Cisco IOS XR Software Release 3.6.0 for Cisco CRS-1 Routers and Cisco XR 12000 Series Routers

PB478696

Product Overview

Cisco IOS® XR Software Release 3.6.0 provides additional core routing features and extends feature coverage further into edge routing. This release also introduces new features for both the Cisco® CRS-1 Carrier Routing Systems and the Cisco XR 12000 Series Routers, including Nonstop Routing support for Label Distribution Protocol (LDP) and Open Shortest Path First (OSPF), Management Plane Protection, QoS Policy Propagation using BGP (QPPB), BGP Prefix Independent Convergence (BGP PIC), and OSPF Sham Link.

Release 3.6.0 also supports the following new hardware for the Cisco CRS-1 routers: a multi-chassis 4+4 system, 40-Gbps differential phase-shift keying (DPSK) IP-over-DWDM module, 1-port 10 Gigabit Ethernet LAN/WAN-PHY Shared Port Adapter (SPA), Cisco CRS-1 Modular Services Card B (CRS-MSC-B-40G and CRS-MSC-B-20G), and 2 GB flash disk. Additional software features for the Cisco CRS-1 includes Ethernet-over-MPLS Remote Ethernet Port Shutdown on 1 Gigabit Ethernet and 10 Gigabit Ethernet interfaces, Equal Cost Multipath (ECMP) with inter-interface and Layer 4 field hashing support, Policy Routing onto MPLS Traffic Engineering Tunnels (PBTS), and MPLS Traffic Engineering (TE) Preferred Path.

For Cisco XR 12000 Series Routers, two new types of channelized SPAs (SPA-1XCHOC48/DS3 and SPA-8XCHT1/E1) are now supported. In addition, the 2.5-Gbps and 10-Gbps enhanced fabric cards are supported on the Cisco XR 12004, 12006, 12404, and 12406. In terms of software support, several edge features have been added to various SPAs: MPLS VPN over IP tunnels with support for Inter-autonomous-system (Inter-AS) and Carrier Supporting Carrier (CSC), Layer 2 VPN support for Frame Relay interfaces (Frame Relay over MPLS), QoS classification based on access control list (ACL) Deny support, Multilink Frame Relay (MLFR) and Frame Relay FRF.12 standard support, Link Fragmentation and Interleaving (LFI), Link Bundling support for Gigabit Ethernet SPAs and 10 Gigabit Ethernet SPAs, and In-Chassis License Management and Upgrade for modular, multi-rate SPA interface processors (SIPs). Detailed information is provided in the following sections.

Cisco IOS XR Software Release 3.6.0 incorporates support for all hardware modules and software features of all prior releases.

Complete documentation of this release is available at
http://www.cisco.com/en/US/products/ps5845/tsd_products_support_series_home.html.

Table 1. New Hardware Supported on Cisco CRS-1 in Cisco IOS XR Software Release 3.6.0

Part Number	Description
CRS-MSC-B	Cisco CRS-1 Modular Service Card B
1OC768-DPSK/C	Cisco CRS-1 1-Port OC-768/STM-256c (C-band) DPSK DWDM Physical Layer Interface Module (PLIM)
SPA-1X10GE-WL-V2=	Cisco 1-Port 10GE LAN/WAN-PHY Shared Port Adapter

Note: For multi-chassis system product availability and pricing information for the Cisco CRS-1 Fabric Chassis Integrated Switch Controller Card module, part number CRS-FCC-SC-22GE(=), please refer to the data sheet and product bulletin at www.cisco.com/en/US/prod/collateral/routers/ps5763/ps5862/product_data_sheet0900aecd80340 baa_ps5763_Products_Data_Sheet.html.

Table 2. New Hardware Supported on Cisco XR 12000 in Cisco IOS XR Software Release 3.6.0

Part Number	Description
SPA-8XCHT1/E1	Channelized T1/E1 SPA
SPA-1XCHOC48/DS3	Channelized OC-48 SPA

Note: Cisco IOS XR Software Release 3.6.0 is supported in the following chassis: Cisco XR 12004, 12404, 12006, 12406, 12010, 12410, 12810, 12016, 12416, and 12816.

Table 3. New Software Features Supported in Cisco IOS XR Software Release 3.6.0 common to both the CRS-1 and the XR12000 series routers

Feature	Description
Nonstop Routing (NSR) support for Label Distribution Protocol (LDP)	LDP NSR functionality makes failures invisible to routing peers with minimal to no disruption of convergence performance. The failure situation can be either route processor (RP) or distributed route processor (DRP) failover. By default, NSR is globally enabled on all LDP sessions except Any Transport over MPLS (AToM).
NSR support for Open Shortest Path First Version 2 (OSPFv2)	NSR allows an RP failover, process restart, or in-service upgrade to be invisible to peer routers and helps ensure that there is minimal performance or processing impact. Routing protocol interactions between routers are not impacted by NSR. NSR is built on the warm standby extensions. NSR alleviates the requirement for Cisco NSF and IETF graceful restart protocol extensions.
Management Plane Protection	The Management Plane Protection (MPP) feature provides the capability to restrict the interfaces on which network management packets are allowed to enter a device. The MPP feature allows a network operator to designate one or more router interfaces as management interfaces. Device management traffic may enter a device only through these management interfaces. After MPP is enabled, no interfaces except designated management interfaces accept network management traffic destined to the device. In Cisco IOS XR Release 3.6.0, MPP is disabled by default, and the support includes the following: • In-band interface can be configured to handle both management packets and data-forwarding packets • RP Ethernet interface supported as default out-of-band interface • Support for HTTP, HTTPS, SNMPv3, Telnet, SSH, and TFTP daemon (TFTPD) servers
QoS Policy Propagation using BGP (QPPB)	The QoS policy propagation via Border Gateway Protocol (BGP) feature allows packet classification based on access lists, BGP community lists, and BGP autonomous system (AS) paths. The supported modification policies include setting the Internet Protocol (IP) precedence and tagging the packet with a QoS class identifier internal to the router (QoS Group ID). After a packet has been classified, you can use other QoS features such as Policing and Weighted Random Early Detection (WRED) to specify and enforce business policies to fit the business model. BGP policy propagation provides the following benefits: • Allows packet classification based on access lists, community lists, and AS paths. • Uses BGP to distribute QoS policy to remote routers in your network. • Allows ingress routers to prioritize incoming and outgoing traffic. • Allows packet classification based on IP precedence or QoS group ID.
IP-MIB with 64-bit counters support	64-bit counter is supported in IP-MIB

Feature	Description
IP SLA enhancement	IP SLA enhancement • Multiprotocol Label Switching (MPLS) Equal Cost Multipath (ECMP) Tree trace support • LSP ping and trace automation • Support for Virtual Circuit Connectivity Verification (VCCV) for pseudowire • ECMP support
Stream Control Transmission Protocol (SCTP)	SCTP is a reliable datagram oriented IP transport protocol specified by RFC 2960. It provides the layer between an SCTP user application and an unreliable end-to-end datagram service such as IP. The basic service offered by SCTP is the reliable transfer of user datagrams between peer SCTP users. It performs this service within the context of an association between two SCTP hosts. SCTP is connection-oriented, but SCTP association is a broader concept than the TCP connection, for example. SCTP provides the means for each SCTP endpoint to provide its peer with a list of transport addresses, such as address and UDP port combinations. This list is provided during association startup and shows the transport addresses through which the endpoint can be reached and from which messages originate. The SCTP association includes transfer over all the possible source and destination combinations that might be generated from the two endpoint lists (also known as multihoming). SCTP is not explicitly configured on routers, but it underlies several Cisco applications.
Open Shortest Path First (OSPF) sham-link support	In an MPLS VPN environment, several VPN client sites can be connected in the same OSPF area. If these sites are connected over a backdoor link (intra-area link) and connected over the VPN backbone, all traffic passes over the backdoor link instead of over the VPN backbone, because provider-edge (PE) routers advertise OSPF routes learned over the VPN backbone as inter-area or external routes that are less preferred than intra-area routes advertised over backdoor links. To correct this default OSPF behavior in an MPLS VPN, configure a sham link between two PE routers to connect the sites through the MPLS VPN backbone. A sham link represents an intra-area (unnumbered point-to-point) connection between PE routers. All other routers in the area see the sham link and use it to calculate intra-area shortest path first (SPF) routes to the remote site. A cost must be configured with each sham link to determine whether traffic is sent over the backdoor link or sham link.
BGP Prefix Independent Convergence	Provides the ability to converge BGP routes within sub-seconds instead of multiple seconds. The Forwarding Information Base (FIB) is updated, independent of a prefix, to converge multiple 100K BGP routes with the occurrence of a single failure. This convergence is applicable to both core and edge failures and with or without MPLS. This fast convergence innovation is unique to Cisco IOS XR Software.
Disk Mirroring support	The route processor (RP) card in Cisco IOS XR platforms has a primary storage device that is used to store installation packages and configuration files. This primary storage device is referred to as the primary boot device and is essential for booting the RP and its normal operation. Disk mirroring replicates the critical data on the primary boot device onto another storage device on the same RP, henceforth referred to the secondary device. If the primary boot device fails, applications continue to be serviced transparently by the secondary device, thereby avoiding a switchover to the standby RP. The failed primary storage device can be replaced or repaired without disruption of service.

Table 4.   New Software Features Supported in Cisco IOS XR Software Release 3.6.0 on the Cisco CRS-1 Routers

Feature	Description
Cisco CRS-1 4+4 multi-chassis system support	The Cisco CRS-1 multi-chassis system can support 4 LC chassis (LCC) and up to 4 fabric chassis (can be either 1, 2, or 4) in Cisco IOS XR Release 3.6.0.
CISCO-OTN-IF-MIB support	CISCO-OTN-IF-MIB is supported.
Ethernet-over-MPLS (EoMPLS) Remote Ethernet Port Shutdown (1GE, 10GE)	Ethernet remote port shutdown provides a mechanism for the detection and propagation of remote link failure for port mode EoMPLS on a Cisco CRS-1 line card. This lets a service provider edge router on the local end of an EoMPLS pseudowire detect a cross-connect or remote link failure and cause the shutdown of the Ethernet port on the local customer edge router. Shutting down the Ethernet port on the local customer edge router prevents or mitigates a condition where that router would otherwise lose data by forwarding traffic continuously to the remote failed link, especially if the link were configured as a static IP route.

Feature	Description

Interface and Layer 4 field hashing support for Equal Cost Multipath (ECMP)	Load balancing describes the functionality in a router that distributes packets across multiple links based on Layer 3 (network layer) and Layer 4 (transport layer) routing information. If the router discovers multiple paths to a destination, the routing table is updated with multiple entries for that destination.
	
	In Cisco IOS XR Software Release 3.6.0, the following fields are considered for flow load balancing:
	• Layer 3 routing Information
	  ◦ Source IP address
	  ◦ Destination IP address
	  ◦ Protocol
	• Layer 4 routing Information
	  ◦ Source port
	  ◦ Destination port
	• Cisco CRS-1 platform-specific information
	  ◦ Router ID
	  ◦ Ingress interface handle

MPLS Traffic Engineering (TE)—Policy Routing onto MPLS TE Tunnels	Policy-based tunnel selection (PBTS) provides a mechanism that lets you direct traffic into specific TE tunnels based on different criteria. PBTS will benefit ISPs that carry voice and data traffic through their MPLS networks and MPLS VPNs and that want to route this traffic to provide optimized voice service. PBTS works by selecting tunnels based on the classification criteria of the incoming packets, which are based on the IP precedence, EXP, or ToS field in the packet. When there are no paths with a default class configured, this traffic is forwarded using the paths with the lowest class value.
MPLS TE Preferred Path	Preferred tunnel path functionality lets you map pseudowires to specific TE tunnels. Attachment circuits are cross-connected to specific MPLS TE tunnel interfaces instead of remote PE router IP addresses (reachable using IGP or LDP). Using preferred tunnel path, it is always assumed that the TE tunnel that transports the Layer 2 traffic runs between the two PE routers (that is, its head starts at the imposition PE router and its tail terminates on the disposition PE router).
Multiprotocol Label Switching (MPLS) NetFlow for IPv6 labeled packets	NetFlow can collect information from MPLS packets with IPv6 fields.

Table 5.   New Software Features Supported in Cisco IOS XR Software Release 3.6.0 on the Cisco XR 12000 Series Routers

Feature	Description
IPsec VPN SPA solution enhancements	64,000 tunnel scale Single-Security Association (SA) support for interoperability with remote Easy VPN (EZVPN) clients in Network Extension Mode (NEM) Configurable metrics for Reverse Route Injection (RRI) Object tracking for interface and routes Internet Key Exchange (IKE) policy selection: Allow Data Encryption Standard/Triple Data Encryption Standard (DES/3DES) selection enforcement SVI scale: 1000 per LC, 3,500 per chassis
Support for MPLS VPNs over IP Tunnels: Inter-AS and Carrier Supporting Carrier (CSC) support	The MPLS VPNs over IP Tunnels feature introduces the capability to deploy Layer 3 VPN services, as proposed in RFC 2547, and BGP/MPLS VPNs over an IP core network using Layer 2 Tunneling Protocol Version 3 (L2TPv3) multipoint tunneling instead of Multiprotocol Label Switching (MPLS). CSC is implemented in circumstances in which one service provider needs to use the transport services provided by another service provider. The service provider that provides the transport is called the backbone carrier. The service provider that uses the services provided by the backbone carrier is called a customer carrier. Backbone carriers with CSC bridge two or more customer carrier sites through an MPLS VPN/MPLS-VPN-over-IP-tunnels backbone. Inter Autonomous System (Inter-AS) feature allows a VPN to span service providers and autonomous systems. It provides a solution when VPNs reside on different autonomous systems in different geographic areas. It also helps situations when some VPNs need to extend across multiple service providers (overlapping VPNs). Regardless of the complexity and location of the VPNs, the connection between autonomous systems must be transparent to the customer.
Layer 2 VPN support for Frame Relay interfaces (Frame Relay over MPLS)	With Cisco Any Transport over MPLS (AToM) for Frame Relay, customer Frame Relay traffic can be encapsulated in MPLS packets and forwarded to destinations required by the customer. Cisco AToM allows service providers to quickly add new sites with less effort than typical Frame Relay provisioning.

Feature	Description
QoS classification based on ACL Deny	The ACL Deny feature takes into account the action associated with the access list entry (permit or deny), treating the deny action in an ACL differently from the permit action. The access control entry (ACE) permit and deny actions in an access group within a class map are classified differently. Traffic matching an ACL with a deny action skips the class map and attempts to match subsequent classes. If there is no deny ACE for an ACL, the packet skips to the next class.
Multicast forwarding with byte-based weighted RED (WRED)	Multicast forwarding with byte-based WRED support is now available for the ISE (Engine 3) line cards.
Multilink Frame Relay (MLFR) support	MLFR support is now available for the SPA-1XCHSTM1/OC3, SPA-2XCT3, and SPA-4XCT3 shared port adapters.
Frame Relay Fragmentation Implementation Agreement (FRF.12)	FRF.12 support is now available for the SPA-1XCHSTM1/OC3, SPA-2XCT3, and SPA-4XCT3 shared port adapters.
Maintenance Data Link (MDL) and DS-3 Subrate	MDL and DS-3 Subrate support is now available for the SPA-1XCHOC12/DS0 and SPA-1XCHOC48/DS3 shared port adapters.
Link Fragmentation and Interleaving (LFI)	LFI support is now available for the SPA-1XCHOC12/DS0 shared port adapters.
Link Bundling support for GE SPAs and 10GE SPAs	The following features support are added over link bundling using GE SPAs and 10GE SPAs on the Cisco XR 12000 Series Routers: VLAN, NetFlow, Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP), Loose Mode uRPF, and Multicast (Native IPv6 Multicast) support.
In-Chassis License Management and Upgrade for Modular Multirate SIP (12000-SIP-401, 12000-SIP-501, and 12000-SIP-601)	The default throughput for the Cisco XR 12000-SIP-401 is 2.5 Gbps and for the Cisco XR 12000-SIP-501 is 5 Gbps. The Cisco XR 12000-SIP-401 can be configured to run at 5 Gbps using a single 2.5-Gbps to 5-Gbps license. The Cisco XR 12000-SIP-401 can be configured to run at 10 Gbps, using a single 2.5-Gbps to 10-Gbps license, or using a 2.5-Gbps to 5-Gbps license together with a 5-Gbps to 10-Gbps license. A Cisco XR 12000-SIP-501 can be configured to run at 10 Gbps, using a single 5-Gbps to 10-Gbps license. The Cisco XR 12000-SIP-601 operates at 10-Gbps throughput by default and does not require any additional configuration or license.

Ordering Information

Table 6 lists ordering information for Cisco IOS XR Software Release 3.6.0 for Cisco CRS-1 Carrier Routing Systems and Cisco XR 12000 Series Routers. These are the only part numbers that will be orderable. When re-releases of Cisco IOS Software Release 3.6.0 are available, ordering these part numbers will automatically result in the latest release being shipped.

Table 6. Ordering Information for Cisco IOS XR Software Release 3.6.0 for Cisco CRS-1 Routers and Cisco XR 12000 Series Routers

Part Number	Description
XC-RP-03.06	Cisco CRS-1 All Packages except Cryptographic Support
XC-RPK9-03.06	Cisco CRS-1 All Packages with Cryptographic Support
XC-XR12K-03.06	Cisco XR 12000 All Packages except Cryptographic Support
XC-XR12KK9-03.06	Cisco XR 12000 All Packages with Cryptographic Support

Release 3.6 Lifecycle

The Cisco IOS XR Software release strategy is time-based, with a fixed release date and life cycle, as opposed to being a feature-based release strategy with a variable release date. Table 7 lists the major milestones of Cisco IOS XR Software Release 3.6.

Table 7. Major Milestones for Cisco IOS XR Software Release 3.6

Milestone	Definition	Date
Availability Date	The date that the Cisco IOS XR Software Release 3.6.0 information is published on Cisco.com and becomes available to the general public.	December 21, 2007
End-of-Life Announcement Date	The official End-of-Life document that announces the end of sale and end of life of Cisco IOS XR 3.6 is distributed to the general public.	September 21, 2008

Milestone	Definition	Date
End-of-Sale Date and End-of-Maintenance Date	The last date to order Cisco IOS XR 3.6 through Cisco point-of-sale mechanisms. The product is no longer for sale after this date. This also marks end of engineering, maintenance rebuilds, and software fixes through rebuilds of Cisco IOS XR 3.6.x. After this date, maintenance rebuilds and software-fix support will be provided only through rebuilds of Cisco IOS XR 3.7.x or later.	June 21, 2009
End of Software Maintenance Releases through migration: OS Software	The last date that Cisco Engineering may release any final software maintenance releases or bug fixes via SMU. From June 21, 2009 until June 21, 2010, maintenance rebuilds and software fix via SMU support for Cisco IOS XR 3.6.x will be provided only through migration to rebuilds of Cisco IOS XR 3.7.x. After June 21, 2010, Cisco Engineering will no longer develop, repair, maintain, or test Cisco IOS XR 3.6.x.	June 21, 2010
Last Date of Support	The last date to receive service and support for the product. After this date, all support services for the product are unavailable and the product becomes obsolete.	June 21, 2014

For official End-of-Life and End-of-Sale announcements for Cisco IOS XR Software, please visit http://www.cisco.com/en/US/products/ps5845/prod_eol_notices_list.html or contact your local account representative.

For More Information

For more information about the Cisco CRS-1 Carrier Routing System, Cisco 12000 Series Router, Cisco XR 12000 Series Router, or Cisco IOS XR Software, visit http://www.cisco.com/ or contact your local Cisco account representative.