

Release Notes for Cisco 8000 Series Routers, IOS XR Release 24.2.11

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Cisco 8100, 8200, 8600, and 8800 Series Routers

What's New in Cisco IOS XR Release 24.2.11

For more details on the Cisco IOS XR release model and associated support, see Software Lifecycle Support Statement - IOS XR.

New in Documentation

Feature	Description
Cisco IOS XR Feature Finder	We have launched this interactive tool that assists you in locating features introduced across Cisco IOS XR releases and platforms. This tool empowers you to explore, discover, and utilize the full potential of our platforms. As we continue to enhance the tool, we would love to hear your feedback. You are welcome to drop us a note here.

Software Features Enhanced and Introduced

To learn about features introduced in other Cisco IOS XR releases, select the release from the Documentation Landing Page.

Cisco 8000

Feature	Description
Cisco IOS XR Setup and Upgrade	
Install Owner and Partner RPMs Using IOS XR Install Infrastructure	You can now use the existing IOS XR install infrastructure to install your proprietary Owner and Partner RPMs. This enhancement streamlines the process of integrating third-party software seamlessly into the IOS XR environment, including bundling the owner and partner RPMs into a GISO. In previous releases, you could only install Owner and Partner applications using the Application Manager interface. This feature introduces the keyword **skip-implicit-owner-packages-checks** in the following install commands: • **install package add** • **install replace** • **install replace reimage**
Application Hosting	

Feature	Description
CPU-Based Packet Generator	You can now use a CPU-based packet generator for IOS-XR routers to simplify the diagnostic process for routers experiencing problems. This tool allows you to generate a wide range of traffic streams directly within the production environment without physically isolating the routers and moving them to a lab setup. This tool is beneficial in environments that use routers from different vendors or different models from the same vendor. The feature introduces the **packetgen** command with different options to generate different types of packets.
Telemetry	
Stream Telemetry Data for ASIC Error Statistics	You can now stream and monitor the telemetry data remotely on a gNMI interface, after subscribing to a sensor path. This data is gathered directly from the Network Processor Unit (NPU) driver at regular, predefined intervals for each block. This streaming enables real-time monitoring and analysis of router health and network performance, including error reporting and key metrics, allowing for rapid response to dynamic network conditions. Previously, you needed to log into the router to check the ASIC statistics.
Stream Telemetry Data for LLDP Statistics	You can now oversee and diagnose your network infrastructure in real time by periodically streaming the Link Layer Discovery Protocol (LLDP) information of a router through a gRPC Network Management Interface (gNMI) client. By continuously monitoring LLDP data from a switch or router, you gain immediate insights into network topology and the attributes of devices on the network, facilitating proactive management and troubleshooting.
Programmability	
NETCONF Version 1.0 with YANG Support	You can now monitor and manage a larger number of network devices, ensuring comprehensive oversight and control over your network infrastructure with NETCONF-YANG version 1.0. This enhancement is possible because our system has increased the support for NETCONF YANG sessions from 50 to 128.
SPIFFE ID-Based Authentication and Authorization Services for gRPC Services	You can now securely manage service identities for workloads that communicate over gRPC. This capability is critical for environments such as distributed systems, where workloads move across different platforms. This security measure is feasible because workloads can use the Secure Production Identity Framework for Everyone (SPIFFE) ID and SPIFFE Verifiable Identity Document (SVID) to encrypt and authenticate gRPC traffic. This feature introduces the following changes: CLI: • **aaa map-to username** Yang Data Models: • New XPaths for `Cisco-IOS-XR-um-aaa-task-user-cfg.yang` • `Cisco-IOS-XR-aaa-locald-cfg.yang` (see GitHub, YANG Data Models Navigator)

Feature	Description
gNMI Union Replace Operation	You can now update your router's entire configuration in one go to ensure that the actual settings of your network operating system align with the intended setup. The update includes OpenConfig (OC), Native YANG (NY), and CLI configurations and is done using the gRPC Network Management Interface (gNMI). The update is possible with the gNMI union-replace operation in a `gNMI SetRequest` RPC message which supports mixing of the configuration schemas. The supported schema combinations are: • OpenConfig (OC) and CLI • OC and native YANG (NY) To view the specification of gNMI union-replace, see the Github repository.
gNMI XPath-Based Authorization	We've introduced gNMI authorization through the gNSI pathz policy which is adding authorization of a user or a group to access a specified YANG XPath through gNMI. The policy configurations can be done on the router either when the router boots up or dynamically when the router is up and running. When a user or a group sends a `gNMI SetRequest` message using a certain XPath, the system validates the request against the permissions specified in the policies associated with that user or the group. To view the specification of gNSI for the OpenConfig XPath-based Authorization, see the Github repository. The feature introduces these changes: **CLI:** • show gnsi path authorization policy • show gnsi path authorization counters • show gnsi trace pathz • show gnsi path authorization statistics • show tech-support gnsi • clear gnsi path authorization counters
gNOI Packet Link Qualification	You can now check and assess the reliability of the link speed and packet drops between the two network devices (generator and the reflector) by performing the gNOI packet-based link qualification service. This can be achieved by sending the packets from the generator to the reflector, and receiving the looped back packets from the reflector within a certain tolerance limit. The link transimmision rate and the link's capacity range for that interface can be obtained from the following gNSI Packet Link Qualification RPC messages: • `Capabilities`—Minimum and maximum rate of the transmission link • `Get`—Expected rate and actual rate of link transmission
gNSI Credentialz Update	To improve communication confidentiality and security, you can now update or rotate account-specific and host-specific SSH credentials on a router. You can access the latest SSH credentials through the gNMI credentialz RPC. The updated SSH credentials encompass passwords, host keys, and certificates. To view the specification of gNSI credentialz RPCs and messages, see the Github repository.

Feature	Description
Preprogram Backup LSPs Using Service Layer API	This feature extends the Service Layer API, allowing the controller to preprogram backup Label Switched Paths (LSPs) in the hardware. When the *Path Priority* flag indicates a transition from the backup LSP to the primary LSP, the controller switches the traffic to the backup LSP.
Routing	
Bidirectional Forwarding Detection over VXLAN Tunnel	You can now monitor the health of VXLAN tunnel and detect failures in the tunnel rapidly which ensures faster rerouting of traffic, resulting in high availability of networks.
Multi-area Loopback Interface for OSPF	You can save IP addresses and resources, prevent the use of multiple node SIDs for labels associated with loopback interfaces, and save time configuring multiple loopback interfaces for an Area Border Router (ABR) in a network. These improvements are possible as you can now configure a single loopback interface for multiple areas. With this feature, an ABR can use a single loopback interface for all areas it connects to, eliminating the need for separate loopback interfaces for each area. Previously, each loopback interface was linked to only one area. The feature introduces these changes: **CLI:** The **multi-area-interface** command is extended to support loopback interfaces.
Policy-Based Routing on 88-LC1-36EH line cards	You can now create customised routing policies based on different parameters such as IP address, port numbers, or protocols. With Policy-Based Routing (PBR), you can enhance your network security by steering sensitive data away from potentially vulnerable network segments. Also, by allowing you to distribute traffic across multiple paths, PBR can help prevent traffic congestion in your network. This feature is supported only on routers with 88-LC1-36EH line cards.

Feature	Description
Protect IS-IS Processes in OOR Conditions	This feature enables prompt alerts for out-of-resource conditions in IS-IS processes that could otherwise cause network instability and disruption due to memory leaks and excessive link-state packets (LSPs). Additionally, you can disable the overload bit status flag in the router's LSP to prevent setting the overload-bit. We recommend consulting with Cisco for optimal results before making this change. Previously, during OOR conditions, IS-IS processes restarted themselves, but the OOR conditions could persist. This ability to protect IS-IS processes in OOR conditions is enabled by default and you can't disable it. The feature introduces these changes: **CLI:** • The feature introduces fields that indicate the memory state of the IS-IS protocol in the **show isis protocol** command. • **oor-set-overload-bit disable** command. **YANG Data Model** • New XPaths for `Cisco-IOS-XR-clns-isis-cfg` • `Cisco-IOS-XR-um-router-isis-cfg` (see GitHub, YANG Data Models Navigator)
Segment Routing	
Data Plane Validation for SR-MPLS IPv6-based Controller Instantiated LSPs	You can now verify the network configuration and paths and policies set up, without interrupting or potentially disrupting live network traffic, for SR-MPLS (Segment Routing over Multiprotocol Label Switching) IPv6-based Label Switched Paths (LSPs). With this feature, you can validate controller instantiated LSPs programmed directly into the forwarding hardware. Previously, SR data plane validation was possible over IPv4-based LSPs. The feature introduces these changes: **CLI:** • The **dataplane-only** keyword is introduced in the **traceroute sr-mpls** and **ping sr-mpls** commands. **YANG Data Models:** • `Cisco-IOS-XR-mpls-traceroute-act.yang` • `Cisco-IOS-XR-mpls-ping-act.yang` See (GitHub, Yang Data Models Navigator)

Feature	Description
Delay Measurement for IP Endpoint over SRv6 Network	In Segment Routing over an IPv6 network (SRv6), you can measure packet delay from the source to a specific IP endpoint. You can use this information for troubleshooting, network maintenance, and optimizing network performance. Additionally, you can use flow labels to verify the delay of each subsequent hop path towards the IP endpoint of that path. So that, when network traffic is distributed across multiple available paths towards an IP endpoint, delay measurement tracks the delay of each of these paths towards the IP endpoint. The feature introduces these changes: **CLI:** • The **source-address ipv6** keyword is introduced in the **performance-measurement endpoint** command. • The **segment-list name** keyword is introduced in the **segment-routing traffic-eng explicit** command. • The **flow-label** keyword is introduced in the **performance-measurement delay-profile name** command. **YANG Data Model:** • `Cisco-IOS-XR-um-performance-measurement-cfg` • `Cisco-IOS-XR-perf-meas-oper.yang` (See GitHub, YANG Data Models Navigator)
Liveness Monitoring for IP Endpoint over SRv6 Network	In Segment Routing over an IPv6 network (SRv6), you can keep track of the operational status of both the forward and reverse paths of a particular node or IP endpoint. You can use this information for troubleshooting, network maintenance, and optimizing network performance. Additionally, you can use flow labels to verify the liveness of each subsequent hop path toward the IP endpoint of that path. So that, when network traffic is distributed across multiple available paths towards an IP endpoint, liveness detection tracks the operational status of each of these paths towards the IP endpoint. The feature introduces these changes: **CLI:** • The **reverse-path** and **segment-list name** keywords are introduced in the **segment-routing traffic-eng explicit** command. • The **source-address ipv6** is introduced in the **performance-measurement endpoint** command. **YANG Data Model:** • `Cisco-IOS-XR-um-performance-measurement-cfg` • `Cisco-IOS-XR-perf-meas-oper.yang` (see GitHub, YANG Data Models Navigator)

Feature	Description
MPLS OAM support for SR-TE Policies using MPLS IPv6-based LSPs	You can now verify the network configuration and paths and SR-TE policies set up, without interrupting or potentially disrupting live network traffic, for SR-MPLS (Segment Routing over Multiprotocol Label Switching) IPv6-based Label Switched Paths (LSPs). Previously, MPLS OAM support was only for IPv4-based LSPs. The feature introduces these changes: **CLI:** The **traceroute sr-mpls** and **ping sr-mpls** commands are extended to support IPv6 nexthop addresses. **YANG Data Models:** • `Cisco-IOS-XR-mpls-traceroute-act.yang` • `Cisco-IOS-XR-mpls-ping-act.yang` See (GitHub, Yang Data Models Navigator)
Overriding MPLS Imposition (IP-to-MPLS) via Service Layer API (SL-API)	In scenarios where SR-prefer is enabled, this feature allows you to specify SR prefixes through an Access Control List where their imposition forwarding entry (IP-to-MPLS) gives preference to SL-API, instead of the SR native LSP. The labeled forwarding entries (MPLS-to-MPLS or MPLS-to-IP) continue to follow the SR native LSP. This feature introduces the following command under Router RIB AF configuration mode: **segment-routing mpls preserve-label-forwarding access-list***acl_name* **[apply-inverse]**
User-Defined Generic Metric Support for IS-IS Flex Algo	This feature adds support for user-defined generic metric as a metric type for IS-IS Flexible Algorithm. You can now have more control over traffic flows using user-defined generic metrics. You can define a family of user-defined generic metrics that can advertise different types of administrative metrics such as jitter, reliability, and fiscal cost depending on the traffic class for Flexible Algorithms. You can selectively define and assign semantics of these metrics as per the network requirement. The feature introduces the following changes: **CLI**: • The feature introduces the **generic-metric flex-algo** and **metric-type generic** commands. **YANG Data Models:** • `Cisco-IOS-XR-um-router-isis-cfg.yang`
BGP	
Advertising IPv4 NLRI with IPv6 Next Hops in the non-default VRF	This feature enhances network efficiency and security by allowing you to create default and non-default virtual routing tables. These tables isolate traffic through customized routing policies, allowing for the communication of IPv4 address family over IPv6 next hops specifically within non-default VRFs.

Feature	Description
BGP Fast Fallover	You can now terminate the external BGP sessions to an adjacent peer when the link to that peer goes down, without waiting for the hold timer to expire. With this feature you can enable fast fallover mechanism on a specific BGP neighbor even if **bgp fast-external-fallover disable** command is globally configured. This feature enables quicker failure detection, and allows other recovery mechanisms to reroute the traffic quickly, thus resulting in faster convergence. The feature introduces these changes: **CLI:** • **fast-fallover** **YANG Data Model:** • Cisco-IOS-XR-um-router-bgp-cfg.yang (see GitHub, YANG Data Models Navigator)
Steering of BGP Control-Plane Traffic over IP Path	You can now steer the BGP control-plane traffic through an IP-only transport path even when MPLS Link State Packets (LSPs) are configured for BGP neighbor reachability. This feature allows you to keep the BGP control-plane traffic independent of the data plane traffic, enabling you to have more granular control over your network traffic. The feature introduces these changes: **CLI:** New Commands: • **table ip-only activate vrf** • **tcp ip-only-preferred** Modified Commands: • The **distribute-list** command is modified with a new **ip-only** keyword. **YANG Data Models:** New XPaths for • Cisco-IOS-XR-clns-isis-cfg.yang • Cisco-IOS-XR-ipv4-bgp-cfg.yang • Cisco-IOS-XR-ip-rib-cfg.yang • Cisco-IOS-XR-um-router-bgp-cfg.yang • Cisco-IOS-XR-um-router-isis-cfg.yang (see GitHub, YANG Data Models Navigator)

Feature	Description
BGP Flowspec Redirect from Global VRF to L3VPN	You can now enhance network routing efficiency by integrating BGP Flowspec rules into Layer 3 VPNs and SR-Policies. This integration enables dynamic VRF determination, surpassing static or ODN-derived methods. With BGP Flowspec, define traffic criteria for precise VRF control in L3VPN or SR-Policy environments. This improvement boosts routing adaptability and service continuity. Additionally, the protocol extension equips you to execute precise traffic actions, optimizing network performance and security.
Enhanced Monitoring of BGP Keepalive Messages	You can now achieve enhanced stability and fairness in your network's traffic processing by utilizing Enhanced Monitoring of BGP Keepalive Messages feature. This functionality enables you to efficiently manage the influx of messages from multiple neighbors by meticulously monitoring and adjusting the rate of message processing through throttling. Take advantage of a comprehensive log detailing each neighbor's throttling incidents, empowering network administrators with critical data to refine and optimize overall network performance. **CLI:** The feature modifies the output of the show command given below: • **show bgp neighbor detail** **YANG Data Model:** • `Cisco-IOS-XR-ipv4-bgp-oper` (see GitHub, YANG Data Models Navigator)
Enhanced Monitoring of BGP Memory Utilization	You can now enhance your network's reliability and efficiency with the Enhanced Monitoring of BGP Memory Utilization feature, allowing administrators to proactively oversee BGP's memory footprint—essential for routing within sophisticated networks. This feature acts as a vigilant alert system, offering regular assessments, documenting memory usage, and providing timely notifications as you approach critical memory thresholds, all to ensure optimal BGP memory management for uninterrupted network functionality. **CLI:** The feature modifies the output of the show command given below: • **show bgp memory history** **YANG Data Model:** • `Cisco-IOS-XR-ipv4-bgp-oper` (see GitHub, YANG Data Models Navigator)

Feature	Description
Enhanced Monitoring of NSR Statistics	You can maintain uninterrupted network functionality during upgrades or failovers with Non-Stop Routing (NSR), ensuring consistent data across primary and standby engines. The Enhanced Monitoring of NSR Statistics feature offers metrics on NSR packet handling, providing processing times, counts, and sequence numbers in real-time. If no new packets are received, the last known statistics persist, keeping the displayed data current. **CLI:** The feature modifies the output of the show command given below: • **show bgp nsr** **YANG Data Model:** • `Cisco-IOS-XR-ipv4-bgp-oper` (see GitHub, YANG Data Models Navigator)
Enhanced Monitoring of Version-Rate Statistics	You can now effectively pinpoint the sources of BGP churn with the enhanced feature that monitors and sorts version bumps. This functionality empowers you to calculate version rates within defined intervals and organize them by their origin—whether reachable, unreachable, import, redistribution, or label-related—while maintaining a cumulative count of churn. The feature generates comprehensive reports on version bumps for both AFI and neighbor AFI levels, providing totals for each interval, bucketized categorization, and additional sources based on the main table's version number. **CLI:** The feature modifies the output of the show command given below: • **`show bgp sessions version-rate`** **YANG Data Model:** • `Cisco-IOS-XR-ipv4-bgp-oper` (see GitHub, YANG Data Models Navigator)
Enhanced Next Hop Monitoring	You can now optimize routing decisions with the BGP Nexthop Event Tracking feature. This feature strengthens BGP's integration with the RIB by actively monitoring critical nexthop events. It enables you to swiftly pinpoint the root causes of network fluctuations, especially in large-scale deployments, by providing comprehensive event data. **CLI:** The feature modifies the output of the show command given below: • **show bgp nexthops** **YANG Data Model:** • `Cisco-IOS-XR-ipv4-bgp-oper` (see GitHub, YANG Data Models Navigator)

Feature	Description
Handling ECMP Out of Resource Situations	You can now gracefully handle transient out-of-resource (OOR) conditions, and prevent traffic loss during periods of intense BGP route updates, by utilizing the Make-Before-Break (MBB), and Destination-based Load Balancing (DLB) approaches. This feature introduces these changes: **CLI:** • **cef load-balancing recursive oor mode dampening-and-dlb**
Store and analyze changes in the prefixes received from BGP peer	You can now actively monitor changes, acceptances, and rejections of received prefixes by providing insightful statistics using this feature. It enables storing all original copies of routes received from peers, even those not chosen as the best path. Use the command to accomplish this, while the inbound RPL concurrently modifies received prefixes. The feature introduces these changes: **CLI:** • The **soft-reconfig-stats** keyword is added to the **show bgp summary** command. • The **dryrun-policy** keyword is added to the **show bgp neighbor** command. **YANG Data Model:** • `Cisco-IOS-XR-ipv4-bgp-oper` (see GitHub, YANG Data Models Navigator)
Interface and Hardware Component	
Default Carrier Delay Value on Physical Interfaces	We have introduced the carrier-delay up default value to ensure enough time to establish a stable hardware link state. If you haven't configured the timer, the default carrier delay automatically delays the hardware link-up notifications by 200 ms. Previously, we recommended that you set the carrier delay-up timer to 10 ms. If you want to change the delay of the interface state change notification, you can use the **carrier-delay** command to set a different value.
Mirroring Buffer Drop Packets	The SPAN to File and ERSPAN mirroring capability is enhanced to mirror dropped packets by the Traffic Management (TM) buffer when it's full and starts dropping incoming packets. This capability allows you to retain and store a mirrored copy of the dropped packets, and work effectively even during process restarts or network failovers, providing a dependable solution for traffic monitoring. This feature is supported only on Cisco Silicon One 88-LC1-36EH line cards and Q200 based routers. This feature introduces the following changes: • **CLI: drops** • **YANG Data Model:**New XPath for `Cisco-IOS-XR-Ethernet-SPAN-cfg.yang` (see GitHub, YANG Data Models Navigator)

Feature	Description
Monitoring Layer 3 Connectivity Using Down MEP on L3 Interfaces	This enhancement expands network diagnostics to L3 interfaces at L2 network termination, simplifying the management and maintenance of multilayer networks. Without impacting the underlying L2 infrastructure, this feature uses CFM packets to verify the connection of L3 paths. Previously, CFM Down MEP support was limited to L2 interfaces associated with cross-connect or bundle members. This feature is supported on both physical main and subinterfaces, bundle main and subinterfaces.
Untagged L2 Subinterface	You can now use untagged L2 subinterfaces to effectively manage and process traffic from customer edge (CE) devices that do not employ VLAN tagging. This capability allows you to apply services to untagged packets, which would not have been possible if the packets were to be logically received on the main interface. As a result, you can now push a dot1q or other supported Layer 2 encapsulation on the received frame. This feature introduces the **encapsulation untagged** command.
User-Defined Fields for ECMP Hashing	We ensure that in cases where multiple paths are used to carry packets from source to destination, each path is utilized for this purpose and no path is over-utilized or congested. This is made possible because we now provide customized ECMP hashing fields that are used for path computation. Previously, the router relied on fixed packet header fields for hashing, which were not user configurable. With additional user-defined bytes considered for hashing, the granularity at which the traffic can be analyzed for ECMP load balancing increases, resulting in better load balancing and path utilization. The feature introduces these changes: **CLI:** • **cef load-balancing fields user-data** • The **show cef exact-route** command is modified with a new **user-data** keyword. • The **show cef ipv4 exact-route** command is modified with a new **user-data** keyword. • The **show cef ipv6 exact-route** command is modified with a new **user-data** keyword. **YANG:** • New Xpath for `Cisco-IOS-XR-8000-fib-platform-cfg.yang` (see Github, YANG Data Models Navigator).
IP Addresses and Services	
IPv4 and IPv6 ACLs in Layer 2	You can now configure both IPv4 and IPv6 ACLs on Layer 2 interfaces. This functionality is supported on the physical and bundle main layer 2 interfaces, enabling layer 3 ACLs. With this feature, you can implement traffic filtering at layer 2, effectively preventing undesired traffic from progressing deeper into the network, like using an IPV6 ACL as an IPV6 router advertisement (RA) guard. Previously, IPv6 and IPv4 ACLs weren't supported on Layer 2 interface.

Feature	Description
Internal VRF based Forwarding	We have now enhanced forwarding capabilities in VRFs, allowing internal VRFs (iVRF) to redirect incoming packets to a different destination using GRE tunneling. This functionality can be used to examine packets that do not match the predefined access control entries. Instead of discarding these packets by default, we can use a forwarding match ACE to send them to a VRF that can forward them using GRE tunnels. This allows for a more thorough inspection of these discarded packets, helping to identify any hidden threats or attacks in the contents and improving network security.
TCP Dump File Converter	You can now convert an entire TCP dump of packet traces in binary files into readable formats such as text or cap, which makes it easier to analyze them for troubleshooting using third-party or open-source tools. This feature saves time and effort by preventing the need to examine each packet for failure. This feature introduces the **tcp dump-file convert** command.
HSRP over Physical interfaces and Bundle interfaces	This feature provides first-hop redundancy and enables failover to a standby interface within a group of physical or bundle interfaces or sub-interfaces in a network in the event of any failure in the active interface or sub-interface in that group. The feature allows you to configure HSRP for IPv4 and IPv6 networks on the physical and bundle interfaces and sub-interfaces.
VRRP over Physical interfaces and Bundle interfaces	This feature ensures high availability of routing paths by mitigating any failure in the primary interfaces within a group of physical or bundle interfaces or sub-interfaces in a network with a failover to a backup physical or bundle interface. The feature achieves this failover through a backup router in the VRRP router group configured on the physical or bundle interfaces or sub-interfaces. The virtual IP addresses from the failed primary router are handed over to this backup router.
L2VPN	
G.8032 Ethernet Ring Protection Switching	Ethernet Ring Protection Switching (ERPS) protocol, defined in ITU-T G.8032, provides protection for Ethernet traffic in a ring topology, while ensuring that there are no loops within the ring at the Ethernet layer. The loops are prevented by blocking either a predetermined link or a failed link. This feature introduces the **ethernet ring g8032** and **ethernet ring g8032 profile** commands.
Withdraw Dynamic MAC Addresses Between Peer PE Routers	We now prevent packet drops between peer routers when the attachment circuit (AC) of a PE router goes down, by withdrawing all dynamic MAC addresses from that PE router. When the AC goes down, the PE routers remove or unlearn the MAC addresses learned from the peer routers, that do not need to be relearned. This enables faster convergence when the AC comes up.
EVPN	
BUM Ingress Replication for EVPN E-LAN the 88-LC1-36EH Line Cards	The BUM ingress replication is now supported on routers with the 88-LC1-36EH line cards.
CFM on EVPN	You can now proactively monitor connectivity and verify faults and isolate them for EVPN services. This is because Ethernet Connectivity Fault Management (CFM) is now available for EVPN and provides end-to-end service level OAM (Operations, Administration, and Maintenance) for EVPN services. This feature is supported only on routers with Q200 and 88-LC1-36EH line cards.

Feature	Description
Core Isolation by Interface Tracking on the 88-LC1-36EH Line Cards	The core isolation by interface tracking is now supported on routers with the 88-LC1-36EH line cards.
Detect and Block Duplicate MAC Addresses on the 88-LC1-36EH Line Cards	The Detect and Block Duplicate MAC Addresses feature is now supported on the 88-LC1-36EH line cards.
EVPN Core Isolation through Peer Failure Detection on the 88-LC1-36EH Line Cards	EVPN Core Isolation through Peer Failure Detection is now supported on the 88-LC1-36EH line cards.
EVPN Cost-Out	The cost-out node brings down the bundle interfaces on the PE to prepare the node for reload or software upgrade. By costing out a node, the traffic is steered away from the PE without any traffic disruption. This allows you to manage the network traffic effectively while reloading or upgrading a node. This feature is supported only on routers with the 88-LC1-36EH line cards.
EVPN Designated Forwarder Election	Designated Forwarder (DF) election enables the access network to control EVPN PE devices by defining the backup path much before the event of a link failure. During the link failure, the PE node is aware of the next PE that will take over the active role and this reduces the traffic loss. DF election supports preference-based and access-driven mechanism. This feature is supported only on routers with the 88-LC1-36EH line cards.
EVPN E-LAN L2 Gateway Single-Homing on the 88-LC1-36EH Line Cards	EVPN single-homing is now supported on routers with the 88-LC1-36EH line cards.
EVPN E-LAN Single-Flow-Active Multi-Homing	This feature introduces EVPN E-LAN single-flow-active multi-homing load balancing mode to connect PE devices in an access network that run Layer 2 access gateway protocols. In this mode, only the PE that first advertises the host MAC address in a VLAN forwards the traffic in a specific flow. When the primary link fails, the traffic quickly switches to the standby PE that learns the MAC address from the originated path, thereby providing fast convergence. The feature introduces the **load-balancing-mode** command with keyword, **single-flow-active** . This feature is supported only on routers with the 88-LC1-36EH line cards.
EVPN E-Tree (Scenario 1a)	We now support EVPN E-Tree with route-targets (RT) constraints using two RTs per EVI on routers with the 88-LC1-36EH line cards.
EVPN E-Tree (Scenario 2)	We now enable a PE device to have both root and leaf sites for a given EVI, which increases the granularity of leaf designation from the entire bridge to AC bridge ports; ACs under a bridge may be root or leaf. This feature is supported on routers with the 88-LC1-36EH line cards.

Feature	Description
EVPN MPLS Multi-Homing	EVPN multi-homing enables you to connect a customer edge (CE) device to two or more provider edge (PE) devices to provide redundant connectivity. When the primary link fails, the standby PE device becomes active immediately, ensuring no traffic disruption and providing faster convergence. This feature is supported only on routers with the 88-LC1-36EH line cards.
EVPN Multiple Services per Ethernet Segment	You can configure EVPN to run multiple services on a single Ethernet Segment (ES), which enables the efficient use of network resources. While the services run on the same physical hardware resource, each service can be associated with a different EVPN instance and separated from each other. This allows traffic segregation, which enables users to employ their own traffic management configurations. This feature is supported only on routers with the Q200 and 88-LC1-36EH line cards.
EVPN Seamless Integration with Legacy VPWS on the Q200 and 88-LC1-36EH Line Cards	The seamless migration of VPWS to EVPN-VPWS services on PE nodes is now supported on routers with the Q200 and 88-LC1-36EH line cards.
Ethernet VPN Virtual Private Wire Service on the Q200 and 88-LC1-36EH Line Cards	The EVPN VPWS or E-Line service is now supported on routers with the Q200 and 88-LC1-36EH line cards.
MAC Mobility for EVPN E-LAN on the 88-LC1-36EH Line Cards	The MAC mobility for EVPN E-LAN is now supported on routers with the 88-LC1-36EH line cards.
Seamless Migration of VPLS Network to EVPN Network on the 88-LC1-36EH Line Cards	The seamless VPLS-to-EVPN migration is now supported on routers with the 88-LC1-36EH line cards.
Split-Horizon Groups for EVPN E-LAN on the 88-LC1-36EH Line Cards	The split-horizon groups for EVPN E-LAN is now supported on routers with the 88-LC1-36EH line cards.
VRF Leaking for EVPN E-LAN on the 88-LC1-36EH Line Cards	The VRF leaking for EVPN E-LAN is now supported on routers with the 88-LC1-36EH line cards.
Virtual Ethernet Segment	A Virtual Ethernet Segment (VES) allows a Customer Edge (CE) device to connect to an EVPN service over an MPLS network, which can be used for redundancy and load balancing. This feature is supported only on routers with the 88-LC1-36EH line cards.
L3VPN	

Feature	Description

VXLAN Static Routing	You can now configure the source and destination virtual tunnel endpoints (VTEPs) for a particular traffic flow, which is particularly useful for scenarios where your data center is connected to an enterprise network, so multiple servers in the data center provide cloud services to your customers and the enterprise edge router. These endpoints help provide rapid convergence in case of failure. Plus, using the UDP header in the VXLAN packet, the VXLAN static routing (also called unicast VXLAN) facilitates network balancing by preventing the transmission of replicated packets.
	
	Alternatively, you can use Service Layer API for faster provisioning of VXLAN static routing.
	
	This feature is supported only on the following PIDs:
	• 8202-32FH-M
	• 8101-32H
	• 8201-32FH
	
	This feature introduces these changes:
	• **CLI:**
	  • **host-reachability protocol static**
	  • **overlay-encapsulation**
	  • **hw-module profile cef vxlan ipv6-tnl-scale**
	• **YANG Data Model:** (see GitHub, YANG Data Models Navigator)
	  • `Cisco-IOS-XR-tunnel-nve-cfg`
	  • `Cisco-IOS-XR-ip-static-cfg`

MPLS	
Conditional Label Advertisement in Label-Switched Path Networks	You can now enhance your network's stability and performance with the streamlined label management. This can be achieved by configuring LDP to advertise labels to peers only when at least one labeled path is available for a prefix. Previously, LDP would advertise local labels to peers even if all next-hop paths for a specific Forwarding Equivalence Class (FEC) had no labels. This release has the following changes: **CLI:** • Introduced a new keyword **unlabelled-all** in **show mpls ldp forwarding** command. • **conditional minimum-one-labelled-nexthop**
Modular QoS	
Enhanced Running Configuration Display for Policy Maps and Class Maps	Now, you can view each class map or policy map running configuration instance on a separate line. The feature modifies the output display of this command: CLI: **show run formal**

Feature	Description
Global Statistics Counters for Priority Flow Control and Priority Flow Control Watchdog	You can now view statistics for Priority Flow Control (PFC) and PFC Watchdog for all interfaces in a consolidated, compact, tabular, and easy-to-read format. We've also made the display of these global statistics faster by ensuring data is collected from all line cards for their interfaces and cumulatively sent to the local statistics infrastructure from where the show commands collect the data. Previously, you could view statistics only per interface for PFC and PFC Watchdog, wherein the show commands get the data from each interface. This feature modifies the following command: • **show controllers**
Set IP Marking for SRv6 Encapsulation	With this feature support for IP marking for SRv6 packets that are encapsulated, there are some important updates to the QoS behavior. This is an explicit packet marking feature that applies only to ingress QoS policies. **CLI:** This feature introduces the **set ip encapsulation** command.
Set VXLAN Outer IP Header DSCP Value to 0	When a PE device transports IP traffic over a VXLAN tunnel that originates on the device, it automatically sets the DSCP value in the VXLAN outer IP header to 0 (CS0).
Traffic Class Queue High Water Marks Monitoring	Introduced in this release on Cisco 8000 Series Routers with Cisco Silicon One Q200 network processors. The Cisco 8608 router is not currently supported. This feature monitors egress interface traffic class queues and records the queue occupancy and queue delay high water marks information for each traffic class. This information includes the virtual output queue that experienced the high water mark and a timestamp indicating when the high water mark was recorded. You can use this data to identify network bottlenecks and prevent traffic congestion. This feature introduces these changes: **Configuration CLI:** • **hw-module profile qos high-water-marks** **EXEC commands:** • **show controllers npu qos high-water-marks** • **clear controller npu qos high-water-marks** **YANG Data Models:** • cisco-IOS-XR-ofa-npu-qos-oper.yang • cisco-IOS-XR-ofa-npu-qos-act.yang • cisco-IOS-XR-um-8000-hw-module-profile-cfg.yang • cisco-IOS-XR-npu-hw-profile-cfg.yang

Feature	Description
View Traffic Class Queue Pause Duration	Introduced in this release on Cisco 8000 Series Routers with Cisco Silicon One Q200 network processors that support the PFC buffer-extended mode function. For traffic flows between routers, you can view the pause duration of output and input queues in the transmitting andreceiving routers, respectively. Thepause duration values of the impacted traffic class queues are displayed for regular intervals within a specified time duration. With the information, you can view the extent of congestion on PFC-enabled interfaces over a period of time and identify whether traffic congestion is due to small bursts of traffic or other causes. The feature introduces these changes: **CLI:** • **show controllers npu packet-memory interface** **YANG Data Models:** • **`Cisco-IOS-XR-platforms-ofa-oper`** (see GitHub, YANG Data ModelsNavigator)
View VOQs Evicted to HBM	The newly introduced command displays the virtual output queues (VOQs) that are evicted to the High Bandwidth Memory (HBM) and the VOQs' HBM buffer usage details. You can use this information whilst monitoring and debugging congestion scenarios. This feature introduces the **show controllers npu voq in-extended-memory instance** command. This feature modifies the `Cisco-IOS-XR-8000-platforms-npu-evict-voq-buff-oper.yang` (see GitHub, YANG Data ModelsNavigator)data model.
Virtual Output Queue Watchdog	We ensure the continuous movement of traffic queues, which is crucial for enforcing QoS policies, even when hardware issues disrupt the Virtual Output Queue (VOQ) and impede the flow of traffic. With this feature, if the router detects a stuck queue on a line card, it shuts down the line card, and if it detects a stuck queue on a fabric card, the router triggers a hard reset on the NPU. A queue is considered stuck only when there is no transmission for one minute. The feature is disabled by default and can be enabled using the command **hw-module voq-watchdog feature enable** . The feature is supported only on Cisco 8000 Series Routers (Modular) with Cisco Silicon One Q100 or Q200 ASICs. The feature introduces these changes: **CLI:** • **hw-module voq-watchdog feature enable** **hw-module voq-watchdog cardshut disable**
Multicast	

Feature	Description
Draft-Rosen Multicast VPN for Profiles 0, 3, and 11	Draft-Rosen is a widely used MVPN model and uses GRE tunnels to securely transmit multicast traffic between the PE routers. It also enables ease of deployment by using the Protocol-Independent Multicast (PIM) protocol between edge routers (PE) and hosts (CE), and between PE routers that are running in VRF mode. You can now configure MVPN using Draft-Rosen for profiles 0, 3, and 11.
Protection-based MoFRR	We have made fault detection and convergence faster for multicast routes, ensuring multicast data, such as IPTV feeds, is delivered with minimum interruptions. This is made possible because we enable the use of a Protection Global Identifier (GID) for Multicast-Only Fast Reroute (MoFRR), which allows the router to quickly identify and switch to a backup or secondary path when a failure is detected on the primary path. This feature introduces the following changes: **CLI**: • The **protect** keyword is introduced in the **mofrr** command. **YANG Data Model:** • New XPaths for `Cisco-IOS-XR-ipv4-pim-cfg.yang` (see GitHub, YANG Data Models Navigator)
NetFlow and sFlow	
Monitor GTP-U Traffic in 5G Network	You now get a comprehensive view of your 5G network's performance and gain detailed insights into the slice utilization, QoS policies applied, and their impact on traffic. This includes verifying the QoS policies of the deployed slices, assessing the effectiveness of 5G slice mechanisms and tracking GTP-U endpoints for specific applications or services. This information is available because we've enabled the exporting of GTP-U related Information Elements. This feature introduces these changes: **CLI:** • The **gtp** keyword is introduced in the **record ipv4** and **record ipv6** commands.
System Security	

Feature	Description
RADIUS with DTLS Protection	You can now secure communication for RADIUS packets by using Datagram Transport Layer Security (DTLS) as the transport layer for the RADIUS protocol. The RADIUS protocol continues to operate over UDP but now benefits from the added security provided by DTLS. Utilizing DTLS enables the manual distribution of long-term proof of peer identity through TLS-PSK cipher suites and the option to use X509 certificates in a PKI infrastructure. In the absence of DTLS, RADIUS packets may be subject to potential security vulnerabilities, including data exposure, replay attacks, weak authentication, and encryption vulnerabilities, especially when transmitted across untrusted networks. The feature introduces these changes: **CLI:** • The keyword **dtls-server** is introduced in the **radius-server host** command. **YANG Data Models:** • New Xpath for `Cisco-IOS-XR-um-aaa-cfg.yang` • New Xpath for `Cisco-IOS-XR-aaa-lib-cfg.yang` (see GitHub, YANG Data Models Navigator)
Lawful Intercept	You can now enable Lawful Intercept (LI) by installing and activating the LI package to enable service providers to perform surveillance on an individual (or target) as authorized by a judicial or administrative order and share the communication intercepts with law enforcement agencies. This feature is supported on Cisco 8800 series routers that have the 88-LC1-36EH line card installed.
System Management	
Fabric Link Management for Uncorrectable Errors	You can now run your fabric links error-free using the forward error correction (FEC) technique. The feature allows you to determine the link quality by monitoring the noisy fabric links during and post bring-up. This feature introduces the **hw-module fabric-fec-monitor disable** command.
Fault Recovery Handling	You can now configure the number of fault recovery attempts by a line card, fabric card or a route processor before it permanently shuts down, thus preventing a faulty card from entering into a cycle of automatic recovery. This feature introduces the following change: **CLI**: • **hw-module fault-recovery** **YANG DATA Model**: • New XPaths for Cisco-IOS-XR-hw-module-cfg.yang (see GitHub, YANG Data Models Navigator)

Feature	Description
Increasing Commit Limit	The maximum number of commits is increased in the router that allows you to configure complex topology changes without interruptions caused by the default blocking of commit changes during rebase or ASCII backup operations. You can prevent the commit operation from getting blocked by using the **cfs check** command, which increases the commit (pacount) count from 20 to 40, and the commit file diff size (configuration data) from 2 MB to 4 MB, and by using the **clear configuration ascii inconsistency** command, which performs an ASCII backup after 55 minutes. The feature modifies the following commands: • **cfs check** • **clear configuration ascii inconsistency**
View VRF-specific Configuration	You can now filter the configurations associated with a specific VRF using the **show running-configuration filter vrf** command. Earlier, the **show running configuration** command displayed configuration under a specific keyword only and that may not publish all configurations related to the object. **CLI:** **show running-configuration filter vrf**
System Monitoring	
Fabric Link Keepalive Monitoring	This feature allows you to monitor and identify the fabric links that are down due to failure to receive keep-alive messages. If a fabric link doesn't receive the keep-alive message, the CiscoIOSXR software performs a port-reset action and tries to activate the fabric link. This feature is enabled by default. You also have the option to disable the maximum port-reset threshold value of five, which causes the link to flap again, but we recommend you avoid using this command unless you have evaluated its impact on your traffic flow. This feature introduces the **hw-module fabric-tsmon-port-reset disable** command, which disables the maximum port-reset threshold value.
Monitor Data Plane Health	You can now easily detect fabric memory corruption and packet loss by checking the health of data plane components including fabric and NPUs on a distributed system using our on-demand diagnostic utility. This functionality introduces the following commands: • **monitor dataplane-health** • **show dataplane-health status**
Traffic Statistics with Packet Drop Location	We help you save debugging time to locate packet drops by automatically detecting nonzero traffic drops from the commands running in the background and giving you the exact location of the packet drop. In earlier releases, you used multiple show commands with their respective locations to detect packet drops. This feature introduces the **show drops all** command.
Collect Comprehensive Tech-Support Information	You can now collect a comprehensive list of troubleshooting data and restore network operations quickly in case of a network disruption. This release allows you to collect more tech-support data than you could in previous releases by executing the **show tech-support custom** command.

Feature	Description
Online Diagnostics for NPU Slices and Fabric cards	You can now use the online diagnostics functionality to test the health of fabric cards and all the slices in an NPU. This feature can help you detect fabric, and slice level failures.
Supporting Custom Profile show tech command	We have simplified the process to collect technical support information for traffic, control-plane, and system by consolidating multiple commands for each of these parameters under the following options: • **traffic** - Generates tech-support information related to network traffic. • **control-plane** - Generates tech-support information related to the control-plane. • **system** - Generates tech-support information related to the system (router). This release adds the keywords **traffic** , **control-plane** , and **system** to the **show tech-support custom** command.
System Log Facility and Source-address per Remote Server	You can now assign a facility type per remote syslog server, which the router uses to calculate the priority value of the syslog messages sent. You can also configure the source address to choose the interface to send remote syslog packets per remote server. The feature introduces these changes: Modified Command: **CLI** • The keywords **facility** and **source-address** per remote syslog server are introduced in the **logging** command. **YANG Data Models:** • New XPaths for `openconfig-system-logging.yang` (see GitHub, YANG Data Models Navigator)
Low Voltage Threshold Value Alarms Disabled	The router will not raise a minor alarm from this release onwards when a voltage sensor goes below the lower threshold value, thus saving memory space that the alarm logs would've consumed otherwise. The router now generates alarms only when voltage sensors cross the critical threshold value.

YANG Data Models Introduced and Enhanced

This release introduces or enhances the following data models. For detailed information about the supported and unsupported sensor paths of all the data models, see the Github repository. To get a comprehensive list of the data models supported in a release, navigate to the Available-Content.md file for the release in the Github repository. The unsupported sensor paths are documented as deviations. For example, openconfig-acl.yang provides details about the supported sensor paths, whereas cisco-xr-openconfig-acl-deviations.yang provides the unsupported sensor paths for openconfig-acl.yang on Cisco IOS XR routers.

You can also view the data model definitions using the YANG Data Models Navigator tool. This GUI-based and easy-to-use tool helps you explore the nuances of the data model and view the dependencies between various containers in the model. You can view the list of models supported across Cisco IOS XR releases and platforms, locate a specific model, view the containers and their respective lists, leaves, and leaf lists presentedvisually in a tree structure.

Feature	Description
Programmability	
Cisco-IOS-XR-Ethernet-SPAN-cfg.yang	The following new leaf is added to this Cisco native data model to enable mirroring of traffic management buffer drop packets: • `tm-drops`
Cisco-IOS-XR-infra-statsd-oper.yang	Previously, the native path for statsd included an additional 'mechanism' node, which supported 'Total', 'Cache', and 'Latest' options. This mechanism node has been removed. With the removal of the mechanism node, all queries will now be addressed using the cache only **Previous Path:** sensor-path Cisco-IOS-XR-infra-statsd-oper:infra-statistics/interfaces/interface/<**mechanism**>/<data-type> **Updated Path:** sensor-path Cisco-IOS-XR-infra-statsd-oper:infra-statistics/interfaces/interface/<data-type>" The supported paths are Cisco-IOS-XR-infra-statsd-oper:infra-statistics/interfaces/interface/**GenericCounters | DataRate | InterfacesMIBCounters | Protocols**
openconfig-interface.yang Version 2.5.0	The OpenConfig data model version 2.5.0 enables you to: • record the precise time in milliseconds at which the counters such as in-octets, in-pkts, out-octets, out-pkts are retrieved from the hardware through an augmented model using the 'last-read-time' field. In the augmented model the 'last-read-time' field wrapped around vendor specific container (name Cisco) indicates the timestamp of the most recent hardware counter readings. • fetches the L2 interface counters on OC-interface.
openconfig-local-routing.yang Version 2.0.1	The OpenConfig data model, which is part of the openconfig-network-instance.yang data model is revised from version 1.2.0 to 2.0.1. This revision enables you to configure the preference for the order selection when multiple sources, such as protocols and static routes, contribute to the same prefix entry. A lower number signifies a better preference. When the preference value is not specified, default preference value is considered which is one. This data model supports event-driven and Model-driven telemetry.

Feature	Description
openconfig-sflow.yang Version 1.0.0	This OpenConfig data model is enhanced to support: • stream cadence-driven telemetry data for the total number of flow record packets sent to the collector using **packets-sent** leaf • stream cadence-driven telemetry data for the total number of packets sampled from the interface using **packets-sampled** leaf This data model supports model-driven telemetry and not event-driven telemetry.
openconfig-system.yang Version 2.3.0	The OpenConfig data model is revised from version 1.0.0 to 2.3.0. This revision enables you to monitor the status of boot up process using the following leaves: • checksum • error-count • status • last-boot-attempt This data model doesn't support event-driven telemetry.
openconfig-platform-pipeline-counters.yang Version 0.3.1	The OpenConfig data model is enhanced to effectively track the telemetry for a particular application-specific Integrated Circuit (Example: 8800-LC-48H, 88-LC0-36FH-M) within a router by utilising its comprehensive packet and drop counters. These counters encompass metrics for the following packet parameters using the in-packets and out-packets leaves: • incoming and outgoing packets (in-packets and out-packets) • data volume (in-bytes and out-bytes) • incoming and outgoing drops (in-drops and out-drops)
Cisco-IOS-XR-infra-statsd-oper.yang	The native yang data model streams cached counters using a TARGET_DEFINED subscription. It enables you to fetch interface statistics, such as bytes-received, packets-received and other details, from a cache which is periodically updated from hardware using generic-counters container. The hardware-timestamp field indicates the timestamp of the most recent hardware counter readings. If hardware-timestamp field is 0, the last-data-time field indicates the timestamp of the most recent counter readings, which could be either from hardware or software. This data model supports event-driven telemetry.

Feature	Description
openconfig-if-ip.yang Version 3.5.0	This OpenConfig data model is revised from version 3.0.0 to 3.5.0. This update introduces the ability to configure both global unicast and link-local IP addresses using the config/type leaf.
openconfig-policy-forwarding.yang	This data model is revised from version 0.6.0 to 0.6.1. The sub-interface leaf is introduced in OpenConfig to enable precise Layer-3 configurations for Policy Based Routing, allowing IP addresses and policies to be applied to logical sub-interfaces in addition to the main interface. This version introduces sub-interface leaf under the following X-paths: • network-instances/network-instance/policy-forwarding/interfaces/interface/interface-ref/config/subinterface • network-instances/network-instance/policy-forwarding/interfaces/interface/interface-ref/state/subinterface • network-instances/network-instance/policy-forwarding/interfaces/interface/interface-ref/config/interface • network-instances/network-instance/policy-forwarding/interfaces/interface/interface-ref/state/interface Model-driven telemetry is supported.
Cisco-IOS-XR-hw-module-cfg.yang	The Cisco-IOS-XR-hw-module-cfg.yang unified data model is enhanced with a new leaf, fault-recovery-count, to configure the default numbers of times a fault recovery can take place in a line card.
Cisco-IOS-XR-mpls-traceroute-act.yang	This unified data model is enhanced with a new container, *ipv6*, and leaves such as *next-hop*, *lsp-endpoint*, and *force-ipv6-explicit-null* in the *type-ipv6-next-hop* interface to extend support to Segment Routing OAM to verify network configuration for SR-MPLS IPv6-based LSPs.
Cisco-IOS-XR-mpls-ping-act.yang	This unified data model is enhanced with a new container, *ipv6*, and leaves such as *next-hop*, *lsp-endpoint*, and *force-ipv6-explicit-null* in the *type-ipv6-next-hop* interface to extend support to Segment Routing OAM to verify network configuration for SR-MPLS IPv6-based LSPs.
Cisco-IOS-XR-um-router-isis-cfg	This unified data model is enhanced with new containers *generic-metric*, and *generic-metric-level* to define a family of user-defined generic metrics that can advertise different types of administrative metrics such as jitter, reliability, and fiscal cost depending on the traffic class for Flexible Algorithms.

Feature	Description
Cisco-IOS-XR-ofa-npu-qos-oper.yang	The Cisco-IOS-XR-ofa-npu-qos-oper.yang data model's node container is updated with the following: The high-water-marks container is added to hold high water marks parameters. The high-water-marks container includes two containers: - The monotonic container provides monotonically increasing traffic class high water marks (since bootup or the last clear operation) for each egress interface and traffic class. - The periodic container provides traffic class queue high water marks from recent periodic polling intervals for each egress interface and traffic class
Cisco-IOS-XR-ofa-npu-qos-act.yang	The Cisco-IOS-XR-ofa-npu-qos-act.yang action model is added and contains a single clear-npu-qos-high-water-marks action to clear the traffic class queue high water marks. The clear-npu-qos-high-water-marks action provides the type, interface-name, traffic-class, and node-name input leaves. The leaves can be optionally specified to limit the scope of the clear action.
Cisco-IOS-XR-um-8000-hw-module-profile-cfg.yang	In the Cisco-IOS-XR-um-8000-hw-module-profile-cfg.yang data model, the qos container is updated with the high-water-marks leaf to enable traffic class queue high water marks monitoring.
Cisco-IOS-XR-npu-hw-profile-cfg.yang	In the Cisco-IOS-XR-npu-hw-profile-cfg.yang data model, the qos container is updated with the high-water-marks leaf to enable traffic class queue high water marks monitoring.
Cisco-IOS-XR-8000-platforms-npu-evict-voq-buff-oper.yang	In the Cisco-IOS-XR-8000-platforms-npu-evict-voq-buff-oper.yang data model, the evic-voq-buff-instances container is added for displaying VOQs evicted to HBM.

Hardware Introduced

For a complete list of supported hardware and ordering information, see the Cisco 8000 Series Data Sheet.

Hardware	Description
8808-FC1 Fabric Card based on F100 Silicon Chip	The Cisco 8808 Series Routers support the Cisco 8808 fabric card (8808-FC1). The 8808-FC1 fabric card is based on Silicon One F100 ASIC. The 8808-FC1 fabric card provides 36 Tbps of switching capacity between the eight line-cards. Because of the higher switching capacity, this fabric card offers benefits, such as faster communication, lower latency, and ability to manage higher data flows. The fabric card supports 8FC and 5FC modes.

Hardware	Description
PSU4.3KW-HVPI Power Supply Unit for Cisco 8608 Router	We're now introducing a high voltage power supply unit, PSU4.3KW-HVPI that accepts HVAC or HVDC input power to operate the Cisco 8608 router in the port side intake configuration. The PSU4.3KW-HVPI power supply unit has a dual input redundant power supply with 55V (main) and 3.3V (standby) outputs. The benefits of the PSU4.3KW-HVPI power supply unit are: • Supports HVDC and HVAC input power • Helps when high power transceivers are installed in the router which need more power to operate • Provides better efficiency for power distribution
88-LC1-36EH based on P100 Silicon One ASIC	The Cisco 8808 Series Routers support the P100 Silicon One ASIC based 88-LC1-36EH line card. The 88-LC1-36EH is a 36-port combination line card providing 28.8 Tbps of throughput. It has thirty-six ports of 800 G. The 88-LC1-36EH line card support 400 (QSFP56-DD), 2X400 (QSFP-DD800), 2X400 (QDD-2X400G-FR), 8X100 (QDD-8X100G-FR), 4X100 (QSFP-DD56) 2X100 (QDD-2X100-LR4-S), 4X10/40 (QSFP+) GbE breakout. See the Cisco 8000 Series Routers Data Sheet for more information on this line card.
Optics	**Note**: Optics support varies across devices (routers, line cards, RPs, and so on). To know if an optics is compatible with a specific Cisco device, refer to the Transceiver Module Group (TMG) Compatibility Matrix. This release introduces the following optics: • Cisco 400G DP04QSDD-E25-280 • Cisco 400G DP04QSDD-E26-28

Release 24.2.11 Packages

The Cisco IOS XR software is composed of a base image (ISO) that provides the XR infrastructure. The ISO image is made up of a set of packages (also called RPMs). These packages are of three types:

- A mandatory package that is included in the ISO
- An optional package that is included in the ISO
- An optional package that is not included in the ISO

Visit the Cisco Software Download page to download the Cisco IOS XR software images.

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

```
RP/0/RP0/CPU0#show install active
XR Software Hash: 2208d945d845204eca7cea785d4a0a62f7c5981c3c5e72ed093032d63325390a

Xr Package                                                          Version
------------------------------------------------- ----------------------------
xr-8000-af-ea                                                    24.2.11v1.0.0-1
xr-8000-aib                                                      24.2.11v1.0.0-1
xr-8000-bfd                                                      24.2.11v1.0.0-1
xr-8000-buffhdr-ea                                               24.2.11v1.0.0-1
xr-8000-bundles                                                  24.2.11v1.0.0-1
```

```
xr-8000-card-support                                    24.2.11v1.0.0-1
xr-8000-cdp-ea                                          24.2.11v1.0.0-1
xr-8000-cem-driver                                      24.2.11v1.0.0-1
xr-8000-cfm                                             24.2.11v1.0.0-1
xr-8000-common-otn                                      24.2.11v1.0.0-1
xr-8000-core                                            24.2.11v1.0.0-1
xr-8000-cpa                                             24.2.11v1.0.0-1
xr-8000-cpa-devobj-misc                                 24.2.11v1.0.0-1
xr-8000-cpa-npu                                         24.2.11v1.0.0-1
xr-8000-cpa-sb-data                                     24.2.11v1.0.0-1
xr-8000-dot1x                                           24.2.11v1.0.0-1
xr-8000-dsm                                             24.2.11v1.0.0-1
xr-8000-dyinggasp-pd                                    24.2.11v1.0.0-1
xr-8000-edpl                                            24.2.11v1.0.0-1
xr-8000-encap-id                                        24.2.11v1.0.0-1
xr-8000-ether-ea                                        24.2.11v1.0.0-1
xr-8000-fabric                                          24.2.11v1.0.0-1
xr-8000-feat-mgr                                        24.2.11v1.0.0-1
xr-8000-fib-ea                                          24.2.11v1.0.0-1
xr-8000-forwarder                                       24.2.11v1.0.0-1
xr-8000-fpd                                             24.2.11v1.0.0-1
xr-8000-fwd-tools                                       24.2.11v1.0.0-1
xr-8000-fwdlib                                          24.2.11v1.0.0-1
xr-8000-gil-ea                                          24.2.11v1.0.0-1
xr-8000-host-core                                       24.2.11v1.0.0-1
xr-8000-hw-resmon                                       24.2.11v1.0.0-1
xr-8000-l2fib                                           24.2.11v1.0.0-1
xr-8000-l2mcast                                         24.2.11v1.0.0-1
xr-8000-leabaofa                                        24.2.11v1.0.0-1
xr-8000-libofaasync                                     24.2.11v1.0.0-1
xr-8000-lpts-ea                                         24.2.11v1.0.0-1
xr-8000-mcast                                           24.2.11v1.0.0-1
xr-8000-netflow                                         24.2.11v1.0.0-1
xr-8000-npu                                             24.2.11v1.0.0-1
xr-8000-oam                                             24.2.11v1.0.0-1
xr-8000-optics                                          24.2.11v1.0.0-1
xr-8000-os-oe                                           24.2.11v1.0.0-1
xr-8000-os-oe-extra                                     24.2.11v1.0.0-1
xr-8000-pbr                                             24.2.11v1.0.0-1
xr-8000-pd-port-mode                                    24.2.11v1.0.0-1
xr-8000-pfilter                                         24.2.11v1.0.0-1
xr-8000-pidb                                            24.2.11v1.0.0-1
xr-8000-pktio                                           24.2.11v1.0.0-1
xr-8000-ple-sdk                                         24.2.11v1.0.0-1
xr-8000-pm                                              24.2.11v1.0.0-1
xr-8000-port-mapper                                     24.2.11v1.0.0-1
xr-8000-ppinfo                                          24.2.11v1.0.0-1
xr-8000-pwhe-ea                                         24.2.11v1.0.0-1
xr-8000-qos-ea                                          24.2.11v1.0.0-1
xr-8000-sat                                             24.2.11v1.0.0-1
xr-8000-span                                            24.2.11v1.0.0-1
xr-8000-spio                                            24.2.11v1.0.0-1
xr-8000-spp-ea                                          24.2.11v1.0.0-1
xr-8000-timing                                          24.2.11v1.0.0-1
xr-8000-tunnel-ip                                       24.2.11v1.0.0-1
xr-8000-utapp-blaze                                     24.2.11v1.0.0-1
xr-8000-vether                                          24.2.11v1.0.0-1
xr-8000-ztp-ea                                          24.2.11v1.0.0-1
xr-aaa                                                  24.2.11v1.0.0-1
xr-acl                                                  24.2.11v1.0.0-1
xr-apphosting                                           24.2.11v1.0.0-1
xr-appmgr                                               24.2.11v1.0.0-1
xr-bcdl                                                 24.2.11v1.0.0-1
xr-bfd                                                  24.2.11v1.0.0-1
```

xr-bgp	24.2.11v1.0.0-1
xr-bgputil	24.2.11v1.0.0-1
xr-bng-stubs	24.2.11v1.0.0-1
xr-bundles	24.2.11v1.0.0-1
xr-cal-pi	24.2.11v1.0.0-1
xr-cdp	24.2.11v1.0.0-1
xr-cds	24.2.11v1.0.0-1
xr-cfgmgr	24.2.11v1.0.0-1
xr-cfm	24.2.11v1.0.0-1
xr-cofo	24.2.11v1.0.0-1
xr-core	24.2.11v1.0.0-1
xr-core-calv	24.2.11v1.0.0-1
xr-cpa-common	24.2.11v1.0.0-1
xr-cpa-common-optics	24.2.11v1.0.0-1
xr-cpa-common-psu	24.2.11v1.0.0-1
xr-cpa-driver-devobj-gnss	24.2.11v1.0.0-1
xr-cpa-driver-devobj-misc	24.2.11v1.0.0-1
xr-cpa-driver-devobj-npu	24.2.11v1.0.0-1
xr-cpa-driver-devobj-phy	24.2.11v1.0.0-1
xr-cpa-driver-devobj-sensors	24.2.11v1.0.0-1
xr-cpa-driver-devobj-storage	24.2.11v1.0.0-1
xr-cpa-driver-devobj-test	24.2.11v1.0.0-1
xr-cpa-driver-devobj-timing	24.2.11v1.0.0-1
xr-cpa-driver-fpgalib-access	24.2.11v1.0.0-1
xr-cpa-driver-fpgalib-common	24.2.11v1.0.0-1
xr-cpa-driver-fpgalib-infra	24.2.11v1.0.0-1
xr-cpa-driver-fpgalib-kmod-oe	24.2.11v1.0.0-1
xr-cpa-driver-fpgalib-misc	24.2.11v1.0.0-1
xr-cpa-driver-fpgalib-optics	24.2.11v1.0.0-1
xr-cpa-driver-optics	24.2.11v1.0.0-1
xr-cpa-ethsw	24.2.11v1.0.0-1
xr-cpa-idprom	24.2.11v1.0.0-1
xr-cpa-tamlib	24.2.11v1.0.0-1
xr-ctc	24.2.11v1.0.0-1
xr-debug	24.2.11v1.0.0-1
xr-dhcp	24.2.11v1.0.0-1
xr-diags	24.2.11v1.0.0-1
xr-diskboot	24.2.11v1.0.0-1
xr-drivers	24.2.11v1.0.0-1
xr-edpl	24.2.11v1.0.0-1
xr-eem	24.2.11v1.0.0-1
xr-elmi-stubs	24.2.11v1.0.0-1
xr-ema	24.2.11v1.0.0-1
xr-enhancedmanageability	24.2.11v1.0.0-1
xr-erp	24.2.11v1.0.0-1
xr-featurecapability	24.2.11v1.0.0-1
xr-fib	24.2.11v1.0.0-1
xr-filesysinv	24.2.11v1.0.0-1
xr-foundation-8000	24.2.11v1.0.0-1
xr-fpd	24.2.11v1.0.0-1
xr-gil	24.2.11v1.0.0-1
xr-ha-infra	24.2.11v1.0.0-1
xr-healthcheck	24.2.11v1.0.0-1
xr-host-core	24.2.11v1.0.0-1
xr-httpclient	24.2.11v1.0.0-1
xr-icpe-eth	24.2.11v1.0.0-1
xr-icpe-opt	24.2.11v1.0.0-1
xr-identifier	24.2.11v1.0.0-1
xr-infra-sla	24.2.11v1.0.0-1
xr-install	24.2.11v1.0.0-1
xr-ip-apps	24.2.11v1.0.0-1
xr-ip-core	24.2.11v1.0.0-1
xr-ip-infra-vrf	24.2.11v1.0.0-1
xr-ip-mibs	24.2.11v1.0.0-1

xr-ip-static	24.2.11v1.0.0-1
xr-ipc	24.2.11v1.0.0-1
xr-ipsla	24.2.11v1.0.0-1
xr-is-is	24.2.11v1.0.0-1
xr-k9sec	24.2.11v1.0.0-1
xr-l2snooptransport	24.2.11v1.0.0-1
xr-l2vpn	24.2.11v1.0.0-1
xr-ldp	24.2.11v1.0.0-1
xr-licensing	24.2.11v1.0.0-1
xr-link-oam	24.2.11v1.0.0-1
xr-linuxnetworking	24.2.11v1.0.0-1
xr-linuxsecurity	24.2.11v1.0.0-1
xr-lldp	24.2.11v1.0.0-1
xr-lpts	24.2.11v1.0.0-1
xr-manageabilityxml	24.2.11v1.0.0-1
xr-mandatory	24.2.11v1.0.0-1
xr-mcast	24.2.11v1.0.0-1
xr-mcastl2snoop	24.2.11v1.0.0-1
xr-mda	24.2.11v1.0.0-1
xr-mpls	24.2.11v1.0.0-1
xr-mpls-oam	24.2.11v1.0.0-1
xr-mpls-oam-client	24.2.11v1.0.0-1
xr-mpls-static	24.2.11v1.0.0-1
xr-netflow	24.2.11v1.0.0-1
xr-networkboot	24.2.11v1.0.0-1
xr-nosi	24.2.11v1.0.0-1
xr-ntp	24.2.11v1.0.0-1
xr-ofa	24.2.11v1.0.0-1
xr-optics	24.2.11v1.0.0-1
xr-orrspf	24.2.11v1.0.0-1
xr-os-oe-apps	24.2.11v1.0.0-1
xr-os-oe-core	24.2.11v1.0.0-1
xr-os-oe-docker	24.2.11v1.0.0-1
xr-os-oe-hardware	24.2.11v1.0.0-1
xr-ospf	24.2.11v1.0.0-1
xr-p4rt	24.2.11v1.0.0-1
xr-perf-meas	24.2.11v1.0.0-1
xr-perfmgmt	24.2.11v1.0.0-1
xr-pfi	24.2.11v1.0.0-1
xr-pird-stubs	24.2.11v1.0.0-1
xr-pkt-trace	24.2.11v1.0.0-1
xr-platforms-ras	24.2.11v1.0.0-1
xr-pm-alarm	24.2.11v1.0.0-1
xr-portmode	24.2.11v1.0.0-1
xr-procmgr	24.2.11v1.0.0-1
xr-python	24.2.11v1.0.0-1
xr-qos	24.2.11v1.0.0-1
xr-rid-mgr	24.2.11v1.0.0-1
xr-routing	24.2.11v1.0.0-1
xr-rpl	24.2.11v1.0.0-1
xr-rsvp-te	24.2.11v1.0.0-1
xr-sanitizer-tools	24.2.11v1.0.0-1
xr-security	24.2.11v1.0.0-1
xr-security-tams	24.2.11v1.0.0-1
xr-secy-driver	24.2.11v1.0.0-1
xr-servicelayer	24.2.11v1.0.0-1
xr-snmp	24.2.11v1.0.0-1
xr-snmp-hw	24.2.11v1.0.0-1
xr-span	24.2.11v1.0.0-1
xr-spi-core	24.2.11v1.0.0-1
xr-spi-hw	24.2.11v1.0.0-1
xr-spp	24.2.11v1.0.0-1
xr-sr	24.2.11v1.0.0-1
xr-stats	24.2.11v1.0.0-1

```
xr-stp                                                  24.2.11v1.0.0-1
xr-stubs                                                24.2.11v1.0.0-1
xr-sysdb                                                24.2.11v1.0.0-1
xr-syslog                                               24.2.11v1.0.0-1
xr-telemetry                                            24.2.11v1.0.0-1
xr-telnet                                               24.2.11v1.0.0-1
xr-timing                                               24.2.11v1.0.0-1
xr-tmpdir-cleanup                                       24.2.11v1.0.0-1
xr-track                                                24.2.11v1.0.0-1
xr-transports                                           24.2.11v1.0.0-1
xr-tty                                                  24.2.11v1.0.0-1
xr-tunnel-ip                                            24.2.11v1.0.0-1
xr-tunnel-nve                                           24.2.11v1.0.0-1
xr-upgradematrix                                        24.2.11v1.0.0-1
xr-utils                                                24.2.11v1.0.0-1
xr-vether                                               24.2.11v1.0.0-1
xr-vpnmib                                               24.2.11v1.0.0-1
xr-xmlinfra                                             24.2.11v1.0.0-1
xr-xrlibcurl                                            24.2.11v1.0.0-1
xr-ztp                                                  24.2.11v1.0.0-1
```

To know about all the RPMs installed including XR, OS and other components use the **show install active all** command.

To view all supported Cisco IOS XR Software upgrades from the current version according to the support data installed on the running system, enter the **show install upgrade-matrix running** command.

The software modularity approach provides a flexible model that allows you to install a subset of IOS XR packages on devices based on your individual requirements. All critical components are modularized as packages so that you can select the features that you want to run on your router.



Note The above show command output displays mandatory packages that are installed on the router. To view the optional and bug fix RPM packages, first install the package and use the **show install active summary** command.

Caveats

Table 1: Cisco 8000 Series Router Specific Bugs

Bug ID	Headline
CSCwk03083	BFD Session bringdown is delayed due to FIB Churn
CSCwj98866	The storm control rate limiter on P100 ASIC based line cards is inaccurate
CSCwj25963	Router in its ideal state displays a counter overrun syslog message for one or more interfaces

Behavior Changes

- In addition to the IPV6 LPM normal entries, IPv6 LPM shortening entries are now displayed in the **show controllers npu resources lpmtcam location** command output to determine the total number of IPv6 routes.

- On all Egress Traffic Management (ETM)-based platforms, when the NPU compatibility mode is set to P100, the maximum number of SPAN sessions supported on the 88-LC1-52Y8H-EM and 88-LC1-12TH24FH-E line cards are as follows:
  - ERSPAN (GRE IPv4, GRE IPv6, or GRE IPv4 + GRE IPv6): 4
  - Local SPAN: 4
  - SPAN to File: 4
  - Combined SPAN (GRE IPv4 + GRE IPv6 + Local SPAN + SPAN to File): 4

  Note: For more information on NPU compatibility mode, see Configure the Comaptibility Mode.
- Cisco IOS XR enforces the existence of the leaves referenced by OpenConfig list key leafrefs. If the referenced leaves do not exist in the OpenConfig datastore, the following error is returned:

  Leaf `name` inside the `config` container must also be set to value `default` to satisfy the leafref constraint on the list key.
- The **route-monitoring policy post inbound** command is replaced by **route-monitoring inbound post-policy**
- To configure load-balancing parameters, use the **cef load-balancing** command in Global configuration mode.
- When multiple IS-IS instances are configured on a router, by default, **show isis** commands display information from all IS-IS instances. To display information from only one specific IS-IS instance, use the **set default-isis-instance** command in the EXEC mode.

Deprecated Features

- PXE Server: Starting from Cisco IOS XR Release 24.2.11, the PXE server feature is deprecated and will not be supported in future releases. We recommend not to use this feature starting from Cisco IOS XR Release 24.2.11.

Determine Software Version

Log in to the router and enter the **show version** command:

```
RP/0/RP0/CPU0# show version
Cisco IOS XR Software, Version 24.2.11 LNT
Copyright (c) 2013-2024 by Cisco Systems, Inc.

Build Information:
 Built By     : sajshah
 Built On     : Tue Jul 02 23:55:50 UTC 2024
 Build Host   : iox-ucs-055
 Workspace    : /auto/ioxdepot6/GISO/giso_build_lindt/giso_custom_create/moht_2024-07-03_06-53-28_UTC
 Version      : 24.2.11
 Label        : 24.2.11
```

Determine Firmware Support

Log in to the router and enter **show fpd package** command:

Cisco 8100 Series Router

```
RP/0/RP0/CPU0# show fpd package
================================ ================================================
                                          Field Programmable Device Package
                                 ================================================
                                           Req      SW       Min Req    Min Req
Card Type            FPD Description       Reload   Ver      SW Ver     Board Ver
================== ========================== ====== ======= ========= =========
--------------------------------------------------------------------------------
8011-12G12X4Y-A      ADMConfig                  YES     1.01      1.01       0.0
                     ADMConfig                  YES     2.01      2.01       0.4
                     BckUp-BootLoader           YES    52.02     52.02       0.0
                     IoFpga                     YES     0.70      0.70       0.0
                     IoFpgaGolden               YES     0.70      0.70       0.0
                     Prim-BootLoader            YES    52.06     52.06       0.0
                     StdbyFpga                  YES     1.23      1.23       0.0
                     StdbyFpgaGolden            YES     1.23      1.23       0.0
                     TamFw                      YES     9.04      9.04       0.0
                     TamFwGolden                YES     9.04      9.04       0.0
--------------------------------------------------------------------------------
8011-12G12X4Y-D      ADMConfig                  YES     1.01      1.01       0.0
                     ADMConfig                  YES     2.01      2.01       0.4
                     BckUp-BootLoader           YES    52.02     52.02       0.0
                     IoFpga                     YES     0.70      0.70       0.0
                     IoFpgaGolden               YES     0.70      0.70       0.0
                     Prim-BootLoader            YES    52.06     52.06       0.0
                     StdbyFpga                  YES     1.23      1.23       0.0
                     StdbyFpgaGolden            YES     1.23      1.23       0.0
                     TamFw                      YES     9.04      9.04       0.0
                     TamFwGolden                YES     9.04      9.04       0.0
--------------------------------------------------------------------------------
8011-24X-A           ADMConfig                  YES     1.01      1.01       0.0
                     ADMConfig                  YES     2.01      2.01       0.4
                     BckUp-BootLoader           YES    52.02     52.02       0.0
                     IoFpga                     YES     0.70      0.70       0.0
                     IoFpgaGolden               YES     0.70      0.70       0.0
                     Prim-BootLoader            YES    52.06     52.06       0.0
                     StdbyFpga                  YES     1.23      1.23       0.0
                     StdbyFpgaGolden            YES     1.23      1.23       0.0
                     TamFw                      YES     9.04      9.04       0.0
                     TamFwGolden                YES     9.04      9.04       0.0
--------------------------------------------------------------------------------
8011-24X-D           ADMConfig                  YES     1.01      1.01       0.0
                     ADMConfig                  YES     2.01      2.01       0.4
                     BckUp-BootLoader           YES    52.02     52.02       0.0
                     IoFpga                     YES     0.70      0.70       0.0
                     IoFpgaGolden               YES     0.70      0.70       0.0
                     Prim-BootLoader            YES    52.06     52.06       0.0
                     StdbyFpga                  YES     1.23      1.23       0.0
                     StdbyFpgaGolden            YES     1.23      1.23       0.0
                     TamFw                      YES     9.04      9.04       0.0
                     TamFwGolden                YES     9.04      9.04       0.0
--------------------------------------------------------------------------------
8011-24Y8L2FH-I      ADM1_Config                YES     0.06      0.06       0.0
                     ADM2_Config                YES     0.06      0.06       0.0
                     BckUp-BootLoader           YES    52.02     52.02       0.0
                     IoFpga                     YES     1.10      1.10       0.0
                     IoFpgaGolden               YES     1.10      1.10       0.0
                     Prim-BootLoader            YES    52.06     52.06       0.0
                     StdbyFpga                  YES     1.23      1.23       0.0
                     StdbyFpgaGolden            YES     1.23      1.23       0.0
                     TamFw                      YES     9.04      9.04       0.0
                     TamFwGolden                YES     9.04      9.04       0.0
```

```
--------------------------------------------------------------------------------
8011-2X2XP4L         ADM1_Config               YES     0.29      0.29      0.0
                     ADM2_Config               YES     0.29      0.29      0.0
                     BckUp-BootLoader          YES    51.08     51.08      0.0
                     IoFpga                    YES     4.00      4.00      0.0
                     IoFpgaGolden              YES     4.00      4.00      0.0
                     Prim-BootLoader           YES    53.01     53.01      0.0
                     StdbyFpga                 YES     1.23      1.23      0.0
                     StdbyFpgaGolden           YES     1.23      1.23      0.0
                     TamFw                     YES     9.04      9.04      0.0
                     TamFwGolden               YES     9.04      9.04      0.0
--------------------------------------------------------------------------------
8011-32Y8L2H2FH      ADM1_Config               YES     1.03      1.03      0.0
                     ADM2_Config               YES     1.03      1.03      0.0
                     BckUp-BootLoader          YES    52.02     52.02      0.0
                     IoFpga                    YES     1.10      1.10      0.0
                     IoFpgaGolden              YES     1.10      1.10      0.0
                     Prim-BootLoader           YES    52.06     52.06      0.0
                     StdbyFpga                 YES     1.23      1.23      0.0
                     StdbyFpgaGolden           YES     1.23      1.23      0.0
                     TamFw                     YES     9.04      9.04      0.0
                     TamFwGolden               YES     9.04      9.04      0.0
--------------------------------------------------------------------------------
8011-4G24Y4H-I       ADMConfig                 YES     4.00      4.00      0.0
                     BckUp-BootLoader          YES    52.02     52.02      0.0
                     IoFpga                    YES     0.70      0.70      0.0
                     IoFpgaGolden              YES     0.70      0.70      0.0
                     Prim-BootLoader           YES    52.06     52.06      0.0
                     StdbyFpga                 YES     1.23      1.23      0.0
                     StdbyFpgaGolden           YES     1.23      1.23      0.0
                     TamFw                     YES     9.04      9.04      0.0
                     TamFwGolden               YES     9.04      9.04      0.0
--------------------------------------------------------------------------------
PWR-400-AC           LI-PrimMCU                NO      0.04      0.04      0.0
                     LI-SecMCU                 NO      0.06      0.06      0.0
                     PrimMCU                   NO      1.02      1.02      0.0
                     SecMCU                    NO      1.03      1.03      0.0
--------------------------------------------------------------------------------
PWR-400-DC           LI-PrimMCU                NO      0.04      0.04      0.0
                     LI-SecMCU                 NO      0.06      0.06      0.0
                     PrimMCU                   NO      1.03      1.03      0.0
                     SecMCU                    NO      1.03      1.03      0.0
--------------------------------------------------------------------------------
PWR-650W-AC          DC-SecMCU                 NO      1.01      1.01      0.0
                     EM-PrimMCU                NO      1.01      1.01      0.0
                     EM-SecMCU                 NO      1.02      1.02      0.0
--------------------------------------------------------------------------------
PWR-930W-DC          DC-SecMCU                 NO      1.01      1.01      0.0
                     LI-SecMCU                 NO      1.01      1.01      0.0
```

Cisco 8200 Series Router

```
RP/0/RP0/CPU0# show fpd package
================================================================================
                           Field Programmable Device Package
                      ================================================
                                          Req     SW      Min Req   Min Req
Card Type            FPD Description      Reload  Ver     SW Ver  Board Ver
==================== ==================== ======= ======= ======== =========
--------------------------------------------------------------------------------
8201                 Bios                 YES     1.29      1.29      0.0
                     BiosGolden           YES     1.29      1.15      0.0
                     IoFpga               YES     1.11      1.11      0.1
                     IoFpgaGolden         YES     1.11      0.48      0.1
```

	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.06	1.06	0.0
	x86FpgaGolden	YES	1.06	0.48	0.0
	x86TamFw	YES	5.13	5.13	0.0
	x86TamFwGolden	YES	5.13	5.05	0.0
8201-ON	Bios	YES	1.208	1.208	0.0
	BiosGolden	YES	1.208	1.207	0.0
	IoFpga	YES	1.11	1.11	0.1
	IoFpgaGolden	YES	1.11	0.48	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.06	1.06	0.0
	x86FpgaGolden	YES	1.06	0.48	0.0
	x86TamFw	YES	5.13	5.13	0.0
	x86TamFwGolden	YES	5.13	5.05	0.0
8201-SYS	Bios	YES	1.29	1.29	0.0
	BiosGolden	YES	1.29	1.15	0.0
	IoFpga	YES	1.11	1.11	0.1
	IoFpgaGolden	YES	1.11	0.48	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.06	1.06	0.0
	x86FpgaGolden	YES	1.06	0.48	0.0
	x86TamFw	YES	5.13	5.13	0.0
	x86TamFwGolden	YES	5.13	5.05	0.0
8201-SYS-ON	Bios	YES	1.208	1.208	0.0
	BiosGolden	YES	1.208	1.207	0.0
	IoFpga	YES	1.11	1.11	0.1
	IoFpgaGolden	YES	1.11	0.48	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.06	1.06	0.0
	x86FpgaGolden	YES	1.06	0.48	0.0
	x86TamFw	YES	5.13	5.13	0.0
	x86TamFwGolden	YES	5.13	5.05	0.0
PSU1.4KW-ACPE	DT-PrimMCU	NO	3.01	3.01	0.0
	DT-SecMCU	NO	2.02	2.02	0.0
	QC-PrimMCU	NO	1.00	1.00	0.0
	QC-SecMCU	NO	1.00	1.00	0.0
PSU1.4KW-ACPI	DT-PrimMCU	NO	3.01	3.01	0.0
	DT-SecMCU	NO	2.02	2.02	0.0
	QC-PrimMCU	NO	1.00	1.00	0.0
	QC-SecMCU	NO	1.00	1.00	0.0
PSU2KW-ACPE	PO-PrimMCU	NO	1.03	1.03	0.0
	PO-SecMCU	NO	1.06	1.06	0.0
	QC-PrimMCU	NO	1.01	1.01	0.0
	QC-SecMCU	NO	1.04	1.04	0.0
PSU2KW-ACPI	PO-PrimMCU	NO	1.03	1.03	0.0

```
                    PO-SecMCU                NO      1.08      1.08      0.0
                    QC-PrimMCU               NO      1.01      1.01      0.0
                    QC-SecMCU                NO      3.02      3.01      0.0
--------------------------------------------------------------------------------
PSU2KW-DCPE         PO-PrimMCU               NO      1.07      1.07      0.0
--------------------------------------------------------------------------------
PSU2KW-DCPI         PO-PrimMCU               NO      1.07      1.07      0.0
--------------------------------------------------------------------------------
PSU2KW-HVPI         PO-PrimMCU               NO      1.09      1.09      0.0
                    PO-SecMCU                NO      1.10      1.10      0.0
```

Cisco 8600 Series Router

```
RP/0/RP0/CPU0# show fpd package
================================================================================
                          Field Programmable Device Package
                    ================================================
                                                Req     SW      Min Req   Min Req
Card Type           FPD Description             Reload  Ver     SW Ver  Board Ver
=================== ========================== ====== ======= ======== =========
--------------------------------------------------------------------------------
86-3.2KW-AC         EM-LogicMCU                NO      0.10      0.10      0.0
                    EM-PrimMCU                 NO      0.02      0.02      0.0
                    EM-SecMCU                  NO      0.02      0.02      0.0
--------------------------------------------------------------------------------
86-3.2KW-DC         EM-LogicMCU                NO      0.11      0.11      0.0
                    EM-PrimMCU                 NO      0.04      0.04      0.0
                    EM-SecMCU                  NO      0.04      0.04      0.0
--------------------------------------------------------------------------------
86-MPA-14H2FH-M     IoFpga                     YES     1.05      1.05      0.1
                    IoFpgaGolden               NO      1.05      1.00      0.1
--------------------------------------------------------------------------------
86-MPA-24Z-M        IoFpga                     YES     1.05      1.05      0.1
                    IoFpgaGolden               NO      1.05      1.00      0.1
--------------------------------------------------------------------------------
86-MPA-4FH-M        IoFpga                     YES     1.05      1.05      0.1
                    IoFpgaGolden               NO      1.05      1.00      0.1
--------------------------------------------------------------------------------
8608-FS[FB]         IoFpga                     NO      1.11      1.11      0.2
                    IoFpgaGolden               NO      1.11      1.00      0.2
--------------------------------------------------------------------------------
8608-RP             Bios                       YES     1.09      1.09      0.0
                    BiosGolden                 YES     1.09      1.01      0.0
                    IoFpga                     YES     1.10      1.10      0.0
                    IoFpgaGolden               NO      1.10      1.01      0.0
                    SsdMicron7300M2            YES     2.60      2.60      0.0
                    SsdMicron7450M2            YES    11.00     11.00      0.0
                    SsdSRMP8N2                 YES    14.38     14.38      0.0
                    x86Fpga                    YES     1.07      1.07      0.0
                    x86FpgaGolden              YES     1.07      1.07      0.0
                    x86TamFw                   YES     7.12      7.12      0.0
                    x86TamFwGolden             YES     7.12      7.12      0.0
--------------------------------------------------------------------------------
8608-SC0-128        IoFpga                     YES     1.01      1.01      0.0
                    IoFpgaGolden               YES     1.01      1.01      0.0
--------------------------------------------------------------------------------
8608-SC0-128[FB]    IoFpga                     NO      1.11      1.11      0.2
                    IoFpgaGolden               NO      1.11      1.00      0.2
--------------------------------------------------------------------------------
PSU4.3KW-HVPI       DT-LogicMCU                NO      2.05      2.05      0.0
                    DT-PrimMCU                 NO      1.08      1.08      0.0
                    DT-SecMCU                  NO      1.08      1.08      0.0
```

Cisco 8800 Series Router

```
RP/0/RP0/CPU0# show fpd package
================================ ============================================
                                        Field Programmable Device Package
                                 ============================================
                                          Req      SW       Min Req   Min Req
Card Type            FPD Description      Reload   Ver      SW Ver    Board Ver
================== ========================== ====== ======= ======== =========
------------------------------------------------------------------------------
88-LC0-34H14FH       Bios                   YES     1.15      1.15      0.0
                     BiosGolden             YES     1.15      0.13      0.0
                     EthSwitch              YES     1.05      1.05      0.0
                     EthSwitchGolden        YES     1.05      0.07      0.0
                     IoFpga                 YES     1.09      1.09      0.1
                     IoFpgaGolden           YES     1.09      1.01      0.1
                     SsdIntelS3520          YES     1.21      1.21      0.0
                     SsdIntelS4510          YES    11.32     11.32      0.0
                     SsdMicron5100          YES     7.01      7.01      0.0
                     SsdMicron5300          YES     0.01      0.01      0.0
                     x86Fpga                YES     0.97      0.97      0.1
                     x86FpgaGolden          YES     0.97      0.78      0.1
                     x86TamFw               YES     6.18      6.18      0.1
                     x86TamFwGolden         YES     6.18      6.10      0.1
------------------------------------------------------------------------------
88-LC0-34H14FH-O     Bios                   YES     0.241     0.241     0.0
                     BiosGolden             YES     0.241     0.218     0.0
                     EthSwitch              YES     1.05      1.05      0.0
                     EthSwitchGolden        YES     1.05      0.07      0.0
                     IoFpga                 YES     1.09      1.09      0.1
                     IoFpgaGolden           YES     1.09      1.01      0.1
                     SsdIntelS3520          YES     1.21      1.21      0.0
                     SsdIntelS4510          YES    11.32     11.32      0.0
                     SsdMicron5100          YES     7.01      7.01      0.0
                     SsdMicron5300          YES     0.01      0.01      0.0
                     x86Fpga                YES     0.97      0.97      0.1
                     x86FpgaGolden          YES     0.97      0.78      0.1
                     x86TamFw               YES     6.18      6.18      0.1
                     x86TamFwGolden         YES     6.18      6.10      0.1
------------------------------------------------------------------------------
88-LC0-36FH          Bios                   YES     1.15      1.15      0.0
                     BiosGolden             YES     1.15      0.13      0.0
                     EthSwitch              YES     1.05      1.05      0.0
                     EthSwitchGolden        YES     1.05      0.07      0.0
                     IoFpga                 YES     1.14      1.14      0.1
                     IoFpga                 YES     1.125     1.125     2.0
                     IoFpgaGolden           YES     1.14      1.00      0.1
                     IoFpgaGolden           YES     1.125     1.125     2.0
                     SsdIntelS3520          YES     1.21      1.21      0.0
                     SsdIntelS4510          YES    11.32     11.32      0.0
                     SsdMicron5100          YES     7.01      7.01      0.0
                     SsdMicron5300          YES     0.01      0.01      0.0
                     x86Fpga                YES     1.48      1.48      0.1
                     x86FpgaGolden          YES     1.48      1.04      0.1
                     x86TamFw               YES     6.18      6.18      0.1
                     x86TamFwGolden         YES     6.18      6.05      0.1
------------------------------------------------------------------------------
88-LC0-36FH-M        Bios                   YES     1.15      1.15      0.0
                     BiosGolden             YES     1.15      0.13      0.0
                     EthSwitch              YES     1.05      1.05      0.0
                     EthSwitchGolden        YES     1.05      0.07      0.0
                     IoFpga                 YES     1.14      1.14      0.1
                     IoFpga                 YES     1.125     1.125     2.0
                     IoFpgaGolden           YES     1.14      1.00      0.1
```

```
                    IoFpgaGolden              YES     1.125     1.125     2.0
                    SsdIntelS3520             YES     1.21      1.21      0.0
                    SsdIntelS4510             YES    11.32     11.32      0.0
                    SsdMicron5100             YES     7.01      7.01      0.0
                    SsdMicron5300             YES     0.01      0.01      0.0
                    x86Fpga                   YES     1.48      1.48      0.1
                    x86FpgaGolden             YES     1.48      1.04      0.1
                    x86TamFw                  YES     6.18      6.18      0.1
                    x86TamFwGolden            YES     6.18      6.05      0.1
--------------------------------------------------------------------------------
88-LC0-36FH-MO      Bios                      YES     0.241     0.241     0.0
                    BiosGolden                YES     0.241     0.218     0.0
                    EthSwitch                 YES     1.05      1.05      0.0
                    EthSwitchGolden           YES     1.05      0.07      0.0
                    IoFpga                    YES     1.14      1.14      0.1
                    IoFpga                    YES     1.125     1.125     2.0
                    IoFpgaGolden              YES     1.14      1.00      0.1
                    IoFpgaGolden              YES     1.125     1.125     2.0
                    SsdIntelS3520             YES     1.21      1.21      0.0
                    SsdIntelS4510             YES    11.32     11.32      0.0
                    SsdMicron5100             YES     7.01      7.01      0.0
                    SsdMicron5300             YES     0.01      0.01      0.0
                    x86Fpga                   YES     1.48      1.48      0.1
                    x86FpgaGolden             YES     1.48      1.04      0.1
                    x86TamFw                  YES     6.18      6.18      0.1
                    x86TamFwGolden            YES     6.18      6.05      0.1
--------------------------------------------------------------------------------
88-LC0-36FH-O       Bios                      YES     0.241     0.241     0.0
                    BiosGolden                YES     0.241     0.218     0.0
                    EthSwitch                 YES     1.05      1.05      0.0
                    EthSwitchGolden           YES     1.05      0.07      0.0
                    IoFpga                    YES     1.14      1.14      0.1
                    IoFpga                    YES     1.125     1.125     2.0
                    IoFpgaGolden              YES     1.14      1.00      0.1
                    IoFpgaGolden              YES     1.125     1.125     2.0
                    SsdIntelS3520             YES     1.21      1.21      0.0
                    SsdIntelS4510             YES    11.32     11.32      0.0
                    SsdMicron5100             YES     7.01      7.01      0.0
                    SsdMicron5300             YES     0.01      0.01      0.0
                    x86Fpga                   YES     1.48      1.48      0.1
                    x86FpgaGolden             YES     1.48      1.04      0.1
                    x86TamFw                  YES     6.18      6.18      0.1
                    x86TamFwGolden            YES     6.18      6.05      0.1
--------------------------------------------------------------------------------
88-LC1-12TH24FH-E   Bios                      YES     1.09      1.09      0.41
                    BiosGolden                YES     1.09      1.01      0.41
                    EthSwitch                 YES     1.05      1.05      0.0
                    EthSwitchGolden           YES     1.05      0.07      0.0
                    IoFpga                    YES     1.05      1.05      0.0
                    IoFpgaGolden              YES     1.05      1.00      0.0
                    SsdMicron7300M2           YES     2.60      2.60      0.0
                    SsdMicron7450M2           YES    11.00     11.00      0.0
                    SsdSRMP8N2                YES    14.38     14.38      0.0
                    x86Fpga                   YES     1.04      1.04      0.31
                    x86FpgaGolden             YES     1.04      1.00      0.31
                    x86TamFw                  YES     7.16      7.16      0.31
                    x86TamFwGolden            YES     7.16      7.13      0.31
--------------------------------------------------------------------------------
88-LC1-36EH         Bios                      YES     1.09      1.09      0.41
                    BiosGolden                YES     1.09      1.01      0.41
                    EthSwitch                 YES     1.05      1.05      0.0
                    EthSwitchGolden           YES     1.05      0.07      0.0
                    IoFpga                    YES     1.05      1.05      0.0
                    IoFpgaGolden              YES     1.05      1.00      0.0
```

	SsdMicron7300M2	YES	2.60	2.60	0.0
	SsdMicron7450M2	YES	11.00	11.00	0.0
	SsdSRMP8N2	YES	14.38	14.38	0.0
	x86Fpga	YES	1.04	1.04	0.31
	x86FpgaGolden	YES	1.04	1.00	0.31
	x86TamFw	YES	7.16	7.16	0.31
	x86TamFwGolden	YES	7.16	7.13	0.31
88-LC1-52Y8H-EM	Bios	YES	1.09	1.09	0.0
	BiosGolden	YES	1.09	1.01	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	0.14	0.14	0.1
	IoFpgaGolden	YES	0.14	0.14	0.1
	SsdMicron7300M2	YES	2.60	2.60	0.0
	SsdMicron7450M2	YES	11.00	11.00	0.0
	SsdSRMP8N2	YES	14.38	14.38	0.0
	x86Fpga	YES	0.07	0.07	0.1
	x86FpgaGolden	YES	0.07	0.07	0.1
	x86TamFw	YES	9.05	9.05	0.1
	x86TamFwGolden	YES	9.05	9.05	0.1
8800-LC-36FH	Bios	YES	1.29	1.29	0.0
	BiosGolden	YES	1.29	1.15	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.39	1.39	0.0
	IoFpgaGolden	YES	1.39	0.08	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.56	1.56	0.0
	x86FpgaGolden	YES	1.56	0.33	0.0
	x86TamFw	YES	5.17	5.17	0.0
	x86TamFwGolden	YES	5.17	5.05	0.0
8800-LC-36FH-O	Bios	YES	1.208	1.208	0.0
	BiosGolden	YES	1.208	1.207	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.39	1.39	0.0
	IoFpgaGolden	YES	1.39	0.08	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.56	1.56	0.0
	x86FpgaGolden	YES	1.56	0.33	0.0
	x86TamFw	YES	5.17	5.17	0.0
	x86TamFwGolden	YES	5.17	5.05	0.0
8800-LC-48H	Bios	YES	1.29	1.29	0.0
	BiosGolden	YES	1.29	1.15	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.39	1.39	0.0
	IoFpgaGolden	YES	1.39	0.08	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.56	1.56	0.0
	x86FpgaGolden	YES	1.56	0.33	0.0

	x86TamFw	YES	5.17	5.17	0.0
	x86TamFwGolden	YES	5.17	5.05	0.0
8800-LC-48H-O	Bios	YES	1.208	1.208	0.0
	BiosGolden	YES	1.208	1.207	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.39	1.39	0.0
	IoFpgaGolden	YES	1.39	0.08	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	x86Fpga	YES	1.56	1.56	0.0
	x86FpgaGolden	YES	1.56	0.33	0.0
	x86TamFw	YES	5.17	5.17	0.0
	x86TamFwGolden	YES	5.17	5.05	0.0
8800-RP	Bios	YES	1.29	1.29	0.0
	BiosGolden	YES	1.29	1.15	0.0
	EthSwitch	YES	1.03	1.03	0.0
	EthSwitchGolden	YES	1.03	0.07	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	TimingFpga	YES	1.02	1.02	0.0
	TimingFpgaGolden	YES	1.02	0.11	0.0
	x86Fpga	YES	1.38	1.38	0.0
	x86FpgaGolden	YES	1.38	0.24	0.0
	x86TamFw	YES	5.17	5.17	0.0
	x86TamFwGolden	YES	5.17	5.05	0.0
8800-RP-E	Bios	YES	1.29	1.29	0.0
	BiosGolden	YES	1.29	1.15	0.0
	EthSwitch	YES	1.03	1.03	0.0
	EthSwitchGolden	YES	1.03	0.07	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	TimingFpga	YES	1.02	1.02	0.0
	TimingFpgaGolden	YES	1.02	0.11	0.0
	x86Fpga	YES	1.38	1.38	0.0
	x86FpgaGolden	YES	1.38	0.24	0.0
	x86TamFw	YES	5.17	5.17	0.0
	x86TamFwGolden	YES	5.17	5.05	0.0
8800-RP-O	Bios	YES	1.208	1.208	0.0
	BiosGolden	YES	1.208	1.207	0.0
	EthSwitch	YES	1.03	1.03	0.0
	EthSwitchGolden	YES	1.03	0.07	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	TimingFpga	YES	1.02	1.02	0.0
	TimingFpgaGolden	YES	1.02	0.11	0.0
	x86Fpga	YES	1.38	1.38	0.0
	x86FpgaGolden	YES	1.38	0.24	0.0
	x86TamFw	YES	5.17	5.17	0.0
	x86TamFwGolden	YES	5.17	5.05	0.0
8800-RP2	Bios	YES	1.09	1.09	0.3

	BiosGolden	YES	1.09	1.07	0.3
	EthSwitch	YES	1.03	1.03	0.0
	EthSwitchGolden	YES	1.03	0.07	0.0
	PcieSwitch	YES	120.14	120.14	0.7
	SsdMicron7300M2	YES	2.60	2.60	0.0
	SsdMicron7450M2	YES	11.00	11.00	0.0
	SsdSRMP8N2	YES	14.38	14.38	0.0
	TimingFpga	YES	1.01	1.01	0.0
	TimingFpgaGolden	YES	1.01	1.00	0.0
	x86Fpga	YES	1.12	1.12	0.6
	x86FpgaGolden	YES	1.12	1.02	0.6
	x86TamFw	YES	7.17	7.17	0.6
	x86TamFwGolden	YES	7.17	7.13	0.6
8800-RP2-O	Bios	YES	1.00	1.00	0.3
	BiosGolden	YES	1.00	1.00	0.3
	EthSwitch	YES	1.03	1.03	0.0
	EthSwitchGolden	YES	1.03	0.07	0.0
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	TimingFpga	YES	1.01	1.01	0.0
	TimingFpgaGolden	YES	1.01	1.00	0.0
	x86Fpga	YES	0.128	0.128	0.3
	x86FpgaGolden	YES	0.128	0.128	0.3
	x86TamFw	YES	7.12	7.12	0.3
	x86TamFwGolden	YES	7.12	7.12	0.3
8804-FAN	FtFpga	NO	1.00	1.00	0.0
	FtFpgaGolden	NO	1.00	0.16	0.0
8804-FC0	IoFpga	YES	1.00	1.00	0.0
	IoFpga	YES	1.125	1.125	2.0
	IoFpgaGolden	YES	1.00	0.16	0.0
	IoFpgaGolden	YES	1.125	1.125	2.0
8804-FC1	IoFpga	YES	1.03	1.03	0.0
	IoFpgaGolden	YES	1.03	1.03	0.0
8808-FAN	FtFpga	NO	1.00	1.00	0.0
	FtFpgaGolden	NO	1.00	0.16	0.0
8808-FC	IoFpga	YES	1.02	1.02	0.0
	IoFpgaGolden	YES	1.02	0.05	0.0
8808-FC0	IoFpga	YES	1.00	1.00	0.0
	IoFpga	YES	1.125	1.125	2.0
	IoFpgaGolden	YES	1.00	0.16	0.0
	IoFpgaGolden	YES	1.125	1.125	2.0
8808-FC1	IoFpga	YES	1.03	1.03	0.0
	IoFpgaGolden	YES	1.03	1.03	0.0
8808-FC1-G	IoFpga	YES	1.06	1.06	0.0
	IoFpgaGolden	YES	1.06	1.01	0.0
8812-FAN	FtFpga	NO	1.00	1.00	0.0
	FtFpgaGolden	NO	1.00	0.16	0.0
8812-FC	IoFpga	YES	1.02	1.02	0.0
	IoFpgaGolden	YES	1.02	0.05	0.0
	Retimer	YES	3.00	3.00	0.0

```
8818-FAN            FtFpga                  NO      1.00      1.00      0.0
                    FtFpgaGolden            NO      1.00      0.16      0.0
-------------------------------------------------------------------------------
8818-FC             IoFpga                  YES     1.02      1.02      0.0
                    IoFpgaGolden            YES     1.02      0.05      0.0
                    Retimer                 YES     3.00      3.00      0.0
-------------------------------------------------------------------------------
8818-FC0            IoFpga                  YES     1.00      1.00      0.0
                    IoFpga                  YES     1.125     1.125     2.0
                    IoFpgaGolden            YES     1.00      0.16      0.0
                    IoFpgaGolden            YES     1.125     1.125     2.0
                    Retimer                 YES     3.00      3.00      0.0
-------------------------------------------------------------------------------
PSU4.8KW-DC100      PO-PrimMCU              NO     51.85     51.85      0.0
                    PO-SecMCU               NO     51.85     51.85      0.0
-------------------------------------------------------------------------------
PSU6.3KW-20A-HV     DT-LogicMCU             NO      1.00      1.00      0.0
                    DT-PrimMCU              NO      1.00      1.00      0.0
                    DT-SecMCU               NO      1.00      1.00      0.0
-------------------------------------------------------------------------------
PSU6.3KW-HV         AB-LogicMCU             NO      3.08      3.08      0.0
                    AB-PrimMCU              NO      3.08      3.08      0.0
                    AB-SecMCU               NO      3.06      3.06      0.0
                    DT-LogicMCU             NO      4.11      4.11      0.0
                    DT-PrimMCU              NO      4.01      4.01      0.0
                    DT-SecMCU               NO      4.00      4.00      0.0
-------------------------------------------------------------------------------
PWR-4.4KW-DC-V3     DT-LogicMCU             NO      3.02      3.02      0.0
                    DT-Prim1MCU             NO      3.01      3.01      0.0
                    DT-Prim2MCU             NO      3.01      3.01      0.0
                    DT-Sec1MCU              NO      3.01      3.01      0.0
                    DT-Sec2MCU              NO      3.01      3.01      0.0
```

Compatibility Matrix for EPNM and Crosswork with Cisco IOS XR Software

The compatibility matrix lists the version of EPNM and Crosswork that are supported with Cisco IOS XR Release in this release.

Table 2: Compatibility Matrix

Cisco IOS XR	Crosswork	EPNM
Release 24.2.11	Crosswork Optimization Engine 6.0	Evolved Programmable Network Manager 7.1.1

Important Notes

- The warning message that the smart licensing evaluation period has expired is displayed in the console every hour. There is, however, no functionality impact on the device. The issue is seen on routers that don't have the Flexible Consumption licensing model enabled. To stop the repetitive messaging, register the device with the smart licensing server and enable the Flexible Consumption model. Later load a new registration token.

  To register the device with the smart licensing server, see the Registering and Activating Your Router.

Licensing

Starting with Cisco IOS XR Release 24.1.1, Smart Licensing Using Policy (SLP) is the default Licensing model. When you upgrade to the Cisco IOS XR Release 24.1.1 release or later, the Smart Licensing Using Policy is enabled by default.

You can migrate your devices to Smart Licensing with Policy model, see *Migrating from Smart Licensing to Smart Licensing Using Policy*, Smart Licensing Using Policy on Cisco IOS XR Routers.

We recommend that you update to the latest version of SSM On-Prem or Cisco Smart Licensing Utility.



Note SSM On-Prem and CSSM both support SLP devices and SL devices. SLP devices and SL devices can coexist in a network. The Smart Licensing (SL) model is available in releases Cisco IOS XR Release 7.11.1 and earlier.

Production Software Maintenance Updates (SMUs)

A production SMU is a SMU that is formally requested, developed, tested, and released. Production SMUs are intended for use in a live network environment and are formally supported by the Cisco TAC and the relevant development teams. Software bugs identified through software recommendations or Bug Search Tools are not a basis for production SMU requests.

For information on production SMU types, refer the Production SMU Types section of the *IOS XR Software Maintenance Updates (SMUs)* guide.

Supported Transceiver Modules

To determine the transceivers that Cisco hardware device supports, refer to the Transceiver Module Group (TMG) Compatibility Matrix tool.

Cisco IOS XR Error messages

To view, search, compare, and download Cisco IOS XR Error Messages, refer to the Cisco IOS XR Error messages tool.

Cisco IOS XR MIBs

To determine the MIBs supported by platform and release, refer to the Cisco IOS XR MIBs tool.

Related Documentation

The most current Cisco 8000 router documentation is located at the following URL:

https://www.cisco.com/c/en/us/td/docs/iosxr/8000-series-routers.html

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