

Release Notes for Cisco 8000 Series Routers, IOS XR Release 24.4.1

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Cisco 8200, 8600, 8700, and 8800 Series Routers

In Release 24.4.1, BGP and IGP take approximately 10% longer to initiate the traffic flow compared to Release 24.3.1. This delay occurs after any event that triggers new bulk route learning and downloads, such as a router or line card reload, or any other event that can create such a condition.

For example, in the case of BGP IPv4 with a scale of 1 million routes, the route download could take an additional 10 to 15 seconds in Release 24.4.1 compared to Release 24.3.1.

The BGP and IGP traffic delay is only during the initial route programming phase. Once all routes have been learned, there are no functional impacts.

Delays in starting traffic flow cases occur only in situations involving router or line card reloads when using Fast Re-Route (FRR) and Equal-Cost Multi-Path (ECMP) as redundancy mechanisms for the data path.

What's New in Cisco IOS XR Release 24.4.1

Cisco is continuously enhancing the product with every release and this section covers a brief description of key features and enhancements. It also includes links to detailed documentation, where available.

Cisco IOS XR Release 24.4.1 is a new feature release for Cisco 8000 Series routers.

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

Software Features Enhanced and Introduced

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

Feature	Description
Setup and Upgrade	
Immutable bootstrap configurations	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]) ; Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now ensure your router always boots up in a known good state. This feature prevents unauthorized changes to the router's boot configuration, ensuring that it remains static and tamper-proof. This maintains the integrity and security of the router from the initial boot stage and throughout its entire operation.
Programmability	

Feature	Description
Data logging with gNSI AcctzStream service	Introduced in this release on: Fixed Systems(8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]). This feature replaces the existing bi-directional data streaming service, **Acctz**, with the new server-streaming service, **AcctzStream**. In this unidirectional data streaming service, while the router continues to send accounting records to the collector (until the connection is terminated), the collector, on the other hand, sends only the timestamp on its initial connection with the router. With this feature, you can configure the maximum memory allocated for cached accounting history records thus ensuring effective network optimization and resource utilization. The feature introduces these changes: **CLI:** • **grpc aaa accounting history-memory** For specifications on the gNSI Accounting (AcctzStream) RPCs and messages, refer to the Github repository.
gNOI Healthz	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) With gNOI Healthz, you can monitor and troubleshoot device health by collecting logs and conducting root-cause analysis on detected issues. This proactive approach enables early identification and resolution of system health problems, thereby reducing downtime and enhancing reliability. For the specification on gNOI.healthz, see the GitHub repository.
gRPC server TLS version 1.3 support	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now enhance your network security by enabling TLS 1.3 support for your gRPC services. The TLS 1.3 version offers stronger protection against vulnerabilities, eliminates outdated ciphers, and ensures forward secrecy in data encryption by generating a unique session key for each new network session. The feature introduces these changes: **CLI:** • **tls-min-version** • **tls-max-version**
Tracking and Synchronization of PBR PolicyMap Statistics Using Unique IDs and InsightD	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now accurately track, store, and synchronize per-rule statistics for PBR policy maps using unique IDs. These unique IDs are registered with InsightDB through a mapping mechanism, which includes a global key (a combination of policy map and Rule in string format) and a local key (an allocated unique number of uint64 type). To know more about creating a Service Layer API for Interfaces, see *Cisco IOS-XR Service Layer Interfaces.* This feature modifies Cisco-IOS-XR-pbr-fwd-stats-oper (see GitHub, YANG Data Models Navigator) data model.

Feature	Description
Service Level API Enhancements for Policy-Based Routing	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now programmatically create policy-maps and rules or class-maps using the Service Layer API (SL API). This feature allows programmatically applying and removing policy-maps on router interfaces to manage incoming traffic according to defined policies. The SL API infrastructure facilitates granular control over the forwarding plane by enabling external clients to interact with the router's routing services, such as the FIB,RIB, and LSD. This interaction allows for precise and dynamic routing decisions based on the programmed policies, enhancing overall network management and efficiency. You can use GET or GET ALL RPCs to fetch the policies configured on the router and the interfaces on which they are applied by SL-API. • SLPolicyGlobalGet – Retrieve Global Policy capabilities • SLPolicyGet - Retrieve all Policies and its rules and the interfaces where the policy is applied from the server
Validation of Route Installation Using Service Layer API	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now validate route installation through hardware acknowledgements. This feature supports Label Switched Path (LSP) selection based on IP Class-Based Forwarding (CBF) for optimized traffic engineering. It also dynamically updates routing information using next-hop and Next Hop Group (NHG) tracking based on network events and supports forward references between objects for flexible programming. Previously, route installation confirmation, traffic engineering optimization, dynamic routing updates, and flexible programming required more manual configuration and monitoring. To know more about creating a Service Layer API for Interfaces, see Cisco IOS-XR Service Layer Interfaces.

Feature	Description
Nexthop Resolution	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) Nexthop resolution ensures that BGP paths are valid and optimal, minimizing traffic loss and enhancing network performance. Nexthop resolution determines the reachability and metrics of nexthops in a network using a gRPC callback API provided by XR. This process involves registering nexthop IP addresses and receiving updates on their resolution status and IGP metrics. The feature supports incremental registration, resolution status monitoring, and timely updates, making it scalable for large-scale data centers. To know more about creating a Service Layer API for Interfaces, see Cisco Service Layer API Documentation. The feature introduces these changes: **CLI:** • **show service-layer rib notifications registrations** command • The **show rib next-hop**command output is extended to include new values (**recurse cross table** and **connected interfaces only**) in the **Flags** field and new field **metric type**.
Support of IP traffic callback and MPLS traffic callback	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) This feature ensures the integrity and efficiency of network traffic by verifying that routes and MPLS tunnels are ready to receive traffic before being advertised or used. This feature includes two traffic callback components: the Safe to Receive IP Traffic Callback, which uses a gRPC callback API to confirm route readiness, and the Safe to Receive MPLS Traffic Callback, which provides a callback to verify MPLS tunnel readiness. Both components enhance network reliability by preventing packet loss and ensuring smooth traffic flow through timely updates. To know more about creating a Service Layer API for Interfaces, see Cisco Service Layer API Documentation.
Interface Status check of Service Layer API	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now receive low latency notifications for interface state and bandwidth changes via SL- API within 100ms. This feature ensures that when a physical or bundle interface changes its state or bandwidth, notifications are delivered promptly to the customer's SDN agent. The system uses gRPC-based streaming APIs, allowing clients to subscribe to all or specific interfaces. This ensures timely and reliable delivery of interface events to the customer's SDN agent. To know more about creating a Service Layer API for Interfaces, see Cisco Service Layer API Documentation.
Routing	

Feature	Description
BGP BFD Strict-Mode Capabilities for Improved Interoperability	Introduced in this release on: Fixed Systems (8200 [ASIC: P100], 8700 [ASIC: P100]); Modular Systems (8800 [LC ASIC: P100]) You now have the ability to upgrade your network using Cisco's BGP BFD strict-mode negotiate and strict-mode negotiate override modes. These modes improve stability and cooperation between Cisco IOS XR and Cisco IOS XE devices. They ensure BGP sessions start only when BFD sessions are active. The override option enforces this even if a peer device does not support strict-mode. The feature ensures that a BGP session is established between neighbors only after the BFD session is established and stable. This ensures that the BFD functions as intended during a failure, promoting network stability and reliability. This feature introduces these changes: **CLI:** • The **bfd-state** keyword is introduced in the **show bgp sessions** command. • The **BFDmode** and **BFDState** fields are added to the **show bgp neighbors** command output. **YANG Data Models:** • New XPaths for `Cisco-IOS-XR-um-router-bgp-cfg.yang` (See GitHub, YANG Data Models Navigator)
IS-IS protocol shutdown mode	Introduced in this release on: Fixed Systems (8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q200]) You can now gracefully shut down IS-IS on an interface or router without abruptly interrupting network operations. This feature simplifies operations by consolidating multiple steps into a single command, ensuring network stability during maintenance or configuration changes. This feature introduces these changes: **CLI:** • **protocol shutdown** **YANG Data Model:** • `Cisco-IOS-XR-um-router-isis-cfg` (see GitHub, YANG Data Models Navigator)
Segment Routing	

Feature	Description
Delay and synthetic loss measurement for GRE tunnel interfaces	Introduced in this release on: Fixed Systems (8200); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now measure the latency or delay experienced by data packets when they traverse a network, and also proactively monitor and address potential network issues before they impact users by measuring key parameters such as packet loss, and jitter for GRE tunnel interfaces. This feature enables you to report synthetic Two-Way Active Measurement Protocol (TWAMP) test packets that are deployed in delay-profile or delay measurement sessions, and enables delay measurement for GRE tunnel interfaces. The feature introduces these changes: **CLI:** The **performance-measurement interface** command supports the **tunnel-ip** keyword.
Fallback delay advertisement	Introduced in this release on: Fixed Systems (8200); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now advertise fallback delay value, retaining delay information in performance metrics even when delay metrics for interfaces are temporarily unavailable due to hardware, synchronization, or network connectivity issues. The feature ensures optimal routing decisions by maintaining network stability and consistent performance, even when real-time metrics are temporarily unavailable. Previously, the performance metrics did not include delay metrics when they were temporarily inaccessible, resulting in visibility gaps in the network and less effective routing. The feature introduces these changes: **CLI:** The **performance-measurement interface** command is modified with a new **advertise-delay fallback** keyword. **YANG Data Models:** • `Cisco-IOS-XR-um-performance-measurement-cfg.yang` See (GitHub, Yang Data Models Navigator)
Far-end delay metrics in one-way measurement mode	Introduced in this release on: Fixed Systems (8200); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) Segment Routing Performance Monitoring (SR PM) now enables network operators to compute both far-end (T4 – T3) and near-end (T2 – T1) delay metrics, offering a comprehensive view of end-to-end delay across the data path. Measuring far-end delay, from the responder to the querier node, enhances visibility and allows operators to precisely monitor and assess network performance. Previously, you could measure the near-end delay metrics for a given data path.

Feature	Description
Flexible algorithm with bandwidth optimization	Introduced in this release on: Fixed Systems(8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) The enhanced IGP flexible algorithm path computation optimizes routing paths by automatically adjusting to changes in link bandwidth, which is especially beneficial for handling parallel L3 links and dynamic bandwidth variations, such as in L2 link bundles. The algorithm ensures optimal capacity paths by considering the cumulative bandwidth of parallel links and prefers paths with the highest available bandwidth, improving performance for high-bandwidth traffic flows. In addition to traditional metrics like link delay or monetary cost, the algorithm can also optimize paths based on the maximum available bandwidth of links, which can be locally configured or computed from advertised link bandwidth. The feature introduces these changes: **CLI:** • **bandwidth-metric flex-algo** • **metric-type bandwidth** • **reference-bandwidth** • **group-mode** **YANG Data Models:** • New Xpaths are introduced for `Cisco-IOS-XR-um-router-isis-cfg.yang` (see GitHub, YANG Data Models Navigator)
SR-TE policy with enhanced flexible algorithm metric types	Introduced in this release on: Fixed Systems(8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) We have enhanced the SR-TE policy at headend with flexible algorithm that supports additional metric types, user-defined and bandwidth, ensuring consistent path computation across flexible algorithm metric types and constraints, on both intra-IGP and inter-IGP domains. The feature also supports headend computed inter-domain SR policies with Flex Algo constraints and IGP redistribution or leaking. The feature introduces these changes: **CLI:** • The **flex-algo-metric-type** keyword is introduced in the **effective-metric admin-distance** command. **YANG Data Models:** • New Xpaths are introduced for `Cisco-IOS-XR-segment-routing-ms-cfg.yang` (see GitHub, YANG Data Models Navigator)

Feature	Description
SRv6 double recursion for multilayer BGP underlay	Introduced in this release on: Fixed Systems (8200); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q200, P100]) The feature introduces support for SRv6 double recursion, where network services such as BGP VPNs (Layer 2 and Layer 3) require multiple resolution layers. Specifically, one routing layer resolves over another before reaching the final destination. Double recursion is achieved by collapsing the underlay, typically involving protocols like IGP or BGP in the packet forwarding chain. This enables three-level load balancing and an even distribution of traffic across multiple layers of the network stack. The feature is supported on the ingress Provider Edge (PE) router. The feature introduces these changes: **CLI:** • **tag-map tag** <*value*> **map forwarding-hierarchy level-2-used-as-nexthop** • The **show cef ipv6** and **show cef ipv4** commands are enhanced to include the Layer 2 prefix information, which resolve as nexthop Layer 3 prefixes. **YANG Data Models:** • `Cisco-IOS-XR-um-router-rib-cfg:router` (see GitHub, Yang Data Models Navigator) data model.
Segment routing Tree-SID interoperability and SR-P2MP enhancements	Introduced in this release on: Fixed Systems (8200); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) The feature introduces enhancements to the SR Tree-SID functionality and SR-P2MP Policy, enabling full alignment with the Path Computation Element Protocol (PCEP) standard as per IETF specifications. These improvements enable interoperability between Path Computation Client (PCC) devices from different vendors connected to the PCE. The feature introduces these changes: **CLI:** • The **show pce ipv4** and **show segment-routing traffic-eng pcc ipv4** commands are enhanced to display the SR-P2MP capability and the number of SR-P2MP instances.
VRF-to-VRF route leaking in SRv6 core	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC: Q200]); Modular Systems (8800 [LC ASIC: Q200, P100]) VRF-to-VRF route leaking enables sharing of routes between VRFs while maintaining their isolation. This feature allows the source VRF to send leaked routes to remote PEs or Route Reflectors (RRs) across an SRv6 core network, similar to an MPLS core network, enabling communication between different service tenants or administrative domains without compromising VRF isolation.
BGP	

Feature	Description
Per-VRF label allocation for VPN routes	Introduced in this release on: Fixed Systems (8200 [ASIC:Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) This feature modifies the default label allocation from per-prefix to per-VRF by allowing you to enforce per-VRF label allocation for imported VPN routes using the **advertise vpn-imported label-mode per-vrf** command. This feature introduces these changes: **CLI:** • **advertise vpn-imported label-mode per-vrf** **YANG Data Model:** • `Cisco-IOS-XR-um-vrf-cfg.yang` (see GitHub, YANG Data Models Navigator)
Selective FIB Download	Introduced in this release on: Fixed Systems (8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q200]) You can now selectively download BGP prefixes to the Routing Information Base (RIB) and Forwarding Information Base (FIB). This feature prevents traffic drops by ensuring that traffic follows default routes when specific destination routes are unavailable.
Simultaneous monitoring of Adj-RIB-In Pre-Policy and Post-Policy views	Introduced in this release on: Fixed Systems (8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now monitor BGP events and collect BGP route information both before and after applying policy filters. This feature allows you to view the Adj-RIB-In pre-policy and post-policy views simultaneously for all BGP peers, making it easier to troubleshoot routing policies and verify Remotely Triggered Black Hole (RTBH) routes. This feature introduces these changes: **CLI:** This feature modifies the following commands: • **route-monitoring inbound pre-policy** • **show bgp bmp** • **YANG Data Model**: New XPaths for • `Cisco-IOS-XR-um-router-bgp-cfg.yang` • `Cisco-IOS-XR-ipv4-bgp-oper.yang` (see GitHub, YANG Data Models Navigator)
Interface and Hardware Component	

Feature	Description
Always-On SPAN-to-File with periodic write	Introduced in this release on: Fixed Systems(8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]). The routers can now provide reliable, always-available packet capture for post-event analysis, eliminating the need for prior configuration or user interaction. The enhanced SPAN-to-File feature provides continuous packet capture and debugging capability with always-on functionality that starts automatically upon destination configuration. It prevents data loss during node reloads by periodically writing packet buffer contents to disk, without stopping the capture. A default SPAN-to-File session for forwarding and buffer drops is always active and can be disabled if not needed. The feature also supports packet truncation and sampling in software for software-mirrored packets, independent of NPU capabilities. The feature introduces these changes: **CLI:** • **monitor-session default-capture-disable** • **monitor-session local-capture-capacity** • The **always-on, periodic-write,** and **capacity** keywords are introduced in the **destination file** command. • The **write** keyword is introduced in the **monitor-session <name> packet-collection** action command. **YANG data models:** • New Xpaths for `Cisco-IOS-XR-um-monitor-session-cfg.yang` • New Xpaths for `Cisco-IOS-XR-Ethernet-SPAN-cfg.yang` • New Xpaths for `Cisco-IOS-XR-Ethernet-SPAN-act.yang` (see GitHub, YANG Data Models Navigator)
Display of traffic rates for bundle interfaces	Routers can now display a snapshot of the traffic throughput and traffic rate on all bundle interfaces over the last few seconds, facilitating easy analysis. These statistics are presented in a tabular format for quick reference. The feature introduces these changes: **CLI:** • **show interfaces counters rates bundle** **YANG Data Models:** • The existing Xpath `interface-rate` in `Cisco-IOS-XR-infra-statsd-oper.yang` is extended to retrieve bundle interface statistics. (see GitHub, YANG Data Models Navigator)

Feature	Description
Double-Tagged 802.1ad Encapsulation Options for Layer 3 Physical and Bundle Subinterfaces	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) The support for Double-Tagged 802.1ad Encapsulation Options for Layer 3 Physical and Bundle Subinterfaces is now extended to all Systems in the Cisco 8000 Series Routers.
Extended Support for DP04QSDD-ER1 Optical Module	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100](select variants only*); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: P100])(select variants only*) This release introduces support for the Cisco 400G Quad Small Form-Factor Pluggable Double Density (QSFP-DD) optical module DP04QSDD-ER1 on the following routers and line cards Routers: • Cisco 8201-32FH • Cisco 8201-24H8FH • Cisco 8608 Line cards: • 88-LC1-36EH
Increase in number of CFM sessions	Introduced in this release on: Fixed Systems(8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) The number of supported Connectivity Fault Management (CFM) sessions is now increased to 500. This enhancement improves fault detection, network visibility, scalability, and troubleshooting, which are crucial for managing high-performance networks.

Feature	Description
Layer 2 interface VLAN encapsulation using VLAN ranges and lists	Introduced in this release on: Fixed Systems (8200, 8700)(select variants only*); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q200, P100])(select variants only*) You can now leverage the VLAN ranges and lists to effectively separate networks operating over shared links and devices. VLAN encapsulation is typically determined by the access network and customer edge (CE) device, limiting the network provider's control over the VLAN tag or Ethernet type of customer traffic. The VLAN ranges and lists support various customer traffic types, enhancing network flexibility and management. *This feature is supported on: • 8201-32FH • 8201-24H8FH • 8202-32FH-M • 8212-48FH-M • 8608 • 8711-32FH-M • 8712-MOD-M • 88-LC0-34H14FH • 88-LC0-36FH • 88-LC0-36FH-M • 88-LC1-36EH • 88-LC1-52Y8H-EM • 88-LC1-12TH24FH-E This feature modifies these changes: **CLI:** • **encapsulation dot1ad** • **encapsulation dot1ad dot1q** • **encapsulation dot1q** • **encapsulation dot1q second-dot1q**
Machine check error notifications	Introduced in this release on: Fixed Systems (8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now identify and resolve MCE-related issues quickly and easily because Cisco IOS XR Software displays a syslog notification for MCE errors, eliminating the need to manually check for them in the MCE log file.

Feature	Description
Periodic syslog messages for shutdowns due to fault-recovery failures	Introduced in this release on: Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) Cisco IOS XR Software now generates a syslog message immediately to indicate its shutdown state after a Line Card (LC), Fabric Card (FC), or Route Processor (RP) shuts down due to fault-recovery failure. This syslog message is repeated every 60 minutes to keep you informed of the shutdown status. This enhancement helps in identifying and troubleshooting shutdown LC, FC, or RP components.
Unidirectional Link Detection Protocol support on physical Ethernet interfaces	Introduced in this release on: Fixed Systems(8200, 8700)(select variants only*); Modular Systems (8800 [LC ASIC: P100]). The Unidirectional Link Detection Protocol (UDLD) is now supported on the Physical Ethernet interfaces on the Cisco Silicon One P100 ASIC-based Systems. This feature helps detect faults and miswiring conditions with unbundled fiber links and enables each device to understand its own connections as well as those of its neighbors. *This feature is supported on: • 8212-48FH-M • 8711-32FH-M • 8712-MOD-M This feature introduces these changes: **CLI:** • **clear ethernet udld statistics** • **ethernet udld reset interface** • **show ethernet udld interfaces** • **show ethernet udld statistics**
IP Addresses and Services	
View the count of routes per origin protocol in the Cisco Express Forwarding tables	You can now view the count of routes per origin protocol in the Cisco Express Forwarding (CEF) tables, which helps in understanding the distribution and volume of routes learned from different protocols. It also aids in identifying potential issues related to routing loops, inefficiencies, or misconfigurations. The feature introduces these changes: **CLI:** • The **detail**keyword is introduced in the show cef tables command. **YANG Data Models:** • New XPaths for **openconfig-aft-summary.yang** (see GitHub, YANG Data Models Navigator)
L2VPN	

Feature	Description
Dot1Q Q-in-Q (0x8100/0x8100) Tunneling for VLAN Subinterface Encapsulation	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) We have optimized VLAN implementation by enabling service providers to: • expand VLAN space to segregate their networks for customers with multiple VLANs and overlapping VLAN IDs. • enhance service mapping for efficiently differentiating data packets and applying QoS policies based on users and services. Such optimization is possible because this release supports Dot1Q Q-in-Q (0x8100/0x8100) encapsulation for VLAN subinterfaces. This involves configuring these subinterfaces to add an outer 802.1Q tag to packets that are already carrying an 802.1Q VLAN tag. The support for Dot1Q Q-in-Q (0x8100/0x8100) Tunneling for VLAN Subinterface Encapsulation is now extended to all systems in the Cisco 8000 Series Routers.
Enhance network efficiency and scalability with GIL pruning for PWHE interfaces	Introduced in this release on: Modular Systems (8800 [LC ASIC: P100])(select variants only*) You can now manage hardware resources for a Pseudowire Headend (PWHE) interface more efficiently by limiting PWHE replication to the line card locations where the interfaces listed in the Generic Interface List (GIL) are physically present. This optimization ensures that resource usage is confined to only the necessary line cards. The router internally synchronizes the PWHE underlay with the GIL using a mechanism known as GIL pruning. The GIL consists of a subset of core-facing IGP/LDP-enabled interfaces expected to transmit pseudowire traffic for the PWHE interface. This feature is enabled by default and does not require any user configuration. *This feature is supported on: • 88-LC1-52Y8H-EM • 88-LC1-12TH24FH-E

Feature	Description
Increase in pseudowire scale on Cisco 8000 Series Routers	Introduced in this release on: Fixed Systems (8200, 8700)(select variants only*); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: P100]) You can now improve traffic segmentation with a higher Ethernet Flow Point (EFP) that allows you to configure multiple VLANs with an increased scale limit of Layer 2 pseudowire per system for various services. **VPWS PWs** • *8212-48FH-M supports 12288 sessions • 8711-32FH-M, 8608, 88-LC1-36FH, 88-LC1-12TH24FH-E, 88-LC1-52Y8H-EM, 8712-MOD-M supports 28672 sessions **VPLS PWs** • *8212-48FH-M 12288 sessions • 8711-32FH-M, 8608, 88-LC1-36FH, 88-LC1-12TH24FH-E, 88-LC1-52Y8H-EM supports 20480 sessions • 8712-MOD-M supports 32768 sessions **Multi-Dest (internal label ECD)** • *8212-48FH-M supports 12288 sessions • 8711-32FH-M, 8608, 88-LC1-36FH, 88-LC1-12TH24FH-E, 88-LC1-52Y8H-EM, 8712-MOD-M supports 16384 sessions
L2 VLAN Subinterface Encapsulation and Rewrite	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now use the VLAN Subinterface Encapsulation and Rewrite operations to: • Configure exact matching for all single-tagged encapsulations. • Support legacy Q-in-Q encapsulation 0x9100/0x8100. • Enable priority tagged traffic to map to the specified interface. The feature introduces these changes: **CLI:** • **dot1q tunneling ethertype 0x9100** • **hw-module profile encap-exact** • **encapsulation dot1ad priority-tagged** • **encapsulation dot1q priority-tagged** • **rewrite ingress tag** **YANG Data Model:** • `Cisco-IOS-XR-um-8000-hw-module-profile-cfg` (see GitHub, YANG Data Models Navigator)

Feature	Description
MPLS	
Improved scale for MPLS over UDP tunnels	Introduced in this release on: Fixed Systems (8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q200, P100]) To handle high traffic volume, you can enhance the MPLS over UDP tunnel scale up to 15284 tunnels using the **hw-module profile cef mplsoudp scale** command. The feature introduces these changes: **CLI**: • **hw-module profile cef mplsoudp scale**
Prevention of IP traffic steering over MPLS-TE tunnel	Introduced in this release on: Fixed Systems (8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q200, P100]). This feature allows to prevent the MPLS labelled traffic or IP traffic to destinations associated with a segment routing prefix SID from resolving over the MPLS-TE tunnel thus ensuring optimal hardware resource utilization. This feature enhances the existing configuration that prevents only the MPLS labelled segment routing traffic from steering into the MPLS-TE tunnel. The feature introduces these changes: **CLI**: The **all** keyword is introduced in the **autoroute announce exclude-traffic segment-routing** command.
RSVP-TE Transport Solution with Flex LSP Headend	Introduced in this release on: Fixed Systems (8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can enable the router to compute • a primary LSP path, • a secondary LSP path, • a dynamic restore path serves as a backup to the primary LSP path, and • another dynamic restore path acts as a backup to the secondary LSP path. During the primary LSP path failure, the headend router computes a new dynamic restore primary path by reusing the links from the failed primary LSP path, and during the secondary LSP path or backup path or protecting path failure, the headend router computes a new dynamic restore path by reusing the links from the failed secondary LSP path. **CLI:** The **protected-by** keyword is enhanced to include two backup paths in the **path-option** command.
Multicast	

Feature	Description
LSM mLDP based MVPN bud or tail node enhancements on edge routers	Introduced in this release on: Fixed Systems(8200, 8700); Centralized Systems (8600); Modular Systems (8800 [LC ASIC: Q200, P100]). This feature extends the support for the rendezvous point (RP) placement on the LSM mLDP based mVPN bud or tail node on edge routers. With this feature, the BUD node is now supported on these profiles: 0, 1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 17, 19, 23, 25, 27, 28, and 29. Previously, the BUD node was supported only on Profiles 21 and 22.
System Security	
IPv6 support for CA enrollment URL	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]) ; Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can enhance network compatibility and simplify management in modern network environments using IPv6 addresses and CA server URLs that resolve to IPv6 addresses as enrollment URLs for the CA hosted on IPv6-based servers. This improvement addresses previous limitations that caused configuration issues and failures when using IPv6 CA enrollment URL.
MACsec Encryption on Layer 3 Subinterfaces	Introduced in this release on: Centralized Systems (8600 [ASIC:Q200]) You can now configure MACsec policy on Layer 3 subinterfaces, which gives you the flexibility to apply MACsec policies to different L3 subinterfaces that belong to the same main physical interface. This capability is possible because we've enabled the router to keep the VLAN tags unencrypted, enabling the L3 subinterfaces to be the MACsec endpoints. When you apply MACsec policies on these subinterfaces, you can enhance the overall security of your network by adding an extra layer of security to the communication between different subnets. The MACsec Encryption on Layer 3 Subinterfaces feature support is now extended to Cisco 8608 Routers.
Multi-auth MAC Authentication Bypass	Introduced in this release on: Fixed Systems (8200 [ASIC: Q100]) (*select variants only) You can enhance network flexibility by enabling multiple hosts on a single port using MAC Authentication Bypass (MAB). The router now supports up to two clients per port by expanding its MAC learning capability from one to two. It authenticates each MAC address individually, allowing multi-domain authentication and enabling independent management of two endpoints. This feature simplifies network management and increases the connectivity options for devices per port. *This feature is supported on the 8201-SYS routers.
Per-NPU hash rotation	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) You can now configure the hash rotation value for each Network Processing Unit (NPU) to improve traffic load balancing and minimize traffic polarization. Alternatively, the value can be automatically calculated, eliminating the need for manual configuration.

Feature	Description

RADIUS with TLS protection	Remote Authentication Dial-In User Service (RADIUS) packets are now less vulnerable to security risks, including data exposure, replay attacks, weak authentication, and encryption weaknesses. This is because we have enabled support for RADIUS with TLS protection.
	
	You can configure the RADIUS protocol on the router to redirect RADIUS packets to a remote server over TLS for Authentication, Authorization, and Accounting (AAA) services.
	
	The feature introduces these changes:
	
	CLI:
	
	• The keyword **radsec-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)

MACsec Encryption on 8711-32FH-M	Introduced in this release on: Fixed Systems (8700 [ASIC: P100]) (select variants only*) MACsec, the Layer 2 encryption protocol, secures data on physical media and provides data integrity and confidentiality. *We now support MACsec encryption on all ports of8711-32FH-M.
TLS version 1.3 support	Introduced in this release on: Fixed Systems (8200 [ASIC: Q200, P100], 8700 [ASIC: P100, K100]); Centralized Systems (8600 [ASIC:Q200]); Modular Systems (8800 [LC ASIC: Q100, Q200, P100]) We have enhanced the security and performance of the routers by upgrading to TLS version 1.3. This version minimizes vulnerabilities by eliminating outdated algorithms and ensuring forward secrecy. Additionally, TLS 1.3 improves router performance by providing faster connection times and reducing latency. The routers will now use TLS version 1.3 as the default for all TLS session establishment requests. If the peer device does not support TLS version 1.3, the router will automatically revert to TLS version 1.2.
System Management	
Support for Precision Time Protocol (PTP)	Introduced in this release on: Fixed Systems (8200 [ASIC: P100]) (select variants only*) * With this release, support for PTP telecom profiles 8262, 8264, 8273.2, and 8275.1 is extended to the Cisco 8212-48FH-M router.
System Monitoring	
Monitor interface	The **filter physical** keyword was introduced, along with new columns `InDrops` and `OutDrops` in the output, to provide enhanced monitoring capabilities for physical interfaces. **CLI:** • The **filter physical** keyword is added to the **monitor interface** command.

Feature	Description
Timing and Synchronization	
Global Navigation Satellite System (GNSS) Support on Cisco 8712-MOD-M Router	Introduced in this release on: Fixed Systems (8700) (select variants only*). Global Navigation Satellite System (GNSS) is a satellite system used as a timing interface. GNSS receiver receives signals from GNSS satellites and decodes the information from multiple satellites to determine its distance from each satellite. Based on this data, the GNSS receiver identifies the location of each satellite. *This feature is supported on the Cisco 8712-MOD-M routers.
PTP for 8212-48FH-M Line Card on Cisco 8808 Router	Introduced in this release on: Fixed Systems (8200)[ASIC: P100] (select variants only*) Based on the IEEE 1588-2008 standard, Precision Time Protocol (PTP) is a protocol that defines a method to synchronize clocks in a network for networked measurement and control systems. *This feature is now extended to 8212-48FH-M. For 8212-48FH-M line card, support for PTP is extended to G8265.1, G.8263, and G8275.2 profiles.
PTP Support on 88-LC1-12TH24FH-E and 88-LC1-52Y8H-EM	Introduced in this release on: Modular Systems (8800 [LC ASIC: P100])(select variants only*)*;* Based on the IEEE 1588-2008 standard, Precision Time Protocol (PTP) is a protocol that defines a method to synchronize clocks in a network for networked measurement and control systems. *This feature is now supported on 88-LC1-12TH24FH-E and 88-LC1-52Y8H-EM line cards. With this release, 88-LC1-12TH24FH-E and 88-LC1-52Y8H-EM line cards support these PTP telecom profiles: G.8265.1 G.8275.2

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-pbr-fwd-stats-oper	This data model enables collection of per-rule statistics for Policy Based Routing (PBR) policies configured through Service Layer API in Cisco IOS XR, contributing to more efficient and effective network operations.

Feature	Description
openconfig-platform-pipeline-counters	This data model has counters under the platform model to expose the Control Plane Policing (CoPP) counters. The following aggregate leaves are newly supported under the 'state' container: • queued-aggregate • queued-bytes-aggregate • dropped-aggregate • dropped-bytes-aggregate
openconfig-aft-summary.yang	The OpenConfig data model is revised from version 2.4.0 to 4.3.0. The new aft-summaries container provides the count of routes per origin protocol for both IPv4 and IPv6 protocols. The feature introduces the following change: **CLI:** • The detail keyword is introduced in the **show cef tables**command. You can stream Model-driven telemetry (MDT) and Event-driven telemetry (EDT) data for this OpenConfig data model.
openconfig-aft.yang Version 3.0.0	The OpenConfig data model is revised from version 2.2.0 to 3.0.0 to introduce the following enhancements: • The `counters` container - This is a new container in the `next-hop` container that allows you to monitor the volume of traffic hitting a particular next-hop. • The `packets-forwarded` and `octets-forwarded` leaves - These new leaves are added to the `counters` container, enabling you to monitor the number of packets and octets forwarded based on the Abstract Forwarding Table (AFT) entry. These counters can be monitored for all next-hops that perform encapsulation (encap), decapsulation (decap), or both for IP-IP packets programmed via the gRPC Routing Information Base Interface (gRIBI).

Feature	Description
Openconfig-platform-transceiver Version 0.13.0	The OpenConfig data model provides various metrics and thresholds for transceiver monitoring on gNMI subscribe. It includes minimum, maximum, average, instant, interval, minimum-time, and maximum-time values for containers such as supply-voltage, laser-temperature, tec-current, and target-frequency-deviation. The model also defines upper thresholds for transceiver with leaves like laser-temperature-upper, output-power-upper, input-power-upper, laser-bias-current-upper, supply-voltage-upper, and module-temperature-upper, as well as lower thresholds leaves such as laser-temperature-lower, output-power-lower, input-power-lower, laser-bias-current-lower, supply-voltage-lower, and module-temperature-lower. Additionally, it supports transceiver leaves such as state, enabled and module-functional-type, and transceiver physical-channels leaves including associated-optical-channel, tx-laser, target-output-power, and laser-age. This OC model supports event-driven and model-driven telemetry.
Openconfig-terminal-device.yang Version 1.9.0	The OpenConfig data model provides instant, minimum, maximum, and average values for parameters of a terminal device using the pre-fec-ber, post-fec-ber, carrier-frequency-offset, modulator-bias-x-phase, modulator-bias-y-phase, modulator-bias-yi, modulator-bias-yq, osnr, q-value, and sop-roc containers. These parameters include Bit Error Rate (BER), channel quality value in decibels, and electrical signal-to-noise ratio in Baud Rate. Additionally, the model offers information on signal distortion, target output power, operational mode of a channel, the frequency of the optical channel, and the input optical power of the port using leaves chromatic-dispersion and target-output-power.
Cisco-IOS-XR-pbr-fwd-stats-oper	This data model enables collection of per-rule statistics for Policy Based Routing (PBR) policies configured through Service Layer API in Cisco IOS XR Routers, contributing to more efficient and effective network operations.
openconfig-platform-pipeline-counters	This data model has counters under the platform model to expose the Control Plane Policing (CoPP) counters. The following aggregate leaves are newly supported under the ‘state’ container: • queued-aggregate • queued-bytes-aggregate • dropped-aggregate • dropped-bytes-aggregate

Feature	Description
Cisco-IOS-XR-um-router-rib-cfg:router	This Cisco unified YANG data model enables you to achieve SRv6 double recursion by collapsing the underlay, which typically involves protocols like IGP or BGP in the packet forwarding chain, allowing three level load balancing and even distribution of traffic across multiple layers of the network stack.
Cisco-IOS-XR-um-performance-measurement-cfg	This unified data model is enhanced with a new container fallback to advertise a fallback delay value, retaining delay information in performance metrics even when the delay metrics for interfaces is temporarily unavailable due to hardware, synchronization, or network connectivity issues.
Cisco-IOS-XR-um-if-arp-cfg.yang	This Cisco unified YANG data model is revised to introduce a new arp evpn-proxy container which drops the ARP request if the target entry is not available in the ARP tables on the EVPN control plane.
Cisco-IOS-XR-um-ipv6-nd-cfg.yang	This Cisco unified YANG data model is revised to introduce a new ipv6 nd evpn-proxy container which drops the ND request if the target entry is not available in the ND tables on the EVPN control plane.
Cisco-IOS-XR-um-router-isis-cfg.yang	The latest update to the Cisco-IOS-XR-um-router-isis-cfg.yang unified data model includes the following additions: • The **metric-type**leaf is enhanced to include **bandwidth** and **generic** as metric types. • The **auto-cost** container - This is a new container in the **flex-algo** container to configure the auto-cost for bandwidth metric. The newly added **reference-bandwidth-number, granularity,** and **group-mode** leaves enable you to configure the different parameters required for bandwidth metric auto-cost calculation.
Cisco-IOS-XR-um-8000-hw-module-profile-cfg	This unified data model for hw-module profiles is enhanced with a new option for **encap-exact**encapsulation type, which allows you to specify exact matching for single-tagged VLAN encapsulations.
Cisco-IOS-XR-um-router-isis-cfg	This Cisco unified YANG data model is enhanced to introduce a new container, **protocol shutdown**, which allows you to gracefully shut down IS-IS on an interface or router without abruptly interrupting network operations.

Hardware Introduced

Hardware	Description
Cisco 8712-MOD-M Router	The Cisco 8712-MOD-M is a K100-based, 2-RU router with the I/O diversity that provides 6.4 Tbps of network bandwidth. The Cisco 8712-MOD-M features 4 Modular Port Adapter (MPA) slots that support 8K-MPA-4D, 8K-MPA-16H and 8K-MPA-16Z2D MPAs. The 8K-MPA-4D is a pluggable card that provides 4 interface ports that can support QSFP-DD 400GbE, 200GbE, or 100GbE modules The 8K-MPA-16H is a pluggable card that provides 16 interface ports that supports QSFP-28 100GbE module. The 8K-MPA-16Z2D is a pluggable card that provides 20 interface ports that includes 4 ports of QSFP-DD and 16 ports of SFP modules.
PSU2KW-HVPI Power Supply Unit for the Cisco 8201, 8202, 8201-32FH, and 8101-32FH Routers	We are now supporting the high voltage power supply unit, PSU2KW-HVPI, which accepts AC, HVAC, or HVDC input power to operate the Cisco 8201, 8202, 8201-32FH, 8101-32FH routers in the port-side intake configuration. The PSU2KW-HVPI power supply unit offers a maximum power output of 1000W (AC low line) or 2000W (HVAC or HVDC). The advantages of the PSU2KW-HVPI PSU include: • Supports both HVDC and HVAC input power • Enhances performance when transceivers are installed in the router, which requires more power to operate • Provides improved efficiency for power distribution
Route Processor Card 8800-RP2-S	This release introduces support for a new route processor card, 8800-RP2-S, on Cisco 8800 Series routers. It provides a capacity of 8-core x86 CPU at 2.7GHz with 64GB RAM and only supports Secure Zero-Touch Provisioning (sZTP). sZTP streamlines the network deployment process, making it faster, more reliable, and more secure. For more information, see the Cisco 8800 section in the Datasheet here.
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 1000BASE T-X Transceiver Module • SFP-1G-SX • SFP-1G-LH

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

Release 24.4.1 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
Active Packages:    XR: 220    All: 1589
Label:              24.4.1
XR Software Hash:      52964bf171bc9e039fcb9bfe5c10bbbdcdaeb21280419cf2be6cca0df2bee1f4

Optional Packages                                                Version
---------------------------------------------------- ----------------------------
xr-8000-l2mcast                                                24.4.1v1.0.0-1
xr-8000-li                                                     24.4.1v1.0.0-1
xr-8000-mcast                                                  24.4.1v1.0.0-1
xr-8000-netflow                                                24.4.1v1.0.0-1
xr-bgp                                                         24.4.1v1.0.0-1
xr-cdp                                                         24.4.1v1.0.0-1
xr-healthcheck                                                 24.4.1v1.0.0-1
xr-ipsla                                                       24.4.1v1.0.0-1
xr-is-is                                                       24.4.1v1.0.0-1
xr-k9sec                                                       24.4.1v1.0.0-1
xr-li                                                          24.4.1v1.0.0-1
xr-lldp                                                        24.4.1v1.0.0-1
xr-mcast                                                       24.4.1v1.0.0-1
xr-mpls-oam                                                    24.4.1v1.0.0-1
xr-netflow                                                     24.4.1v1.0.0-1
xr-ospf                                                        24.4.1v1.0.0-1
xr-perf-meas                                                   24.4.1v1.0.0-1
xr-perfmgmt                                                    24.4.1v1.0.0-1
xr-telnet                                                      24.4.1v1.0.0-1
xr-track                                                       24.4.1v1.0.0-1
```

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

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:

```
Router# show install upgrade-matrix running
Matrix: XR version: 24.4.1, File version: 1.1, Version: N/A
```

```
The upgrade matrix indicates that the following system upgrades are supported from the current XR version:

From       To         Restrictions
---------- ---------- ----------------------------------------------------
24.4.1     24.1.1     -
24.4.1     24.1.2     -
24.4.1     24.2.11    -
24.4.1     24.2.2     -
24.4.1     24.3.1     -
24.4.1     24.3.2     -
24.4.1     7.10.1     -
24.4.1     7.10.2     -
24.4.1     7.11.1     -
24.4.1     7.11.2     -
24.4.1     7.11.21    -
24.4.1     7.3.4      Target fixes; Caveats; Replace performed via reimage
24.4.1     7.3.5      Target fixes; Caveats; Replace performed via reimage
24.4.1     7.3.6      Caveats; Replace performed via reimage
24.4.1     7.5.3      Target fixes; Caveats; Replace performed via reimage
24.4.1     7.5.4      Target fixes; Caveats; Replace performed via reimage
24.4.1     7.5.5      Caveats; Replace performed via reimage
24.4.1     7.7.2      Target fixes; Caveats; Replace performed via reimage
24.4.1     7.8.2      Target fixes; Caveats; Replace performed via reimage
24.4.1     7.9.1      Caveats; Replace performed via reimage
24.4.1     7.9.2      Caveats; Replace performed via reimage
```

Caveats

Table 1: Cisco 8000 Series Router Specific Bugs

Bug ID	Headline
CSCwj32566	Multicast shaper not working for P100 and K100 ASIC based line cards and routers
CSCwm13906	[8711-32FH-M] EVPN BUM traffic cannot be forwarded to any AC/PW/EVI in bridge domain
CSCwm29953	CFM session is down because of interface down
CSCwm73669	MACNH deletion failed for ARP/ND during MPA reload, causing traffic drop due to unresolved adjacency
CSCwm93169	[8700] HW_PROG_ERROR and MACNH for ARP/NP adjacency deletion failed on MPA reload with FRR
CSCwn14800	[8712-MOD-M] BLB session goes down for 1 to 3 min on Bundle member MPA reload
CSCwm38252	The ASIC reset use-case and monitoring feature does not work

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 24.4.1 LNT
Copyright (c) 2013-2024 by Cisco Systems, Inc.

Build Information:
 Built By     : ponaidu
 Built On     : Mon Dec 16 12:29:39 UTC 2024
 Build Host   : iox-lnx-085
 Workspace    : /auto/srcarchive10/prod/24.4.1/8000/ws
 Version      : 24.4.1
 Label        : 24.4.1

cisco 8000 (Intel(R) Xeon(R) CPU D-1633N @ 2.50GHz)
cisco 8212-48FH-M (Intel(R) Xeon(R) CPU D-1633N @ 2.50GHz) processor with 64GB of memory
ios uptime is 32 minutes
Cisco 8212 2RU System w/ 48x 400G QSFP56-DD w/ MACsec
```

Determine Firmware Support

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

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     1.38      1.38      0.0
                      BiosGolden            YES     1.38      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
                      ssdIntelS4520         YES     1.11      1.11      0.0
                      SsdMicron5100         YES     7.01      7.01      0.0
                      SsdMicron5300         YES     0.01      0.01      0.0
                      SsdSRM28M2            YES    14.71     14.71      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
                      ssdIntelS4520         YES     1.11      1.11      0.0
                      SsdMicron5100         YES     7.01      7.01      0.0
                      SsdMicron5300         YES     0.01      0.01      0.0
                      SsdSRM28M2            YES    14.71     14.71      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     1.38      1.38      0.0
                     BiosGolden              YES     1.38      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
                     ssdIntelS4520           YES     1.11      1.11      0.0
                     SsdMicron5100           YES     7.01      7.01      0.0
                     SsdMicron5300           YES     0.01      0.01      0.0
                     SsdSRM28M2              YES    14.71     14.71      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
                     ssdIntelS4520           YES     1.11      1.11      0.0
                     SsdMicron5100           YES     7.01      7.01      0.0
                     SsdMicron5300           YES     0.01      0.01      0.0
                     SsdSRM28M2              YES    14.71     14.71      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      2.00      2.00      0.0
                     QC-SecMCU               NO      2.00      2.00      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      2.00      2.00      0.0
                     QC-SecMCU               NO      2.00      2.00      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      2.00      2.00      0.0
                     QC-SecMCU               NO      4.00      4.00      0.0
-------------------------------------------------------------------------------
PSU2KW-DCPE          PO-PrimMCU              NO      1.07      1.07      0.0
-------------------------------------------------------------------------------
PSU2KW-DCPI          PO-PrimMCU              NO      1.07      1.07      0.0
                     QC-PrimMCU              NO      2.00      2.00      0.0
                     QC-SecMCU               NO      2.00      2.00      0.0
-------------------------------------------------------------------------------
PSU2KW-HVPI          PO-PrimMCU              NO      1.09      1.09      0.0
                     PO-SecMCU               NO      1.10      1.10
```

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     1.06      1.06      0.1
                    IoFpgaGolden                 NO      1.06      1.00      0.1
------------------------------------------------------------------------------------
86-MPA-24Z-M        IoFpga                       YES     1.06      1.06      0.1
                    IoFpgaGolden                 NO      1.06      1.00      0.1
------------------------------------------------------------------------------------
86-MPA-4FH-M        IoFpga                       YES     1.06      1.06      0.1
                    IoFpgaGolden                 NO      1.06      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     1.20      1.20      0.0
                    BiosGolden                   YES     1.20      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
                    SsdSRMP8S1                   YES    13.79     13.79      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 8700 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
================== ========================== ====== ======= ======== ==========
------------------------------------------------------------------------------------
8711-32FH-M         Bios                         YES     5.05      5.05      0.0
                    BiosGolden                   YES     5.05      5.05      0.0
                    IoFpga                       YES     1.11      1.11      0.0
                    IoFpgaGolden                 YES     1.11      1.09      0.0
                    x86Fpga                      YES     2.13      2.13      0.0
                    x86FpgaGolden                YES     2.13      2.11      0.0
```

```
                    x86TamFw                  YES     9.07      9.07      0.0
                    x86TamFwGolden            YES     9.07      9.07      0.0
--------------------------------------------------------------------------------
8711-32FH-M[FB]     IoFpga                    NO      1.10      1.10      0.0
                    IoFpgaGolden              NO      1.10      1.00      0.0
--------------------------------------------------------------------------------
PSU2KW-ACPE         PO-PrimMCU                YES     1.03      1.03      0.0
                    PO-SecMCU                 YES     1.10      1.10      0.0
--------------------------------------------------------------------------------
PSU2KW-ACPI         PO-PrimMCU                YES     1.03      1.03      0.0
                    PO-SecMCU                 YES     1.13      1.13      0.0
--------------------------------------------------------------------------------
PSU2KW-DCPE         PO-PrimMCU                YES     1.11      1.11      0.0
--------------------------------------------------------------------------------
PSU2KW-DCPI         PO-PrimMCU                NO      1.11      1.11      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     1.21      1.21      0.0
                    BiosGolden                YES     1.21      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
                    ssdIntelS4520             YES     1.11      1.11      0.0
                    SsdMicron5100             YES     7.01      7.01      0.0
                    SsdMicron5300             YES     0.01      0.01      0.0
                    SsdSRM28M2                YES    14.71     14.71      0.0
                    x86Fpga                   YES     0.98      0.98      0.1
                    x86FpgaGolden             YES     0.98      0.78      0.1
                    x86TamFw                  YES     6.19      6.19      0.1
                    x86TamFwGolden            YES     6.19      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
                    ssdIntelS4520             YES     1.11      1.11      0.0
                    SsdMicron5100             YES     7.01      7.01      0.0
                    SsdMicron5300             YES     0.01      0.01      0.0
                    SsdSRM28M2                YES    14.71     14.71      0.0
                    x86Fpga                   YES     0.98      0.98      0.1
                    x86FpgaGolden             YES     0.98      0.78      0.1
                    x86TamFw                  YES     6.19      6.19      0.1
                    x86TamFwGolden            YES     6.19      6.10      0.1
--------------------------------------------------------------------------------
88-LC0-36FH         Bios                      YES     1.21      1.21      0.0
                    BiosGolden                YES     1.21      0.13      0.0
                    EthSwitch                 YES     1.05      1.05      0.0
```

	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.19	1.19	0.1
	IoFpgaGolden	YES	1.19	1.00	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	0.0
	x86Fpga	YES	1.51	1.51	0.1
	x86FpgaGolden	YES	1.51	1.04	0.1
	x86TamFw	YES	6.19	6.19	0.1
	x86TamFwGolden	YES	6.19	6.05	0.1
88-LC0-36FH-M	Bios	YES	1.21	1.21	0.0
	BiosGolden	YES	1.21	0.13	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.19	1.19	0.1
	IoFpgaGolden	YES	1.19	1.00	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	0.0
	x86Fpga	YES	1.51	1.51	0.1
	x86FpgaGolden	YES	1.51	1.04	0.1
	x86TamFw	YES	6.19	6.19	0.1
	x86TamFwGolden	YES	6.19	6.05	0.1
88-LC0-36FH-M-2	Bios	YES	1.21	1.21	0.0
	BiosGolden	YES	1.21	0.13	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.19	1.19	0.1
	IoFpgaGolden	YES	1.19	1.00	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	0.0
	x86Fpga	YES	1.51	1.51	0.1
	x86FpgaGolden	YES	1.51	1.04	0.1
	x86TamFw	YES	6.19	6.19	0.1
	x86TamFwGolden	YES	6.19	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	1.19	1.19	0.1
	IoFpgaGolden	YES	1.19	1.00	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	0.0
	x86Fpga	YES	1.51	1.51	0.1
	x86FpgaGolden	YES	1.51	1.04	0.1
	x86TamFw	YES	6.19	6.19	0.1
	x86TamFwGolden	YES	6.19	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	1.19	1.19	0.1
	IoFpgaGolden	YES	1.19	1.00	0.1
	SsdIntelS3520	YES	1.21	1.21	0.0
	SsdIntelS4510	YES	11.32	11.32	0.0
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	0.0
	x86Fpga	YES	1.51	1.51	0.1
	x86FpgaGolden	YES	1.51	1.04	0.1
	x86TamFw	YES	6.19	6.19	0.1
	x86TamFwGolden	YES	6.19	6.05	0.1
88-LC1-12TH24FH-E	Bios	YES	1.20	1.20	0.41
	BiosGolden	YES	1.20	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
	SsdSRMP8S1	YES	13.79	13.79	0.0
	x86Fpga	YES	1.06	1.06	0.31
	x86FpgaGolden	YES	1.06	1.00	0.31
	x86TamFw	YES	7.18	7.18	0.31
	x86TamFwGolden	YES	7.18	7.13	0.31
88-LC1-36EH	Bios	YES	1.20	1.20	0.41
	BiosGolden	YES	1.20	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
	SsdSRMP8S1	YES	13.79	13.79	0.0
	x86Fpga	YES	1.06	1.06	0.31
	x86FpgaGolden	YES	1.06	1.00	0.31
	x86TamFw	YES	7.18	7.18	0.31
	x86TamFwGolden	YES	7.18	7.13	0.31
88-LC1-52Y8H-EM	Bios	YES	1.20	1.20	0.0
	BiosGolden	YES	1.20	1.01	0.0
	EthSwitch	YES	1.05	1.05	0.0
	EthSwitchGolden	YES	1.05	0.07	0.0
	IoFpga	YES	1.02	1.02	0.1
	IoFpgaGolden	YES	1.02	1.00	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
	SsdSRMP8S1	YES	13.79	13.79	0.0
	x86Fpga	YES	1.01	1.01	0.1
	x86FpgaGolden	YES	1.01	1.00	0.1
	x86TamFw	YES	9.05	9.05	0.1
	x86TamFwGolden	YES	9.05	9.05	0.1
8800-LC-36FH	Bios	YES	1.38	1.38	0.0

	BiosGolden	YES	1.38	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
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	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
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	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	1.38	1.38	0.0
	BiosGolden	YES	1.38	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
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	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
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	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	1.38	1.38	0.0
	BiosGolden	YES	1.38	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
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	0.0
	TimingFpga	YES	1.02	1.02	0.0
	TimingFpgaGolden	YES	1.02	0.11	0.0
	x86Fpga	YES	1.39	1.39	0.0
	x86FpgaGolden	YES	1.39	0.24	0.0
	x86TamFw	YES	5.19	5.19	0.0
	x86TamFwGolden	YES	5.19	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
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	0.0
	TimingFpga	YES	1.02	1.02	0.0
	TimingFpgaGolden	YES	1.02	0.11	0.0
	x86Fpga	YES	1.39	1.39	0.0
	x86FpgaGolden	YES	1.39	0.24	0.0
	x86TamFw	YES	5.19	5.19	0.0
	x86TamFwGolden	YES	5.19	5.05	0.0
8800-RP2	Bios	YES	1.20	1.20	0.3
	BiosGolden	YES	1.20	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
	SsdSRMP8S1	YES	13.79	13.79	0.0
	TimingFpga	YES	1.01	1.01	0.0
	TimingFpgaGolden	YES	1.01	1.00	0.0
	x86Fpga	YES	1.14	1.14	0.6
	x86FpgaGolden	YES	1.14	1.02	0.6
	x86TamFw	YES	7.18	7.18	0.6
	x86TamFwGolden	YES	7.18	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
	ssdIntelS4520	YES	1.11	1.11	0.0
	SsdMicron5100	YES	7.01	7.01	0.0
	SsdMicron5300	YES	0.01	0.01	0.0
	SsdSRM28M2	YES	14.71	14.71	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
8800-RP2-S	Bios	YES	1.20	1.20	0.3
	BiosGolden	YES	1.20	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
	SsdSRMP8S1	YES	13.79	13.79	0.0
	TimingFpga	YES	1.01	1.01	0.0
	TimingFpgaGolden	YES	1.01	1.00	0.0
	x86Fpga	YES	1.14	1.14	0.6
	x86FpgaGolden	YES	1.14	1.02	0.6
	x86TamFw	YES	7.18	7.18	0.6
	x86TamFwGolden	YES	7.18	7.13	0.6
8804-FAN	FtFpga	NO	1.00	1.00	0.0
	FtFpga	NO	1.130	1.130	1.1
	FtFpgaGolden	NO	1.00	0.16	0.0
	FtFpgaGolden	NO	1.130	1.129	1.1
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
8808-FAN	FtFpga	NO	1.00	1.00	0.0
	FtFpga	NO	1.130	1.130	1.1
	FtFpgaGolden	NO	1.00	0.16	0.0
	FtFpgaGolden	NO	1.130	1.129	1.1
8808-FAN-V2	FtFpga	NO	1.00	1.00	0.0
	FtFpga	NO	1.130	1.130	1.1
	FtFpgaGolden	NO	1.00	0.16	0.0
	FtFpgaGolden	NO	1.130	1.129	1.1
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
8812-FAN	FtFpga	NO	1.00	1.00	0.0
	FtFpga	NO	1.130	1.130	1.1
	FtFpgaGolden	NO	1.00	0.16	0.0
	FtFpgaGolden	NO	1.130	1.129	1.1
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
	FtFpga	NO	1.130	1.130	1.1

```
                    FtFpgaGolden              NO      1.00      0.16      0.0
                    FtFpgaGolden              NO      1.130     1.129     1.1
--------------------------------------------------------------------------------
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
```

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 24.4.1	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.

- The Cisco IOS-XR Release 24.4.1 does not support ASIC Reset Use-case and Monitoring.

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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