Cisco CRS 8 slot Fan Tray for CRS-8/S-B | CRS-8-FANTRAY-B | -- |
| **Cisco CRS Series 4-Slot Line Card Chassis** | | |
| Cisco CRS 4-Slot Line Card Chassis | CRS-4-CH | 3.4 |
| **Cisco CRS Fabric Chassis Hardware** | | |
| Cisco CRS-1 Series Fabric Card Chassis Only | CRS-FCC= | 3.2 |
| CRS-1 Fabric Chassis AC Delta Power Kit | CRS-FCC-ACD-KIT | 3.2 |
| CRS-1 Fabric Chassis AC Grille | CRS-FCC-ACGRILLE | 3.2 |
| CRS-1 Fabric Chassis AC-Wye Power Kit | CRS-FCC-ACW-KIT | 3.2 |
| CRS Fabric Chassis DC Power Kit | CRS-FCC-DC-KIT | 3.2 |
| CRS-1 Fabric Chassis DC Power Grille | CRS-FCC-DCGRILLE | 3.2 |
| CRS Fabric Chassis Lift Bracket | CRS-FCC-LIFT-BRKT | 3.2 |
| CRS Fabric Chassis OIM Modules | CRS-FCC-OIM-1S= | 3.2 |
| Cisco CRS-1 Series FC Chassis Shelf/Fan/Enet cntr | CRS-FCC-SC-GE= | 3.2 |
| CRS-1 Fabric Chassis AC Intake Grille | CRS-FCC-ACGRILLE= | 3.2 |
| CRS-1 Fabric Chassis DC Intake Grille | CRS-FCC-DCGRILLE= | 3.2 |
| Cisco CRS-1 Series Fan Tray for FCC | CRS-FCC-FAN-TR= | 3.2 |
| CRS-1 Fabric Card Chassis Fan Tray Filters | CRS-FCC-FILTER= | 3.2 |
| CRS-1 Fabric Chassis Front Cosmetic Kit | CRS-FCC-FRNT-CM= | 3.2 |
| Cisco CRS-1 Series Fabric Card Chassis Fiber Module LED | CRS-FCC-LED= | 3.2 |
| Cisco CRS-1 Series DC Power Shelf for FCC | CRS-FCC-PS-DC= | 3.2 |
| CRS-1 Fabric Chassis Rear Cosmetic Kit | CRS-FCC-REAR-CM= | 3.2 |

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|---|---|---|
| CRS-LIFT Brackets for Fabric Chassis | CRS-FCC-LIFT-BRKT= | 3.2 |
| CRS Fabric Chassis OIM Module | CRS-FCC-OIM-1S | 3.2 |
| CRS-1 Fabric Chassis AC Delta Power Supply | CRS-FCC-PS-ACD | 3.2 |
| CRS-1 Fabric Chassis AC Wye Option | CRS-FCC-PS-ACW | 3.2 |
| CRS-1 Fabric Chassis DC Power Option | CRS-FCC-PS-DC | 3.2 |
| Cisco CRS-1 Series Fabric Card Chassis Switch Fabric Card | CRS-FCC-SFC= | 3.2 |
| CRS-1 Fabric Chassis Integrated Switch Controller Card | CRS-FCC-SC-22GE Integrated Switch | 3.4.1 |
| Cisco CRS-3 Series Fabric Card Chassis Switch | CRS-FCC-SFC-140 | 4.0.3 |
| CRS-1 Fabric Chassis Integrated Switch Controller Card - B | CRS-FCC-SC-22GE-B | 5.1.3 |
| Cisco CRS-X Fabric Card Chassis Switch Fabric Card (400G) | CRS-FCC-SFC-400 | 5.1.3 |
| Cisco CRS-X Fabric Card Chassis Switch Fabric Card (400G)-B | CRS-FCC-SFC-400-B | 5.3.3 with hfr-px-5.3.3.CRS.tar SMU tar file |
| **Cisco CRS General Chassis Hardware** | | |
| Cisco CRS PCMCIA Flash Disk 4 GB | CRS-FLASH-DISK-4G | 3.8 |
| Cisco CRS PCMCIA Flash Disk 16 GB | CRS-FLASH-DISK-16G | 4.2 |
| Cisco CRS Modular Service Card | CRS-MSC | 3.2 |
| Cisco CRS Modular Service Card B | CRS-MSC-B | 3.6 |
| Cisco CRS-1 Series Forwarding Processor 40G | CRS-FP40 | 3.8.1 |
| Cisco CRS Series Modular Services Card 140G | CRS-MSC-140G | 4.0.0 PX |
| Cisco CRS Series Forwarding Processor Card 140G | CRS-FP140 | 4.0.0 PX |
| Cisco CRS-3 Label Switch Processor | CRS-LSP | 4.3.0 |
| Cisco CRS-X Label Switch Processor | CRS-LSP-X | 5.1.2 |
| Cisco CRS Series Modular Services Card 400G | CRS-MSC-X | 5.1.1 |
| Cisco CRS Series Forwarding Processor 400G | CRS-FP-X | 5.1.1 |

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|---|---|---|
| Cisco CRS 8-Slot Fabric Card/Single | CRS-8-FC/S | 3.2 |
| Cisco CRS 8-Slot Fabric Card Blank | CRS-8-FC-BLANK | 3.2 |
| Cisco CRS 8-Slot Fabric Handle | CRS-8-FC-HANDLE | 3.2 |
| Cisco CRS 16-Slot Fabric Card/Single | CRS-16-FC/S | 3.2 |
| Cisco CRS Series 4 Slots Fabric Card / Single (140G) | CRS-4-FC140/S | 4.0.0 PX |
| Cisco CRS Series 8 Slots Fabric Card / Single (140G) | CRS-8-FC140/S | 4.0.0 PX |
| Cisco CRS Series 16 Slots Fabric Card / Single (140G) | CRS-16-FC140/S | 4.0.0 PX |
| Cisco CRS Series 16 Slots Fabric Card / Multi (140G) | CRS-16-FC140/M | 4.0.3 |
| Cisco CRS Series 8 Slots Fabric Card / Single Chassis (400G) | CRS-8-FC400/S | 5.1.1 |
| Cisco CRS Series 16 Slots Fabric Card / Single Chassis (400G) | CRS-16-FC400/S | 5.1.1 |
| Cisco CRS Series 8-Slot Back-to-Back Fabric Card | CRS-8-FC140/M | 4.3.1 |
| Cisco CRS-X 16-Slot Line Card Chassis Fabric Card / Multi (400G) | CRS-16-FC400/M | 5.1.3 |
| Cisco CRS Series Modular Services Card 200G | CRS-MSC-X-L | 5.1.4 |
| Cisco CRS Series Forwarding Processor 200G | CRS-FP-X-L | 5.1.4 |
| Cisco CRS Series 8 Slots Fabric Card / Multi (400G) | CRS-8-FC400/M | 5.3.1 |
| **Cisco CRS Interface and Route Processor Cards** | | |
| Cisco Carrier 1 Series SPA Interface Processor 40G | CRS1-SIP-800 | 3.2 |
| Cisco CRS-1 Distributed Route Processor | CRS-DRP | 3.3 |
| Cisco CRS-1 Distributed Route Processor CPU Module | CRS-DRP-B-CPU | 3.4.1 |
| Cisco CRS-1 Distributed Route Processor PLIM Module | CRS-DRP-B-PLIM | 3.4.1 |

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|---|---|---|
| Cisco CRS Series 14x10GbE LAN/WAN-PHY Interface Module | 14X10GBE-WL-XFP | 4.0.0 PX |
| Cisco CRS Series 20x10GbE LAN/WAN-PHY Interface Module | 20X10GBE-WL-XFP | 4.0.0 PX |
| Cisco CRS 1-port 100-GE CFP PLIM | 1x100-GE CFP PLIM | 4.0.1 PX |
| Cisco CRS 2-port 100-GE and 5-port 40-GE QSFP+combination PLIM | 2X100GE-FLEX-40 | 5.1.3 |
| Cisco CRS Series 4x100GbE LAN/OTN Interface Module | 4X100GE-LO | 5.1.1 |
| Cisco CRS Series 40x10GbE LAN/WAN/OTN Interface Module | 40X10GE-WLO | 5.1.1 |
| Cisco CRS 2-port 100-GE and 5-port 40-GE QSFP+combination PLIM | 2X100GE-FLEX-40 | 5.1.3 |
| Cisco CRS-1 Series 8 Slots 6 Gb Performance Route Processor | CRS-8-PRP-6G | 4.1 |
| Cisco CRS-1 Series 8 Slots 12 Gb Performance Route Processor | CRS-8-PRP-12G | 4.1 |
| Cisco CRS-1 Series 16 Slots 6 Gb Performance Route Processor | CRS-16-PRP-6G | 4.1 |
| Cisco CRS-1 Series 16 Slots 12 Gb Performance Route Processor | CRS-16-PRP-12G | 4.1 |
| Cisco CRS Series 4x40GbE OTU3 Interface Module | 4-40GE-L/OTN | 4.2.3 |
| Cisco CRS Series 2x40GbE OTU3 Interface Module | 2-40GE-L/OTN | 4.2.3 |
| Cisco CRS Series 1x100GbE IPoDWDM Interface Module | 1-100GE-DWDM/C | 4.2.3 |
| Cisco CRS Flexible SPA and 6-port 10GE PLIM | 6-10GE-WLO-FLEX | 4.3.0 |
| Cisco CRS 80 Gbps Carrier Grade Services Engine PLIM | CRS-CGSE-PLUS | 4.3.1 |
| **Cisco CRS SONET Interface Modules and SPAs** | | |
| Cisco CRS 4xOC-192c/STM64c POS/DPT Interface Module/VS | 4OC192-POS/DPT-VS | 3.2 |

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|---|---|---|
| Cisco CRS 4xOC-192c/STM64c POS/DPT Interface Module/SR | 4OC192-POS/DPT-SR | 3.2 |
| Cisco CRS 4xOC-192c/STM64c POS/DPT Interface Module/IR | 4OC192-POS/DPT-IR | 3.2 |
| Cisco CRS 4xOC-192c/STM64c POS/DPT Interface Module/LR | 4OC192-POS/DPT-LR | 3.2 |
| Cisco CRS 16xOC-48c/STM16c POS/DPT Interface Module | 16OC48-POS/DPT | 3.2 |
| Cisco CRS 1xOC-768c/STM256c POS Interface Module/SR | 1OC768-POS-SR | 3.2 |
| Cisco CRS 8-Port OC-12c/STM-4c Shared Port Adapter | SPA-8XOC12-POS | 3.3 on CRS1-SIP-800<br>4.3.1 on 6-10GE-WLO-FLEX |
| Cisco CRS 2-Port OC-48c/STM-16c POS/RPR Shared Port Adapter | SPA-2XOC48-POS/RPR | 3.4 on CRS1-SIP-800<br>4.3.0 on 6-10GE-WLO-FLEX |
| Cisco CRS 4-Port OC-48c/STM-16c POS/RPR Shared Port Adapter | SPA-4XOC48-POS/RPR | 3.4 on CRS1-SIP-800<br>4.3.0 on 6-10GE-WLO-FLEX |
| Cisco CRS 1-Port OC-192c/STM-64c POS/RPR Shared Port Adapter with XFP Optics | SPA-OC192POS-XFP | 3.2 on CRS1-SIP-800<br>4.3.0 on 6-10GE-WLO-FLEX |
| Cisco CRS 4-Port OC-3c/STM-1c Shared Port Adapter | SPA-4XOC3-POS | 3.2 on CRS1-SIP-800<br>4.3.1 on 6-10GE-WLO-FLEX |
| Cisco CRS 1-Port OC-192/STM-64 POS/RPR SPA VSR Optics | SPA-OC192POS-VSR | 3.4.1 on CRS1-SIP-800 |
| Cisco CRS 4-Port OC-12c/STM-4 Packet over SONET SPA | SPA-4XOC12-POS | 4.0.1 on CRS1-SIP-800<br>4.3.1 on 6-10GE-WLO-FLEX |
| Cisco CRS 8-Port OC-3c/STM-1 Packet over SONET SPA | SPA-8XOC3-POS | 4.0.1 on CRS1-SIP-800<br>4.3.1 on 6-10GE-WLO-FLEX |

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|---|---|---|
| Cisco CRS 4-Port OC-3c/STM-1 Packet over SONET SPA | SPA-4XOC3-POS-V2 | 4.0.1 on CRS1-SIP-800<br>4.3.2 on 6-10GE-WLO-FLEX |
| Cisco CRS 1-Port OC-768c/STM-256c (C-band) DWDM PLIM | 1OC768-ITU/C | 3.3 |
| Cisco CRS 1-Port OC-768c/STM-256c (C-band) DPSK+ DWDM PLIM | 1OC768-DPSK/C | 3.6 |
| **Cisco CRS ATM Modules and SPAs** | | |
| 3-Port Clear Channel OC-3 ATM SPA | SPA-3XOC3-ATM-V2 | 3.7 on CRS1-SIP-800 |
| 1-Port Clear Channel OC-12 ATM SPA | SPA-1XOC12-ATM-V2 | 3.7 on CRS1-SIP-800 |
| **Cisco CRS Serial Interface Modules and SPAs** | | |
| Cisco CRS 4-Port Clear Channel T3/E3 Serial Shared Port Adapter | SPA-4XT3/E3 | 3.4.1 on CRS1-SIP-800 |
| Cisco CRS 2-Port Clear Channel T3/E3 Serial Shared Port Adapter | SPA-2XT3/E3 | 3.4.1 on CRS1-SIP-800 |
| **Cisco CRS Ethernet Interface Modules and SPAs** | | |
| Cisco CRS 8x10 GbE Interface Module LR/ER | 8-10GBE | 3.2 |
| Cisco 5-Port Gigabit Ethernet Shared Port Adapter, Version 2 | SPA-5X1GE-V2 | 3.4 on CRS1-SIP-800 |
| Cisco 8-Port Gigabit Ethernet Shared Port Adapter, Version 2 | SPA-8X1GE-V2 | 3.4 on CRS1-SIP-800<br>4.3.0 on 6-10GE-WLO-FLEX |
| Cisco 8-Port Gigabit Ethernet Shared Port Adapter | SPA-8X1GE | 3.2 on CRS1-SIP-800 |
| Cisco 10-Port Gigabit Ethernet Shared Port Adapter, Version 2 | SPA-10X1GE-V2 | 3.4 on CRS1-SIP-800<br>4.3.2 on 6-10GE-WLO-FLEX |
| Cisco 1-Port Ten Gigabit Ethernet Shared Port Adapter, Version 2 | SPA-1X10GE-L-V2 | 3.4 on CRS1-SIP-800<br>4.3.2 on 6-10GE-WLO-FLEX |
| Cisco 4-Port Ten Gigabit Ethernet (C-band) DWDM PLIM | 4-10GE-ITU/C | 3.3 |

| | | |
|---|---|---|
| Cisco 1-port 10GbE SPA WAN/LAN PHY | SPA-1X10GE-WL-V2 | 3.5.2 on CRS1-SIP-800<br>4.3.2 on 6-10GE-WLO-FLEX |
| Cisco CRS-1 Series 4x10GE Interface Module | 4-10GE | 3.8.1 |
| Cisco CRS-1 Series 42x1GE Interface Module | 42-1GE | 3.8.1 |
| Cisco CRS-1 Series 8-Port Ten Gigabit Ethernet Interface Module | 8-10GBE-WL-XFP | 3.9.1 |
| Cisco CRS-1 Series 4-Port Ten Gigabit Ethernet Interface Module | 4-10GBE-WL-XFP | 3.8.4 |
| Cisco CRS-1 Series 20x1GE Flexible Interface Module | 20-1GE-FLEX | 3.8.1 |
| Cisco CRS-1 Series 2x10GE WAN/LAN Flexible Interface Module | 2-10GE-WL-FLEX | 3.8.1 |
| **Cisco CRS 10GE Optical to Electrical Modules** | | |
| 10GBASE-LR XENPAK Module for Cisco CRS | XENPAK-10GB-LR+ | 3.4 |
| 10GBASE-DWDM XENPAK | XENPAK-10GB-DWDM | 3.2.2 |
| 10GBASE-ER XENPAK Modular for Cisco CRS-1 | XENPAK-10GB-ER | 3.4 |
| 10GBASE-ER XENPAK Modular for Cisco CRS-1 | XENPAK-10GB-ER+ | 3.4 |
| Cisco 10GBASE-SR XFP Module for MMF | XFP-10G-MM-SR | 3.8 |
| Cisco Multirate 10GBASE-LR/-LW and OC-192/STM-64 SR-1 XFP Module for SMF | XFP-10GLR-OC192SR | 3.4 |
| Cisco Multirate 10GBASE-LR/-LW and OC-192/STM-64 SR-1 XFP Module for SMF, low power (1.5W) | XFP10GLR-192SR-L | 3.8.4, 3.9.1 |
| Cisco Multirate 10GBASE-ER/-EW and OC-192/STM-64 IR-2 XFP Module for SMF | XFP-10GER-192IR+ | 3.4 |
| Cisco Multirate 10GBASE-ER/-EW and OC-192/STM-64 IR-2 XFP Module for SMF, low power (2.5W) | XFP10GER-192IR-L | 3.8.4, 3.9.1 |
| Cisco Multirate 10GBASE-ZR/-ZW and OC-192/STM-64 lR-2 XFP Module for SMF | XFP-10GZR-OC192LR | 3.4 |

| | | |
|---|---|---|
| Cisco fixed rate Dense Wavelength-Division Multiplexing XFP Modules | DWDM-XFP-30.33 through DWDM-XFP-59.79 | NA |
| Cisco 10GBASE Dense Wavelength-Division Multiplexing XFP Module | DWDM-XFP-C | 4.2.3 |
| 10GBASE-SR SFP Module | SFP-10G-SR | 5.1.1 |
| 10GBASE-SR SFP Module for Extended Temp range | SFP-10G-SR-X | 5.1.1 |
| 10GBASE-LR SFP Module | SFP-10G-LR | 5.1.1 |
| 10GBASE-LR SFP Module for Extended Temp range | SFP-10G-LR-X | 5.1.1 |
| 10GBASE-ER SFP Module | SFP-10G-ER | 5.1.1 |
| 10GBASE-ZR SFP10G Module for SMF | SFP-10G-ZR | 5.1.1 |
| **Cisco CRS SFPs and CFPs** | | |
| Cisco CRS 2.5 G SFP LR Optic | POM-OC48-LR2-LC-C | 3.2 |
| Cisco CRS 2.5 G SFP SR Optic | POM-OC48-SR-LC-C | 3.2 |
| GE SFP, LC connector LX/LH transceiver | GLC-LH-SM | 3.2 |
| 1000BASE-SX SFP transceiver module, MMF, 850nm, DOM | GLC-SX-MMD | 3.6 |
| 1000BASE-LX/LH SFP transceiver module, MMF/SMF, 1310nm, DOM | GLC-LH-SMD | 3.6 |
| 1000BASE-LX/LH SFP | SFP-GE-L | 3.4 |
| 1000BASE-SX SFP (DOM) | SFP-GE-S | 3.4 |
| 1000BASE-T SFP (NEBS 3 ESD) | SFP-GE-T | 3.4 |
| 1000BASE-ZX Gigabit Ethernet SFP (DOM) | SFP-GE-Z | 3.4 |
| 100GBASE-LR4 CFP transceiver module for SMF, 1310-nm wavelength, SC duplex connector | CFP-100G-LR4 | 4.0 |
| 100 Gigabit Ethernet over 10 short-reach optical lanes (SR10) optics (multimode fiber) | CFP-100G-SR10 | 4.2.1 |
| CPAK-100G-LR4 Transceiver module, 10 km SMF | CPAK-100G-LR4 | 5.1.1 |

| | | |
|---|---|---|
| CPAK-100G-SR10 Transceiver module, 100 m OM3 MMF | CPAK-100G-SR10 | 5.1.1 |
| 100-Gigabit Ethernet C Form-factor Pluggable (CFP) optics module - CFP-100G-ER4 | CFP-100G-ER4 | 5.1.2 |
| 40-Gigabit Ethernet C Form-factor Pluggable (CFP) optics module - 40GBASE-LR4 | CFP-40G-LR4 | 4.2.3 |
| 40-Gigabit Ethernet C Form-factor Pluggable (CFP) optics module - 40GBASE-SR4 | CFP-40G-SR4 | 4.2.3 |
| 40-Gigabit Ethernet C Form-factor Pluggable (CFP) optics module - 40GBASE-FR | CFP-40G-FR | 4.2.3 |
| Cisco 40GBASE-SR4 QSFP Module | QSFP-40G-SR4 | 5.1.3 |
| Cisco 40GBASE-LR4 QSFP Module | QSFP-40G-LR4 | 5.1.3 |
| Cisco 40GBASE-ER4 QSFP Module | QSFP-40G-ER4 | 5.3.1 |

- For all slots (except slots 1 & 6): 24 ports of 10GE ER per 24x10GE LC
- For slots 1 & 6: 12 ports of 10GE ER and remaining 12 ports of SR/LR per 24x10GE LC

**Note** This is applicable at 40 degrees C.

## Hardware Not Supported

The following hardware are not supported:

| Component | Part Number |
|---|---|
| Cisco CRS-1 16-Slot Line-Card Chassis Route Processor | CRS-16-RP |
| Cisco CRS PCMCIA Flash Disk 2 GB | CRS-FLASH-DISK-2G |
| Cisco CRS 8-Slot Route Processor | CRS-8-RP |
| Cisco CRS-1 16-slot Route Processor, revision B | CRS-16-RP-B |

**Note**

- The fixed configuration DC power system is not supported for CRS-X 8-slot legacy chassis ( CRS-8-LCC) and CRS-X 16-slot single/multichassis system legacy chassis ( CRS-16-LCC). We recommend to replace the fixed configuration DC power system with modular configuration DC power system. The product ID for modular DC power systems are CRS-8-DCKIT-M= and CRS-16-DCKIT-M= respectively for 8 slots system and 16 slots system.
- CRS supports PRP for all Single chassis and Multichassis configurations, due to its significant advantages in improving boot time, performance, and scale. For information on End-of-Sale and End-of-Life Announcement for the Cisco CRS 8-Slot and 16-slot Line Card Chassis Route Processors:

  http://www.cisco.com/en/US/prod/collateral/routers/ps5763/end_of_life_notice_c51-695816.html

  http://www.cisco.com/en/US/prod/collateral/routers/ps5763/end_of_life_notice_c51-695817.html
- Cisco Session Border Controller (SBC) is not supported. Cisco IOS XR Software Release 3.7 is the last release that supports SBC.
- Cisco CRS-1 Series Forwarding Processor 40G (CRS-FP40) is not supported on Cisco CRS 16-Slot chassis.

## CRS-FP140 Licenses

The following licenses apply to the CRS-FP140:

| Licence | Description |
|---|---|
| XC-ENH-NF-140G | Cisco CRS Series Enhanced Netflow Performance License 140G |
| XC-L2L3VPN-140G | Cisco CRS Series L2 and L3 VPN Peering Edge License 140G |
| XC-RTE-SCL-140G | Cisco CRS Series Route Scale License 140G |
| XC-TE-SCL-140G | Cisco CRS Series Traffic Engineering Scale License 140G |
| XC-MC-LIC-140G | Cisco CRS Series Multichassis License 140G |

CRS-FP140 also supports eDelivery licenses, which can be downloaded as the License Certificates in PDF format.

For further information or questions, please visit http://www.cisco.com/web/partners/tools/edelivery.html.

| eDelivery PID | Description |
|---|---|
| L-XC-ENH-NF-140G= | Cisco CRS Series Enhanced NetFlow License 140G |
| L-XC-RTE-SCL-140G= | Cisco CRS Series Route Scale License 140G |

| | |
|---|---|
| L-XC-MC-LIC-140G= | Cisco CRS Series Multichassis License 140G |
| L-XC-TE-SCL-140G= | Cisco CRS Series Traffic Engineering Scale License 140G |
| L-XC-L2L3VPN-140G= | Cisco CRS Series L2 L3 VPN Peering Edge License 140G |

## CRS-FP400G Licenses

The following licenses apply to the CRS-FP400G:

| Licence | Description |
|---|---|
| XC-ENH-NF-400G | Cisco CRS Series Enhanced Netflow Performance License 400G |
| XC-L2L3VPN-400G | Cisco CRS Series L2 and L3 VPN Peering Edge License 400G |
| XC-RTE-SCL-400G | Cisco CRS Series Route Scale License 400G |
| XC-TE-SCL-400G | Cisco CRS Series Traffic Engineering Scale License 400G |

CRS-FP400G also supports eDelivery licenses, which can be downloaded as the License Certificates in PDF format.

For further information or questions, please visit http://www.cisco.com/web/partners/tools/edelivery.html.

| eDelivery PID | Description |
|---|---|
| L-XC-ENH-NF-400G= | Cisco CRS Series Enhanced NetFlow License 400G |
| L-XC-RTE-SCL-400G= | Cisco CRS Series Route Scale License 400G |
| L-XC-TE-SCL-400G= | Cisco CRS Series Traffic Engineering Scale License 400G |
| L-XC-L2L3VPN-400G= | Cisco CRS Series L2 L3 VPN Peering Edge License 400G |

## Software Compatibility

Cisco IOS XR Software Release 5.3.2 is compatible with the following Cisco CRS-1 and CRS-3 systems:

- Cisco CRS 4-Slot Single Chassis System
- Cisco CRS 8-Slot Single Chassis System
- Cisco CRS 16-Slot Single Chassis System
- Cisco CRS Multichassis Systems

Cisco IOS XR Software Release 5.3.2 is compatible with the following Cisco CRS-3 system:

- Cisco CRS 4-Slot Single Chassis System
- Cisco CRS 8-Slot Single Chassis System
- Cisco CRS 16-Slot Single Chassis System
- Cisco CRS-3 Multichassis System, maximum configuration of 8+2
- Cisco CRS-3 16-slot Back-to-Back System
- Cisco CRS-3 8-slot Back-to-Back System

Cisco IOS XR Software Release 5.3.2 is compatible with the following Cisco CRS-X systems:

- Cisco CRS 8-Slot Single Chassis System. You must use CRS-8-FANTRAY-B fan tray with Cisco CRS-X system.
- Cisco CRS 16-Slot Single Chassis System
- Cisco CRS-X Multichassis System, maximum configuration of 8+2
- Cisco CRS-X 16-slot Back-to-Back System
- Cisco CRS-X 8-slot Back-to-Back System

## Minimum Firmware Requirement

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

| | |
|---|---|
| After completing an RMA, upgrade the firmware as per the matrix in this link, which also links to PDF copies of the IOS XR Firmware Upgrade Guides | http://www.cisco.com/web/Cisco_IOS_XR_Software/index.html |
| For the upgrade CLI, 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 CRS router* | http://www.cisco.com/en/US/products/ps5763/prod_command_reference_list.html |

**Note** P image is discontinued from Cisco IOS XR Software Release 4.2 onwards. For more information about this, see the discontinuation of P image for Cisco CRS in Cisco IOS XR Software Release 4.2 and later at

http://www.cisco.com/en/US/prod/collateral/routers/ps5763/product_bulletin_c25-663499.html.

## Determining Your Software Version

To determine the version of Cisco IOS XR Software packages installed on your router, log in to the router and enter the **show install commit summary** command:

### SUMMARY STEPS

1. Enter **show install commit summary** command from EXEC mode.

### DETAILED STEPS

Enter **show install commit summary** command from EXEC mode.
The **show install commit summary** command output for Cisco CRS-1 and Cisco CRS-3 router:

```
RP/0/RP0/CPU0:router# show install commit summary
Default Profile:
  Admin Resources
  SDRs:
    Owner
  Committed Packages:
    disk0:hfr-mini-px-5.3.2
    disk0:hfr-mgbl-px-5.3.2
    disk0:hfr-mpls-px-5.3.2
    disk0:hfr-mcast-px-5.3.2
    disk0:hfr-k9sec-px-5.3.2
    disk0:hfr-fpd-px-5.3.2
    disk0:hfr-doc-px-5.3.2
    disk0:hfr-diags-px-5.3.2
    disk0:hfr-video-px-5.3.2
    disk0:hfr-services-px-5.3.2
    disk0:hfr-asr9000v-nV-px-5.3.2
    disk0:hfr-li-px-5.3.2
```

## What's New in Cisco IOS XR Release 5.3.x

See the following links for a summary of new and changes features in Release 5.3.x:

- Features Added and Changed in Release 5.3.x

# Software Features Introduced in Cisco IOS XR Software Release 5.3.2

## BGP Graceful Maintenance

When a BGP link or router is taken down, other routers in the network find alternative paths for the traffic that was flowing through the failed router or link, if such alternative paths exist. The time required before all routers involved can reach a consensus about an alternate path is called convergence time. During convergence time, traffic that is directed to the router or link that is down is dropped. The BGP Graceful Maintenance feature allows the network to perform convergence before the router or link is taken out of service. The router or link remains in service while the network reroutes traffic to alternative paths. Any traffic that is yet on its way to the affected router or link is still delivered as before. After all traffic has been rerouted, the router or link can safely be taken out of service.

## Segment Routing and LDP Interoperability

OSPFv2 provides mechanisms through which segment routing (SR) interoperate with label distribution protocol (LDP). The control plane of segment routing co-exists with LDP.

Segment Routing Mapping Server (SRMS) functionality in SR is used to advertise SIDs for destinations in LDP part of the network that do not support SR. SRMS maintains and advertises segment identifier (SID) mapping entries for such destinations. OSPFv2 propagates the SRMS mapping entries and interacts with SRMS to determine the SID value when programming the forwarding plane. OSPF installs prefixes and corresponding labels into routing information base (RIB) that are used to program the forwarding information base (FIB).

## BGP DMZ Aggregate Bandwidth

BGP supports aggregating *dmz-link bandwidth* values of external BGP (eBGP) multipaths when advertising the route to interior BGP (iBGP) peer.

## OSPF FIB Download Notification

OSPF FIB Download Notification feature minimizes the ingress traffic drop for a prolonged period of time after the line card reloads.

For more information on OSPF FIB Download Notification, see *Cisco IOS XR Routing Configuration Guide for the Cisco CRS Router*, section OSPF FIB download notification.

## OSPF strict-mode support for BFD dampening

Strict-mode is a OSPF BFD operation mode which keeps the neighbor state down until BFD session is UP.

For more information on OSPF strict-mode support for BFD dampening, see *Cisco IOS XR Routing Configuration Guide for the Cisco CRS Router*, chapter Implementing OSPF.

## RPL - Best Path Selection

Border Gateway Protocol (BGP) routers receive multiple paths to the same destination. As a standard, by default the BGP best path algorithm decides the best path to install in the IP routing table. The route reflector (RR) can know the best-path and multi-path when the prefix is received. This way the route reflector can use

different communities for best-path, multi-path. When RR gets the update from R1, R2, and R3, it performs best path computation; if you combine them with add-path add-all-path RR could send all path to the controller With this new feature, you can tag best path selected by RR using community-string (if is-best-path then community 100:100) and then the controller checks which best path is sent to all R's. Border Gateway Protocol (BGP) routers typically receive multiple paths to the same destination. While carrying out best path computation you always will have one best path, sometimes equal and few non-equal paths and for that, you need *is-best-path* and *is-equal-best-path* . The BGP best path algorithm decides the best path to install in the IP routing table and to use for traffic forwarding.

For more information about this feature, see Implementing BGP chapter in the *Cisco IOS XR Routing Configuration Guide for the Cisco CRS Router*.

### Per Neighbor TCP MSS

Per neighbor TCP MSS feature enables per neighbor TCP MSS configuration to provide unique TCP MSS profiles for each neighbor. Per neighbor TCP MSS is supported in neighbor-group and session-group configuration modes.

For more information about this feature, refer *Cisco IOS XR Routing Configuration Guide for the Cisco CRS Router*, in Per Neighbor TCP MSS section.

### DNS-based SSM Mapping

DNS-based SSM mapping enables you to configure the last hop router to perform a reverse DNS lookup to determine sources sending to groups. For details, see the section DNS-based SSM Mapping in *Cisco IOS XR Multicast Configuration Guide for the Cisco CRS Router*.

### Sub-interface Address Resolution Protocol Protection

Excessive Punt Flow Trap (EPFT)-based policing of the bad actors for Address Resolution Protocol (ARP) is now supported on Cisco CRS-3 Modular Services Line Card in addition to the Cisco CRS-X Line Card.

For more information, see *Cisco IOS XR IP Addresses and Services Configuration Guide for the Cisco CRS Router*.

### New WANPHY Alarm Reporting Rules

The WANPHY alarms are reported (asserted) in the syslog based on the alarm priority. Alarm reporting follows these rules:

- When more than one alarm is detected, only the highest priority alarms are reported. Even if any lower priority alarms are present, they are masked and not reported.
- When a higher priority alarm is reported, previously existing lower priority alarms are masked and a clear notification is generated.
- When a higher priority alarm is cleared, if lower priority alarms are detected, they get reported.

This rule set ensures that the operator focuses on resolving the alarms with highest priority as they have the most significant impact on system performance.

### VPLS QoS

Virtual Private LAN Services (VPLS) is a class of VPN that supports the connection of multiple sites in a single bridged domain over a managed IP/MPLS network. VPLS presents an Ethernet interface to customers, simplifying the LAN/WAN boundary for Service Providers and customers, and enabling rapid and flexible service provisioning, because the service bandwidth is not tied to the physical interface. All services in a VPLS appear to be on the same LAN, regardless of location.

The VPLS QoS feature is now supported on CRS-X.

For more information about this feature refer *Cisco IOS XR Modular Quality of Service Configuration Guide for the Cisco CRS Router*, in the following section.

- Modular QoS Deployment Scenarios
- Supported Capability Matrix
- CRS support VPLS QoS

### TCP Establishment for DSCP Marking or Setting IP Precedence/DSCP for NTP

Differentiated Services Code Point (DSCP) is a field in an IP packet that enables different levels of service to be assigned to network traffic. This is achieved by marking each packet on the network with a DSCP code and appropriating to it the corresponding level of service. DSCP is the combination of IP Precedence and Type of Service fields. As a customer you can configure, the DSCP level via ntp configuration. The level configured by you will be set in ntp packets at IP layer. The higher the value of the IP Precedence field, the higher the priority of the IP packet.

For more information about this feature refer *Cisco IOS XR Modular Quality of Service Configuration Guide for the Cisco CRS Router*, in the *Configuring Modular QoS Congestion Management* section.

### Entropy Label

This release introduces support for entropy label (EL), an initiative that improves router load-balancing efficiency across the MPLS network using the label distribution protocol (LDP).

For information on the implementation of EL, see *Cisco IOS XR MPLS Command Reference for the Cisco CRS Router, Release 5.3.x*

## Hardware Features Introduced in Cisco IOS XR Software Release 5.3.2

Cisco IOS XR Software Release 5.3.2 for the Cisco CRS Router introduces support for the following:

- For 40-Gbps to 10-Gbps breakout options in the 2-port 100-GE and 5-port 40-GE QSFP+ Combination PLIM, the 40-GE ports only support the SR-4 breakout cable that has a cylindrical splitter.

## Important Notes

- From Cisco IOS XR Release 5.3.2, while configuring the wavelength parameters for the DWDM controller, in addition to the channel number, you must also provide the frequency grid.

```
router(config)#controller dwdm 0/11/0/20/0
router(config-dwdm)#wavelength 50GHz-Grid 55
router(config-dwdm)#commit
```

- 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 CRS Router, Release 5.3.x* .

- 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.

- Field replacable unit (FRU) removal—For all card removal and replacement (including fabric cards, line cards, fan controller, and RP) follow the instructions provided by Cisco to avoid impact to traffic. See the *Cisco IOS XR Getting Started Guide for the Cisco CRS 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 for your purpose.

- **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.

- The following TE Path option attribute commands are not supported on the Cisco CRS-1 Series Router:
  - affinity location set
  - affinity location type
  - affinity program
  - affinity self

- BFD IPv6 UDP Checksum Calculation—Starting Cisco IOS XR Software Release 3.9, you turn the BFD IPv6 UDP checksum calculation on and off:
  - To disable the BFD IPv6 UDP checksum calculation:

```
RP/0/RP0/CPU0:router(config)#bfd
RP/0/RP0/CPU0:router(config-bfd)#ipv6 checksum disable
RP/0/RP0/CPU0:router(config-bfd)#end
```

  - To enable BFD IPv6 UDP checksum calculation:

```
RP/0/RP0/CPU0:router(config)#bfd
RP/0/RP0/CPU0:router(config-bfd)#no ipv6 checksum disable
RP/0/RP0/CPU0:router(config-bfd)#end
```

- When upgrading a system from a release prior to 3.8.4, the MAC address assigned to physical interfaces changes. This is required because prior to Cisco IOS XR Software Release 3.8.4 the MAC address assigned to the bundle interface was taken from the first member's MAC address. If this bundle member is removed from the bundle, the bundle gets a new MAC address, which results in traffic loss due to ARP resolution. Beginning in Cisco IOS XR Software Release 3.8.4, a pool of MAC addresses are assigned to the bundle interfaces by the bundlemgr process during bundle interface creation.

- Deactivation of os-mbi dependent (Nonreload) SMU fails—Backing out the non reload os-mbi SMU fails because deactivation runs out of memory (activation did not release some memory, which stayed at 38 MB). This failure to activate or deactivate the SMU due to insufficient SP resources impacts SP cards on CRS.
- When configuring the Label Distribution Protocol (LDP) graceful restart (GR) process in a network with multiple [link and/or targeted] LDP hello adjacencies with the same neighbor, make sure that GR is activated on the session before any hello adjacency times out due to neighbor control plane failures. One way of achieving this is by configuring a lower session hold time between neighbors such that session time out always occurs before hello adjacency can time out. Cisco recommends setting LDP session hold time using the following formula:

  LDP session hold time <= (Hello hold time - Hello interval) * 3

  This means that for default values of 15/5 seconds respectively for the link Hello hold time and the Hello interval, the LDP session hold time should be set to 30 seconds or less.

  For more information, refer to the *Implementing MPLS Label Distribution Protocol* on *Cisco IOS XR Software* section of the *Cisco IOS XR MPLS Configuration Guide for the Cisco CRS Router*.
- For information about upgrading from a Cisco CRS-1 to a Cisco CRS-3 chassis, refer to the *Cisco CRS-1 Carrier Routing System to Cisco CRS-3 Carrier Routing System Upgrade Guide* at the following URL:

  http://www.cisco.com/en/US/products/ps5763/prod_installation_guides_list.html
- The following commands have been modified to support Cisco CRS-3 and CRS-X routers:
  - **show environment**
  - **hw-module reload**
  - **show controllers egressq client location**
  - **show controllers egressq queue drr [max | min] location <>**
  - **show controllers egressq queue drr [max | min] location <>**
  - **show controllers egressq group ntb [max | min] location <>**
  - **show controllers egressq port bpmap location <>**
  - **show controllers egressq statistics detail location <>**
  - **show controllers egressq resources location <>**

  For information about these commands, refer to the *Commands* section of the *Cisco CRS-1 Carrier Routing System to Cisco CRS-3 Carrier Routing System Upgrade Guide*:

  http://www.cisco.com/en/US/products/ps5763/prod_installation_guides_list.html
- This release supports the following fixed DWDM XFPs with CRS-3 and certain CRS-1 10GE interface modules:
  - DWDM-XFP-30.33
  - DWDM-XFP-60.61
  - DWDM-XFP-50.92
  - DWDM-XFP-50.12
  - DWDM-XFP-31.12

- DWDM-XFP-31.90
- DWDM-XFP-32.68
- DWDM-XFP-34.25
- DWDM-XFP-35.04
- DWDM-XFP-35.82
- DWDM-XFP-36.61
- DWDM-XFP-38.19
- DWDM-XFP-38.98
- DWDM-XFP-39.77
- DWDM-XFP-40.56
- DWDM-XFP-42.14
- DWDM-XFP-42.94
- DWDM-XFP-43.73
- DWDM-XFP-44.53
- DWDM-XFP-46.12
- DWDM-XFP-46.92
- DWDM-XFP-47.72
- DWDM-XFP-48.51
- DWDM-XFP-51.72
- DWDM-XFP-52.52
- DWDM-XFP-54.13
- DWDM-XFP-54.94
- DWDM-XFP-55.75
- DWDM-XFP-56.55
- DWDM-XFP-58.17
- DWDM-XFP-58.98
- DWDM-XFP-59.79

## DWDM Configuration Management

**Note** This section describes the new DWDM configuration requirements in Cisco IOS XR 3.9.0 and later releases. It does not describe all updates to the DWDM feature. For more information about DWDM configuration, refer to the *Configuring Dense Wavelength Division Multiplexing Controllers on Cisco IOS XR Software* module in the *Cisco IOS XR Interface and Hardware Component Configuration Guide for the Cisco CRS Router*.

Cisco IOS XR Software Release 3.9.0 introduced new commands in addition to an important change to the default laser state for all of the DWDM physical layer interface modules (PLIMs) supported on the Cisco CRS-1 and CRS-3 routers, which impacts the required configuration to support those cards.

This change affects all models of the following hardware on the Cisco CRS-1 router:

- Cisco 1-Port OC-768c/STM-256c DWDM PLIM
- Cisco 4-Port 10-Gigabit Ethernet DWDM PLIM

This change affects all models of the following hardware on the Cisco CRS-3 router:

- Cisco 1-Port 100GE OTU4 IPoDWDM PLIM
- Cisco 4-Port 40-GE OTU3 OTN/LAN PLIM
- Cisco 2-Port 40-GE OTU3 OTN/LAN PLIM

The **g709 fec high-gain** and **g709 fec long-haul** commands are added under DWDM configuration to configure the new high-gain FEC mode and long-haul FEC mode for Cisco 1-Port 100GE OTU4 IPoDWDM PLIM.

The following is an example of configuring the **g709 fec high-gain** command under DWDM configuration to configure the new high-gain FEC mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# controller dwdm <>
RP/0/RP0/CPU0:router(config)# g709 fec high-gain
RP/0/RP0/CPU0:router(config)# commit
```

The following is an example of configuring the **g709 fec long-haul** command under DWDM configuration to configure the new long-haul FEC mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# g709 fec long-haul
RP/0/RP0/CPU0:router(config)# commit
```

Important DWDM Changes in Cisco IOS XR Software Release 3.9.0 and Later Releases

- The **laser off** and **shutdown (DWDM)** commands are replaced by the **admin-state-out-of-service** command.
- The default state of the laser has changed from "On" to "Off" for all PLIMs. Therefore, the laser for all DWDM controllers must explicitly be turned on using the **admin-state in-service** command in DWDM configuration mode

Configuration Examples in Cisco IOS XR Software Release 3.9.0 and Later Releases

This section provides configuration examples for turning on and off the laser on a DWDM PLIM.

**Turning On the Laser: Example**

**Note** This is a required configuration beginning in Cisco IOS XR Software Release 3.9.0. The DWDM PLIMs will not operate without this configuration.

The following example shows how to turn on the laser and place a DWDM port in In Service (IS) state:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# controller dwdm 0/1/0/1
RP/0/RP0/CPU0:router(config-dwdm)# admin-state in-service
RP/0/RP0/CPU0:router(config-dwdm)# commit
```

**Turning Off the Laser: Example**

**Note** This configuration replaces the **laser off** and **shutdown (DWDM)** configuration commands.

The following example shows how to turn off the laser, stop all traffic and place a DWDM port in Out of Service (OOS) state:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# controller dwdm 0/1/0/1
RP/0/RP0/CPU0:router(config-dwdm)# admin-state out-of-service
RP/0/RP0/CPU0:router(config-dwdm)# commit
```

# Caveats

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

This section contains caveats that are generic to the Cisco IOS XR Software Release 5.3.2 and those specific to the Cisco CRS-1 router and the Cisco CRS-3 router.

## Using the Cisco Bug Search Tool

You must have a Cisco.com account to log in and access the Cisco Bug Search Tool. If you do not have one, you can register for an account.

1. In your browser, navigate to the Cisco Bug Search Tool.
2. If you are redirected to a Log In page, enter your registered Cisco.com username and password and then, click Log In.
3. To search for a specific bug, enter the bug ID in the Search For field and press Enter.
4. To search for bugs related to a specific software release, do the following:
    1. In the Product field, choose Series/Model from the drop-down list and then enter the product name in the text field. If you begin to type the product name, the Cisco Bug Search Tool provides you with a

drop-down list of the top ten matches. If you do not see this product listed, continue typing to narrow the search results.

2 In the Releases field, enter the release for which you want to see bugs.

The Cisco Bug Search Tool displays a preview of the results of your search below your search criteria.

5 To see more content about a specific bug, you can do the following:

- Mouse over a bug in the preview to display a pop-up with more information about that bug.
- Click on the hyperlinked bug headline to open a page with the detailed bug information.

6 To restrict the results of a search, choose from one or more of the following filters:

| Filter | Description |
|---|---|
| Modified Date | A predefined date range, such as last week or last six months. |
| Status | A specific type of bug, such as open or fixed. |
| Severity | The bug severity level as defined by Cisco. For definitions of the bug severity levels, see Bug Search Tool Help & FAQ. |
| Rating | The rating assigned to the bug by users of the Cisco Bug Search Tool. |
| Support Cases | Whether a support case has been opened or not. |

Your search results update when you choose a filter.

**Note** For more information about how to use the Cisco Bug Search Tool, including how to set email alerts for bugs and to save bugs and searches, see Bug Search Tool Help & FAQ.

## Open and Resolved Bugs

The open and resolved bugs for this release are accessible through the Cisco Bug Search Tool . This web-based tool provides you with access to the Cisco bug tracking system, which maintains information about bugs and vulnerabilities in this product and other Cisco hardware and software products. Within the Cisco Bug Search Tool, each bug is given a unique identifier (ID) with a pattern of CSCxxNNNNN, where x is any letter (a-z) and N is any number (0-9). The bug IDs are frequently referenced in Cisco documentation, such as Security Advisories, Field Notices and other Cisco support documents. Technical Assistance Center (TAC) engineers or other Cisco staff can also provide you with the ID for a specific bug. The Cisco Bug Search Tool enables you to filter the bugs so that you only see those in which you are interested.

In addition to being able to search for a specific bug ID, or for all bugs in a product and release, you can filter the open and/or resolved bugs by one or more of the following criteria:

- Last modified date
- Status, such as fixed (resolved) or open
- Severity
- Support cases

You can save searches that you perform frequently. You can also bookmark the URL for a search and email the URL for those search results.

### Cisco IOS XR Caveats

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

| Identifier | Description |
|---|---|
| CSCuv07420 | BGP advertising prefixes with wrong vrf label 524288 causing traffic loss |
| CSCuv83272 | MPLS software switch is dropping traffic for local-labels assigned to interface. |
| CSCuw01217 | snmpwalk timeout on OID vrrpStatistics 1.3.6.1.2.1.68.2 |

### Caveats Specific to the Cisco CRS-1 Router

There are no open caveats that are specific to the Cisco CRS-1 router in this release.

### Caveats Specific to the Cisco CRS-3 Router

There are no open caveats that are specific to the Cisco CRS-3 platform.

### Caveats Specific to the Cisco CRS-X Router

There are no open caveats that are specific to the Cisco CRS-X router.

## Firmware Support

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

## 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

## Migrating Cisco CRS-1 to CRS-3

For information about migrating from a Cisco CRS-1 to a Cisco CRS-3 chassis, refer to the *Cisco CRS-1 Carrier Routing System to Cisco CRS-3 Carrier Routing System Migration Guide* at the URL http://www.cisco.com/en/US/products/ps5763/prod_installation_guides_list.html

## Migrating Cisco CRS-1 and CRS-3 to CRS-X

For information about migrating from a Cisco CRS-1 and Cisco CRS-3 to a Cisco CRS-X chassis, refer to the URL http://www.cisco.com/en/US/products/ps5763/prod_installation_guides_list.html

## Troubleshooting

For information on troubleshooting Cisco IOS XR Software, see the *Cisco IOS XR Troubleshooting Guide for the Cisco CRS router* and the *Cisco IOS XR Getting Started Guide for the Cisco CRS router*

## Related Documentation

The most current Cisco CRS router hardware documentation is located at the following URL:

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

The Cisco IOS XR Software documentation set includes the Cisco IOS XR software configuration guides and command references.

The most current Cisco CRS 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, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What's New in Cisco Product Documentation.

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the What's New in Cisco Product Documentation RSS feed. RSS feeds are a free service.