

# Release Notes for Cisco 8000 Series Routers, IOS XR Release 24.1.1

## Cisco 8100, 8200, 8600, and 8800 Series Routers

### What's New in Cisco IOS XR Release 24.1.1

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
<b>Licensing</b>	
<a href="#">Smart Licensing Using Policy</a>	<p>Cisco Smart Licensing Using Policy (SLP) is an enhancement to the existing Cisco Smart Licensing model. It streamlines the licensing process for Cisco IOS XR products by introducing a more flexible and automated approach. With SLP, you no longer need to register your device during installation, and there is no evaluation license state or period. This simplifies the licensing process and reduces complexity. To use SLP, your devices must establish trust and send the initial license usage report within 90 days.</p> <p>Starting with this release, <b>cslu</b> is the default communication transport mode.</p> <p>The feature introduces these changes:</p> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-smart-license-cfg.yang</code> (see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</li> </ul>
<b>Application Hosting</b>	
<a href="#">Cisco Secure DDoS Edge Protection</a>	<p>We have now moved DDoS protection to the network edge, ensuring you can mitigate any DDoS attacks at the ingress points and minimize the impact of such attacks on your network and applications running on it. This solution deploys a centralized controller application that manages a distributed network of edge detectors that analyze and mitigate threats across networks.</p>
<a href="#">Support for Docker Run Options via AppMgr Commands</a>	<p>This feature enables you to configure Docker runtime options during the launch of the container. This allows you to overwrite default configurations for parameters such as CPU usage, security settings, health checks, and more. Multiple Docker runtime options are supported, providing users with the flexibility to customize container behavior based on specific requirements.</p>
<a href="#">Traffic Prioritization for TPAs Hosted in Sandbox</a>	<p>To address TPA packet drops caused by traffic congestion and manage TPA traffic, this release enhances the existing LPTS-based traffic prioritization for TPAs hosted in the sandbox. Instead of a single flow for all traffic, this feature allows you to configure three new LPTS traffic flows (high, medium, low), punting the traffic accordingly. Achieving traffic prioritization involves providing a higher policer rate based on the priority.</p>

Feature	Description
<b>Programmability</b>	
<a href="#">IANA Port Numbers For gRPC Services</a>	<p>You can now efficiently manage and customize port assignments for gNMI, gRIBI, and P4RT services without port conflicts. This is possible because Cisco IOS XR now supports the Internet Assigned Numbers Authority (IANA)-assigned specific ports for P4RT (Port 9559), gRIBI (Port 9340), and gNMI (Port 9339). You can now use both IANA-assigned and user-specified ports for these gRPC services across any specified IPv4 or IPv6 addresses. As part of this support, a new submode for gNMI in gRPC is introduced.</p> <p>This feature introduces the following changes:</p> <ul style="list-style-type: none"> <li>• <b>CLI:</b> <b>port</b></li> </ul>
<a href="#">Manage certificates using Certz.proto</a>	<p>Instead of using multiple RPCs, Certz.proto provides a bidirectional Rotate RPC to replace, revoke, or load a certificate. It also provides additional APIs to install Public Key Infrastructure (PKI) entities such as like identity certificates, trust-bundles, and Certificate Revocation Lists (CRLs) for a gRPC Server.</p> <p>This feature introduces the following changes:</p> <p>CLI:</p> <ul style="list-style-type: none"> <li>• <b>grpc gnsi service certz ssl-profile-id</b></li> <li>• <b>show grpc certificate</b></li> </ul> <p>Yang Data Models:</p> <ul style="list-style-type: none"> <li>• Cisco-IOS-XR-man-ems-cfg.yang (see <a href="#">Github</a>, <a href="#">YANG Data Models Navigator</a>)</li> </ul>
<a href="#">Set Limit on Concurrent Streams for gRPC Server</a>	<p>To limit the load on XR gRPC server and to minimize the risk of a vulnerability attack, you can set the limit on the concurrent streams per gRPC connection.</p> <p>This feature enables you to specify a limit on the number of concurrent streams per gRPC connection to be applied on the server.</p> <p>The feature introduces the following commands:</p> <p><b>CLI</b></p> <ul style="list-style-type: none"> <li>• <b>grpc max-concurrent-streams</b></li> </ul> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• Cisco-IOS-XR-man-ems-oper.yang</li> <li>• Cisco-IOS-XR-man-ems-cfg.yang</li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<a href="#">View Inconsistent OpenConfig Configuration</a>	<p>OpenConfig infrastructure now provides an operational data YANG model, <code>Cisco-IOS-XR-yiny-oper</code>, which can be queried to view the inconsistent OpenConfig configuration caused due to activities such as interface breakout operations, installation activities or insertion of a new line card.</p> <p>See <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a></p>

Feature	Description
<b>Segment Routing</b>	
<a href="#">Identical Route Distinguisher (RD) for Interworking Gateways between MPLS and SRv6 Domains</a>	<p>You can now configure the same Route Distinguisher (RD) for interworking gateways catering to both MPLS and SRv6 domains that help conserve hardware resources, reduce the BGP table scale and minimize the processing load on routers. At the same time, it ensures seamless connectivity across SRv6 and MPLS L3 EVPN domains, thus promoting interoperability and efficiency in modern network environments.</p> <p>Previously, a unique RD was required to extend L3 services between MPLS and SRv6 domains resulting in higher router load and resource consumption, which could have affected performance.</p>
<a href="#">Path MTU discovery for SRv6 Packets on Ingress Provider Edge (PE) Routers, Egress (PE) Routers, and P Role Transit Nodes</a>	<p>You can measure and monitor the packet loss information when one SRv6-enabled router sends an oversized packet to another. This functionality enables a router to send an ICMP error message to the source in such cases, prompting the sender to resend a packet whose size is within the MTU value, thus ensuring the packet moves ahead. The feature is critical for SRv6-enabled routers as these routers do not support packet fragmentation.</p> <p>Previously, a router dropped oversized packets without notifying the source, resulting in packet loss.</p> <p>The <b>hw-module</b> configuration is not required, this feature is enabled by default.</p>
<a href="#">Path Tracing Source and Sink Nodes</a>	<p>You can now measure the Hop-by-Hop delay, trace the path in the network, collect egress interface load information and interface ID, and store them for both Source and Sink nodes.</p> <p>You can now gain visibility into the Path Tracing Source and Sink nodes, which handle IPv6 transit in Path Tracing and full characterization of the packet delivery path. This characterization includes real-time information and checking the network's current status, such as if packets are diverted because of a breach, pinpointing the exact location of problems between routers, and checking that traffic flows per specified priority for Quality of Service (QoS) enforcement.</p> <p>This feature introduces a new behavior keyword <b>utef</b> under the <b>router static</b> command.</p>
<a href="#">Reporting of SR-TE Policies Using BGP-Link State</a>	<p>BGP- Link State (LS) is a mechanism by which LS and Traffic Engineering (TE) information can be collected from networks and shared with external components (such as, Segment Routing Path Computation Element (SR-PCE) or Crossword Optimization Engine (COE)) using the BGP routing protocol.</p> <p>You can gather the Traffic Engineering Policy information that is locally available in a node and advertise it into BGP-LS for SR-MPLS.</p> <p>The operators can now take informed decisions based on the information that is gathered on their network's path computation, reoptimization, service placement, network visualization, and so on.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <b>distributed link-state</b></li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• New XPath for module <code>Cisco-IOS-XR-infra-xtc-agent-cfg.yang</code> (see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</li> </ul>
<a href="#">SR-MPLSv6 Traffic Engineering</a>	<p>We have introduced the capability for SR Policy to support segment lists with IPv6 addresses, which can be either dynamically computed or explicitly set at the SRTE headend.</p>

Feature	Description
<p><a href="#">Synthetic Loss Measurement</a></p>	<p>You can now proactively monitor and address potential network issues before they impact users by measuring key parameters everywhere, packet loss, and jitter. Using this information, you can plan network capacity optimally and ensure quality of service. Such proactive action is possible because this feature reports synthetic Two-Way Active Measurement Protocol (TWAMP) test packets deployed in delay-profile or delay measurement sessions.</p> <p>It also enables you to set the upper and lower limits and notifies when the synthetic packet loss metric is out of the set limit.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The optional <b>anomaly-loss</b> keyword is introduced in the <b>performance-measurement delay-profile</b> command.</li> <li>• <b>show performance-measurement history</b></li> </ul> <p><b>YANG Data Model</b></p> <ul style="list-style-type: none"> <li>• New XPath for <code>Cisco-IOS-XR-um-performance-measurement-cfg</code></li> <li>• New operations for <code>Cisco-IOS-XR-perf-meas-oper.yang</code></li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<p>Compute candidate paths and SR-TE policies with IP exclusion</p>	<p>You can now exclude network resources using their IP addresses and enforce affinity for a group of candidate paths that belong to the same disjoint group. Also, for new services that use Pseudo-wire (PW) over SR-TE policies, you can calculate, customize, and preview candidate paths.</p> <p>Previously, affinity constraints and candidate path disjointness were mutually exclusive.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The feature introduces <b>shortest-path</b> and <b>exclude-resources</b> keywords in the <b>segment-routing traffic-eng policy</b> and <b>segment-routing traffic-eng on-demand color</b> commands.</li> </ul> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-infra-xtc-oper.yang</code></li> <li>• <code>Cisco-IOS-XR-infra-xtc-agent-oper.yang</code></li> <li>• <code>Cisco-IOS-XR-infra-xtc-agent-cfg.yang</code></li> </ul>
<p><b>Interface and Hardware Component</b></p>	

Feature	Description
<a href="#">Configurable FDD and FED Alarm Threshold Values</a>	<p>We now ensure that you have accurate data to initiate proactive maintenance for non-critical FEC errors or take prompt action to prevent potential optical link data loss in your network. This is made possible because we've enabled the configuration of FEC (Forward Error Correction) Detected Degrade (FDD) alarm threshold values for non-critical FEC errors and FEC Excessive Degrade (FED) alarm threshold values for critical FEC errors. You can configure or clear these values for QDD-400G-ZR, QDD-400G-ZRP, and DP04QSDD-HE0 optical modules.</p> <p>Prior to this release, the router would automatically generate FEC alarms based on default threshold values.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>Modified the <a href="#">controller optics</a> command by adding the following keywords:</p> <ul style="list-style-type: none"> <li>• <b>host fec-threshold excess-degrade raise</b></li> <li>• <b>media fec-threshold excess-degrade raise</b></li> <li>• <b>host fec-threshold excess-degrade clear</b></li> <li>• <b>media fec-threshold excess-degrade clear</b></li> <li>• <b>host fec-threshold detected-degrade raise</b></li> <li>• <b>media fec-threshold detected-degrade raise</b></li> <li>• <b>host fec-threshold detected-degrade clear</b></li> <li>• <b>media fec-threshold detected-degrade clear</b></li> </ul> <p>The <b>fec-thresholds</b> keyword is added to the <a href="#">show controller optics</a> command.</p> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• New XPath for <code>Cisco-IOS-XR-controller-optics-oper.yang</code></li> <li>• <code>Cisco-IOS-XR-um-cont-optics-fec-threshold-cfg.yang</code></li> </ul>
<a href="#">Enhanced Alarm Prioritization, Monitoring, and Management</a>	<p>In this release, we introduce enhanced alarm management that offers improved alarm prioritization, monitoring and management, as listed below:</p> <ul style="list-style-type: none"> <li>• Suppression of LOL (Loss of Line) alarm when the LOS-P (Loss of Signal-Payload) alarm is generated. This prioritizes the detection and handling of the LOS-P alarm.</li> <li>• Ability to clear alarm static counters using the command <b>clear counters controller coherentDSP location</b> . Clearing static counters enables you to monitor alarms generated for a definitive time period.</li> <li>• Suppression of warnings when the respective alarm is triggered. This prevents redundant or repetitive alerts.</li> </ul>

Feature	Description
<a href="#">Extended Support for DP04QSDD-HE0 Optical Module</a>	<p>This release introduces support for the Cisco 400G QSFP-DD High-Power (Bright) Optical Module, Ethernet Variant on the following routers and line cards:</p> <p>Routers:</p> <ul style="list-style-type: none"> <li>• Cisco 8201</li> <li>• Cisco 8202</li> </ul> <p>Line cards:</p> <ul style="list-style-type: none"> <li>• 8800-LC-36FH</li> <li>• 88-LC0-36FH-M</li> </ul>
<a href="#">Generic UDP Decapsulation for IPv6 Traffic</a>	<p>We've now made it possible for you to decapsulate GUEv6 packets by adding an additional header to packets that identifies or authenticates the data by using User Datagram Protocol (UDP).</p> <p>In GUE, the payload is encapsulated in an IP packet that can be an IPv6 carrier. The UDP header is added to provide extra hashing parameters, and optional payload demultiplexing. At the decapsulation node, the Carrier IP and UDP headers are removed, and the packet is forwarded based on the inner payload.</p>

Feature	Description
<a href="#">QDD Optical Line System</a>	<p>The QDD Optical Line System (OLS) is a pluggable optical amplifier that provides a compact solution for amplification with extended reach. It also increases fiber bandwidth and lowers power dissipation, all of which is possible because it interconnects two routers or switches for transmitting traffic on a limited number of coherent optical channels over a single-span point-to-point link. The QDD OLS is supported on Cisco 8201, 8201-32FH, and 8201-24H8FH routers.</p> <p>This feature introduces the following:</p> <ul style="list-style-type: none"> <li>• <b>CLI:</b> <ul style="list-style-type: none"> <li>• <b>controller ots (QDD OLS)</b></li> <li>• <b>rx-low-threshold</b></li> <li>• <b>tx-low-threshold</b></li> <li>• <b>ampli-control-mode</b></li> <li>• <b>egress-ampli-gain</b></li> <li>• <b>egress-ampli-power</b></li> <li>• <b>egress-ampli-safety-control-mode</b></li> <li>• <b>egress-ampli-osri</b></li> <li>• <b>show controllers ots (QDD OLS)</b></li> </ul> </li> <li>• <b>YANG Data Model:</b> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-controller-ots-oper.yang</code></li> <li>• <code>Cisco-IOS-XR-controller-ots-cfg.yang</code></li> <li>• <code>Cisco-IOS-XR-pmengine-oper.yang</code></li> <li>• <code>Cisco-IOS-XR-pmengine-cfg.yang</code></li> <li>• <code>Cisco-IOS-XR-pmengine-clear-act.yang</code></li> </ul> </li> </ul>
<a href="#">View Additional Alarms for Coherent Optical Transceiver</a>	<p>You can now monitor the optical transceivers for proper functioning and identify the cause of any malfunction. This is made possible because the output of the <a href="#">show alarms</a> command is now enhanced to display the additional media lane alarms for coherent optical transceivers.</p>
<a href="#">View Coherent Optical Transceiver Module Parameters</a>	<p>You can now monitor the overall functioning and status of the coherent optical transceiver. This is possible because you can now view the module state and data path state of the optical transceivers, which give you an insight into the current state of the optical transceiver.</p> <p>This feature modifies the output of the <a href="#">show controller optics</a> command.</p>
<a href="#">XR Interface Operational State in Linux Kernel</a>	<p>You can now use the <code>ifconfig</code> command to determine the operational status of the XR interface in the Linux kernel when its line protocol is UP. The IFF-RUNNING (RUNNING) flag in <code>ifconfig</code> command indicates that the interface is ready for data transmission and reception.</p> <p>Earlier, you could see the XR interface status as UP or Down using the <code>show interfaces</code> command.</p>
<b>IP Addresses and Services</b>	

Feature	Description
<a href="#">Shortened IPv6 Routing Prefixes</a>	<p>We've improved the memory utilization of the Longest Prefix Match (LPM) table, allowing you to accommodate more IPv6 routing prefixes with wider IPv6 prefix lengths by storing them as shorter routing prefixes. This approach conserves router resources by reducing the number of entries in the routing table and is particularly helpful in mitigating out-of-resource (OOR) situations.</p> <p>This feature is supported only on Cisco Silicon One Q200-based routers and line cards.</p> <p>This feature modifies the <a href="#">hw-module profile route scale</a> command with the new <b>lpm wide-entries shortened</b> keyword.</p>
<b>L2VPN</b>	
<a href="#">Dot1Q Q-in-Q (0x8100/0x8100) Tunneling for VLAN Subinterface Encapsulation</a>	<p>We have optimized VLAN implementation by enabling service providers to:</p> <ul style="list-style-type: none"> <li>• expand VLAN space to segregate their networks for customers with multiple VLANs and overlapping VLAN IDs.</li> <li>• enhance service mapping for efficiently differentiating data packets and applying QoS policies based on users and services.</li> </ul> <p>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.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>New L2VPN commands</p> <ul style="list-style-type: none"> <li>• <b>encapsulation dot1q <i>vlan-id</i> second-dot1q <i>vlan-id</i></b></li> <li>• <b>rewrite ingress tag</b></li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• New XPath for <code>openconfig-interfaces.yang</code> (see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</li> </ul> <p>This feature is supported on Cisco 8000 series routers that are based on the Q200 silicon chip application-specific integrated circuit (ASIC).</p>
<b>EVPN</b>	



Feature	Description
<a href="#">EVPN Non-Revertive Designated Forwarder (DF) Election</a>	<p>In a preference-based Designated Forwarder (DF) election, non-revertive mode prevents the traffic loss that occurs during the recovery of a node in a port-active multihoming network.</p> <p>While recovering from a link failure, an EVPN ethernet-segment (ES) performs DF re-election and re-carves the services among the multihomed nodes, which causes traffic interruption and interface flapping, leading to traffic loss. In the non-revertive mode, the EVPN ES remains in the same state after the recovery and does not re-carve the services, thus avoiding the traffic loss.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <b>non-revertive</b></li> <li>• <b>revert</b></li> <li>• The <b>ethernet-segment interface</b> <i>interface-name</i> <b>revert</b> keyword is introduced in the <b>l2vpn evpn</b> command.</li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-evpn-oper.yang</code></li> <li>• <code>Cisco-IOS-XR-l2vpn-cfg.yang</code></li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<b>MPLS</b>	
<a href="#">Common MPLS Label for IPv4 and IPv6 Address Families</a>	<p>This release simplifies network operations and reduces the complexity of maintaining separate MPLS labels for IPv4 and IPv6 address families by enabling you to assign a single MPLS label to a Virtual Routing and Forwarding (VRF) instance common to both address families. You can allocate the label statically and dynamically. Previously, you could only allocate one label per address family.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>per-vrf-46</b> keyword is introduced in the <b>label mode</b> command.</li> <li>• Modified the output of the following show commands: <ul style="list-style-type: none"> <li>• <b>show bgp labels</b></li> <li>• <b>show bgp process</b></li> <li>• <b>show bgp vrf</b></li> </ul> </li> </ul> <p><b>YANG Data Models:</b> <code>Cisco-IOS-XR-um-router-bgp-cfg.yang</code></p> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>

Feature	Description
<a href="#">Set Global RSVP Message Retransmission Interval</a>	<p>During Fast Reroute (FRR), an RSVP router sends multiple messages to neighbors. If a neighbor fails to acknowledge the messages due to an overload of RSVP message processing or a high frequency of failures, RSVP retransmits the messages, which can result in network congestion. You can now set a longer RSVP message retransmission interval to provide sufficient processing time for neighbors, reduce signaling overhead, and prevent network congestion.</p> <p>You can set this interval for all directly connected neighbors at once or remote neighbors connected through backup tunnels. Previously, you could only enable this option per interface.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b> <a href="#">signalling refresh reduction reliable retransmit-time</a></p> <p><b>YANG Data Model:</b> <a href="#">Cisco-IOS-XR-ip-rsvp-cfg.yang</a> (see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<b>Modular QoS</b>	
<a href="#">Available Shared Memory System and High Bandwidth Memory Buffers</a>	<p>You can now view buffer availability for Shared Memory System (SMS) and High Bandwidth Memory (HBM) with higher accuracy without any lag between the minimum and maximum watermark readings, especially when the packet buffers are used and released rapidly. This is possible because we've enabled the instantaneous display of available or free SMS and HBM.</p> <p>Previously, you could view details only for the highest watermark readings for SMS and HBM.</p> <p>You must configure PFC in the buffer-extended mode for this option, and this functionality is available only for Cisco Silicon One Q200-based routers and line cards.</p> <p>This functionality modifies the following:</p> <ul style="list-style-type: none"> <li>• <b>CLI:</b> <a href="#">show controllers npu packet-memory</a></li> <li>• <b>YANG Data Model:</b> <a href="#">Cisco-IOS-XR-8000-platforms-npu-memory-oper</a></li> </ul>
<b>Multicast</b>	
<a href="#">MVPN Ingress Replication Over Dynamic TE-Tunnels</a>	<p>MVPN Ingress replication over dynamic-TE tunnels enables the routing of multicast traffic through an MPLS network using RSVP-TE P2MP (point-to-multipoint) tunnels. The traffic is replicated by the ingress router before sending it to the destination devices through the TE tunnels which are created dynamically.</p> <p>When configured, this feature enables utilization of the TE tunnels for transmission of multicast traffic and ensures inter-operability with other devices that are configured with this feature in the network.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b> The <b>ingress replication</b> keywords are introduced in the following commands:</p> <ul style="list-style-type: none"> <li>• mdt data</li> <li>• mdt default</li> <li>• mdt partitioned</li> </ul>
<a href="#">Profile 22 in Multicast VPN (MVPN) over Edge</a>	<p>Profile 22 in MVPN over edge routers provides enhanced scalability by providing support for a large number of MVPNs and multicast groups. This improves the efficiency by delivering the multicast traffic to specific PE routers that have interested receivers, thereby improving operational performance by reducing the amount of replication and bandwidth required for multicast traffic.</p>

Feature	Description
<b>NetFlow and sFlow</b>	
<a href="#">Flow Monitoring Post-QoS Processing</a>	This feature introduces monitoring Quality of Service (QoS) processing for Netflow and IPFIX by supporting the export of Post-QoS information-related Information Elements. These enhancements provide you with detailed information about QoS policies' impact at various stages, facilitating optimization of network performance based on QoS characteristics.
<a href="#">Flow monitoring on Egress Interface</a>	This feature enhances Cisco routers by introducing support for egress interface flow monitoring. Egress flow monitoring prioritizes outbound traffic, delivering advanced visibility and control over data exiting the network. You can now monitor packets that are either encapsulated or decapsulated through egress NetFlow.
<a href="#">Support for BGP Monitoring using IPFIX in MPLS Records</a>	This feature enhances BGP Information Elements in IPFIX records, specifically supporting the gathering of eight additional BGP fields in IPFIX MPLS IPv4/IPv6 records. This improves monitoring and congestion mitigation capabilities, particularly in core-edge link scenarios.
<b>System Security</b>	
<a href="#">DSCP Marking from TCP Connection Phase for SSH Packets</a>	<p>We now prevent SSH client packet drops in the TCP connection (initial handshake) phase as they travel across transit routers in the network. This is because you can mark the DSCP values for SSH client packets in the TCP connection phase, which overrides the transit routers' policies to filter and drop packets with no DSCP value marked. Using a new command, you can also set the DSCP value from the TCP connection phase for SSH server packets.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">ssh server set-dscp-connection-phase</a></li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• New XPath, <code>set-dscp-connection-phase</code>, for <code>Cisco-IOS-XR-crypto-ssh-cfg.yang</code> (see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</li> </ul>
<a href="#">Interaction with MASA through gRPC</a>	From this release, you can use the gRPC protocol to interact with MASA APIs in addition to the current HTTP protocols. Through structured serialization of data with gRPC's Protocol Buffers, the communication between services is made more efficient, type-safe, and consistent.
<a href="#">Multi-Factor Authentication for SSH</a>	<p>You can now deploy robust authentication mechanisms for SSH connections to your routers and reduce security risks due to compromised or weak passwords. We now support multi-factor authentication (MFA)—a secure access management solution that verifies the identity of a user using multiple verification factors—for SSH login on Cisco IOS XR routers. These verification factors include a combination of login credentials such as username and password and a token, a cryptographic device, or a mobile phone with MFA application installed.</p> <p>No new commands or data models were introduced or modified as part of this feature.</p>
<a href="#">Pre-upload Pinned-Domain Certificate</a>	You can now pre-upload your Pinned-Domain Certificate (PDC) credentials before requesting OVs Ownership Vouchers (OVs) from the MASA server, thus making the voucher request process easier.
<b>System Management</b>	

Feature	Description
<a href="#">Power Redundancy Protection</a>	<p>You can now prevent power module exhaustion or failure due to power redundancy issues in the power feeds with the help of alarms that warn that the total output power required by the router exceeds the total feed redundancy capacity. You can configure either single-fault protection or dual fault protection, depending on whether you want to trigger alarms during redundancy failures in the power supply feed, PSU redundancy, or both.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">power-mgmt feed-redundancy</a></li> <li>• The <code>Total feed redundancy capacity</code> field is added to the <a href="#">show environment</a> command.</li> </ul>
<b>System Monitoring</b>	
<a href="#">Improved Packet Loss Detection and Monitoring</a>	<p>You can now set the tolerance to monitor packet drops in the Network Processing Unit (NPU) for three different NPU trap categories at a configurable cadence of your choice. When a NPU trap breaks the configured packet-drop tolerance for that trap category, the router alerts you with a system log message and you can monitor the trend using healthcheck show commands.</p> <p>This enables you to prioritize taking action depending on the trap category for which the router logs the message.</p> <p>In earlier releases, you could only monitor packet-drops globally for all NPU trap categories at a fixed cadence.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <code>tolerance</code> and <code>window-size</code> keywords are introduced in the <a href="#">use-case</a> command.</p> <p><b>YANG Data Model:</b></p> <p>New xpaths for <code>Cisco-IOS-XR-healthcheck-cfg.yang</code> data model. (see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<a href="#">System Log Alerts for Packet Loss</a>	<p>You can quickly get notified about any traffic impacting errors within the router's Network Processing Unit (NPU). These notifications are error log messages on the router console for NPU interrupts that affect traffic. To diagnose traffic loss, follow the recommended actions in the log.</p> <p>Previously, the only way to identify NPU errors that impacted traffic was to run the <code>show asic-error</code> command.</p> <p>This feature introduces the following changes:</p> <p><b>CLI:</b></p> <p>This feature introduces the <a href="#">hw-module profile packet-loss-alert</a> command.</p> <p><b>YANG Model:</b></p> <p>New xpaths for <code>Cisco-IOS-XR-npu-hw-profile-cfg.yang</code> data model (see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>

## 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 presented visually in a tree structure.

Feature	Description
<b>Programmability</b>	

Feature	Description
openconfig-mpls-ldp.yang Version 3.1.0	<p>This OpenConfig data model introduces the following changes:</p> <ul style="list-style-type: none"> <li>• Enable and authenticate LDP signalling messages using <b>enable</b> and <b>authentication-key</b> leaves globally for all interfaces or for LDP neighbors.</li> <li>• Configure the global and neighbor label switch identifier for the router using <b>lsr-id</b> leaf</li> <li>• Define the time for which a neighbor adjacency will be kept by the router while it waits for a new "hello" message using <b>hello-holdtime</b> leaf</li> <li>• Define the interval for sending these "hello" messages on each link LDP adjacency using <b>hello-interval</b> leaf</li> <li>• Enable and configure the address family name for IPv4 and IPv6 interfaces using <b>enabled</b> and <b>afi-name</b> leaves</li> <li>• Configure the list of LDP configurations for each interface using <b>interface-id</b> leaf where the interface referenced is based on the interface and subinterface leaves within the <b>interface-ref</b> container</li> <li>• Define the list of LDP neighbors and their attributes using <b>label-space-id</b> leaf</li> <li>• Configure the list for attributes related to address families for targeted LDP using <b>afi-name</b> leaf</li> <li>• Specify the neighbor address of the targeted LDP session using <b>remote-address</b> leaf</li> <li>• Enable or disable the acceptance of targeted LDP "hello" messages using <b>hello-accept</b> leaf</li> <li>• Enable and configure the interval for which the remote LDP peers wait for the local node to reconnect gracefully after a failure using <b>enable</b> and <b>reconnect-time</b> leaves</li> <li>• Configure the time interval to gracefully restart a Label Switch Router's (LSR) forwarding when in recovery mode using <b>forwarding-holdtime</b> leaf</li> </ul>
Cisco-IOS-XR-controller-ots-oper.yang	This Cisco native data model is used to view the operational data of the OTS controller (QDD OLS pluggable).
Cisco-IOS-XR-pmengine-oper.yang	This Cisco native data model is used to view the performance monitoring parameters of the OTS controller (QDD OLS pluggable).
Cisco-IOS-XR-controller-ots-cfg.yang	Use this Cisco native data model to configure the QDD OLS pluggable within the optical transport section (OTS) controller mode.

Feature	Description
Cisco-IOS-XR-pmengine-cfg.yang	Use this Cisco native data model to configure the performance monitoring parameters of the QDD OLS pluggable.
Cisco-IOS-XR-pmengine-clear-act.yang	Use this Cisco native data model to clear the performance monitoring statistics of the QDD OLS pluggable.
Cisco-IOS-XR-um-router-bgp-cfg.yang	This yang model is enhanced with the addition of a new leaf node value, per-vrf-46.
Cisco-IOS-XR-npu-hw-profile-cfg.yang	The latest update to the Cisco-IOS-XR-npu-hw-profile-cfg.yang native data model includes the addition of the <b>npu-pktlosswin</b> leaf. This new leaf configures the packet loss duration before the router raises a system log message.
Cisco-IOS-XR-healthcheck-cfg.yang	<p>The latest update to the Cisco-IOS-XR-healthcheck-cfg.yang native data model includes the following additions:</p> <ul style="list-style-type: none"> <li>• The <b>tolerance</b> container - This is a new container in the <b>packet-drop</b> container to configure the NPU packet loss tolerance.</li> <li>• The <b>tolerance-level-low</b>, <b>tolerance-level-medium</b> and <b>tolerance-level-high</b> leaves - These new leaves are added to the <b>tolerance</b> container. These leaves enable you to configure different NPU packet loss tolerance values for low, medium and high tolerance NPU traps.</li> </ul>
Cisco-IOS-XR-evpn-oper.yang	This YANG model is modified to enable non-revertive mode on preference based EVPN DF election.
Cisco-IOS-XR-l2vpn-cfg.yang	This YANG model is modified to enable non-revertive mode on preference based EVPN DF election.
Cisco-IOS-XR-man-ems-cfg.yang	<p>This native data model has been enhanced to include the following:</p> <ul style="list-style-type: none"> <li>• A new container named <i>GNSI Service Certz</i> and a new leaf named <i>SSL Profile ID</i> to manage certificates on the system for gRPC service.</li> <li>• To specify a limit on the number of concurrent streams per gRPC connection.</li> </ul>

Feature	Description
openconfig-platform.yang Version 0.22.0	<p>The OpenConfig data model is revised from version 0.18.0 to 0.22.0 to introduce the following enhancements to the component container:</p> <ul style="list-style-type: none"> <li>• Retrieve Model-driven telemetry (MDT) data of Common Language Equipment Identifier code (CLEI) of a line card using <b>clei-code</b> leaf.</li> <li>• Monitor the changes to maximum and minimum temperature of the Temperature Sensor for a given interval using <b>max</b> and <b>min</b> leaves. Model-driven telemetry (MDT) is already supported for these leaves in the previous releases.</li> <li>• The <code>openconfig-platform-controller-card.yang</code> and <code>openconfig-platform-fabric.yang</code> data models are introduced as part of the <code>openconfig-platform.yang</code> data model to enable or disable power to the controller card and fabric card using <b>power-admin-state</b> leaf. This only applies to standby route processor and configurations for active route processors are rejected.</li> </ul>
Cisco-IOS-XR-show-fpd-loc-ng-oper.yang	<p>This Cisco native data model is enhanced to monitor the on-change notifications to track updates of Field Programmable Device (FPD) using status leaf.</p> <p>You can stream Event-driven telemetry (EDT) data.</p>
Cisco-IOS-XR-sysmgr-oper.yang	<p>This Cisco native data model is enhanced to monitor the on-change notifications for different states of the process using <b>state</b>, <b>last-started</b>, and <b>respawn-count</b> leaves.</p> <p>You can stream Event-driven telemetry (EDT) data.</p>
openconfig-ospfv2.yang Version 0.4.0	<p>The OpenConfig data model is part of the <code>openconfig-network-instance.yang</code> data model and configures OSPF functionalities, such as multiple processes, areas, and interfaces.</p> <p>In this release, the OpenConfig data model supports streaming Model-driven telemetry (MDT)—both Cadence driven and Event-driven telemetry (EDT).</p> <p>EDT and MDT for all state leafs under the Link state database (LSDB) container are not supported.</p>



Feature	Description
openconfig-network-instance.yang	<p>This OpenConfig data model augments the <b>Cisco-IOS-XR-openconfig-bgp-ext.yang</b> and supports streaming Model-driven telemetry (MDT) for all the leaves. However, only the following leaves support both Event-driven telemetry (EDT) and Model-driven telemetry (MDT):</p> <ul style="list-style-type: none"> <li>• <b>max-prefix-discard-extra-paths</b></li> <li>• <b>max-prefix-exceed-paths-discard</b></li> <li>• <b>route-policy-prefix-orf</b></li> <li>• <b>dmz-link-bandwidth</b></li> <li>• <b>previous-connection-state</b></li> </ul>
Cisco-IOS-XR-crypto-ssh-cfg.yang	<p>This Cisco native data model is enhanced with a new leaf, <b>set-dscp-connection-phase</b>, to set the DSCP marking for the SSH packets starting from the TCP connection phase.</p>
Cisco-IOS-XR-ip-rsvp-cfg.yang	<p>The Cisco-IOS-XR-ip-rsvp-cfg.yang data model's <b>global-refresh-reduction</b> container is updated with the following:</p> <p>The <b>global-retransmit-timer</b> container and its two leaves are added to hold the global RSVP message retransmission interval parameters.</p> <p>The <b>retransmit-time</b> leaf holds the RSVP message retransmission interval.</p> <p>The <b>global-retransmit-timer-option</b> leaf either holds the <b>all-option</b> (if the interval is enabled for all RSVP interfaces) or the <b>backup-option</b> (if the interval is enabled only for backup tunnels).</p>
Cisco-IOS-XR-man-ems-oper.yang	<p>This YANG model is modified to specify a limit on the number of concurrent streams per gRPC connection.</p>

## Hardware Introduced

No new hardware introduced in this release.

For a complete list of supported hardware and ordering information, see the [Cisco 8000 Series Data Sheet](#).

## Release 24.1.1 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
Software Hash: dd9bfca88ab7cd98368f46a1177193164edce28f57a4e667ce30c47301c4a8b6
Package                                             Version
-----
xr-8000-af-ea                                     24.1.1v1.0.0-1
xr-8000-aib                                       24.1.1v1.0.0-1
xr-8000-bfd                                       24.1.1v1.0.0-1
xr-8000-buffhdr-ea                               24.1.1v1.0.0-1
xr-8000-bundles                                  24.1.1v1.0.0-1
xr-8000-card-support                             24.1.1v1.0.0-1
xr-8000-cdp-ea                                    24.1.1v1.0.0-1
xr-8000-cem-driver                               24.1.1v1.0.0-1
xr-8000-cfm                                       24.1.1v1.0.0-1
xr-8000-common-otn                              24.1.1v1.0.0-1
xr-8000-core                                     24.1.1v1.0.0-1
xr-8000-cpa                                       24.1.1v1.0.0-1
xr-8000-cpa-devobj-misc                         24.1.1v1.0.0-1
xr-8000-cpa-npu                                  24.1.1v1.0.0-1
xr-8000-cpa-sb-data                             24.1.1v1.0.0-1
xr-8000-dotlx                                    24.1.1v1.0.0-1
xr-8000-dsm                                       24.1.1v1.0.0-1
xr-8000-dyinggasp-pd                            24.1.1v1.0.0-1
xr-8000-encap-id                                 24.1.1v1.0.0-1
xr-8000-ether-ea                                 24.1.1v1.0.0-1
xr-8000-fabric                                   24.1.1v1.0.0-1
xr-8000-feat-mgr                                 24.1.1v1.0.0-1
xr-8000-fib-ea                                   24.1.1v1.0.0-1
xr-8000-forwarder                               24.1.1v1.0.0-1
xr-8000-fpd                                       24.1.1v1.0.0-1
xr-8000-fwd-tools                               24.1.1v1.0.0-1
xr-8000-fwdlib                                   24.1.1v1.0.0-1
xr-8000-gil-ea                                   24.1.1v1.0.0-1
xr-8000-host-core                               24.1.1v1.0.0-1
xr-8000-hw-resmon                               24.1.1v1.0.0-1
xr-8000-l2fib                                    24.1.1v1.0.0-1
xr-8000-l2mcast                                 24.1.1v1.0.0-1
xr-8000-leabaofa                                 24.1.1v1.0.0-1
xr-8000-libofaasync                             24.1.1v1.0.0-1
xr-8000-lpts-ea                                  24.1.1v1.0.0-1
xr-8000-mcast                                    24.1.1v1.0.0-1
xr-8000-netflow                                 24.1.1v1.0.0-1
xr-8000-npu                                       24.1.1v1.0.0-1
xr-8000-oam                                       24.1.1v1.0.0-1
xr-8000-optics                                   24.1.1v1.0.0-1
xr-8000-os-oe                                    24.1.1v1.0.0-1
xr-8000-os-oe-extra                             24.1.1v1.0.0-1
xr-8000-pbr                                       24.1.1v1.0.0-1
xr-8000-pd-port-mode                            24.1.1v1.0.0-1
xr-8000-pfilter                                  24.1.1v1.0.0-1
xr-8000-pidb                                     24.1.1v1.0.0-1
xr-8000-pktio                                    24.1.1v1.0.0-1
xr-8000-ple-sdk                                  24.1.1v1.0.0-1
xr-8000-pm                                       24.1.1v1.0.0-1
xr-8000-port-mapper                              24.1.1v1.0.0-1
xr-8000-ppinfo                                   24.1.1v1.0.0-1
xr-8000-pwhe-ea                                  24.1.1v1.0.0-1
xr-8000-qos-ea                                   24.1.1v1.0.0-1
xr-8000-span                                     24.1.1v1.0.0-1
xr-8000-spio                                     24.1.1v1.0.0-1
```

xr-8000-spp-ea	24.1.1v1.0.0-1
xr-8000-timing	24.1.1v1.0.0-1
xr-8000-tunnel-ip	24.1.1v1.0.0-1
xr-8000-utapp-blaze	24.1.1v1.0.0-1
xr-8000-vether	24.1.1v1.0.0-1
xr-8000-ztp-ea	24.1.1v1.0.0-1
xr-aaa	24.1.1v1.0.0-1
xr-acl	24.1.1v1.0.0-1
xr-apphosting	24.1.1v1.0.0-1
xr-appmgr	24.1.1v1.0.0-1
xr-bcdl	24.1.1v1.0.0-1
xr-bfd	24.1.1v1.0.0-1
xr-bgp	24.1.1v1.0.0-1
xr-bgputil	24.1.1v1.0.0-1
xr-bng-stubs	24.1.1v1.0.0-1
xr-bundles	24.1.1v1.0.0-1
xr-cal-pi	24.1.1v1.0.0-1
xr-cdp	24.1.1v1.0.0-1
xr-cds	24.1.1v1.0.0-1
xr-cfgmgr	24.1.1v1.0.0-1
xr-cfm	24.1.1v1.0.0-1
xr-cofo	24.1.1v1.0.0-1
xr-core	24.1.1v1.0.0-1
xr-core-calv	24.1.1v1.0.0-1
xr-cpa-common	24.1.1v1.0.0-1
xr-cpa-common-optics	24.1.1v1.0.0-1
xr-cpa-common-psu	24.1.1v1.0.0-1
xr-cpa-driver-devobj-gnss	24.1.1v1.0.0-1
xr-cpa-driver-devobj-misc	24.1.1v1.0.0-1
xr-cpa-driver-devobj-npu	24.1.1v1.0.0-1
xr-cpa-driver-devobj-phy	24.1.1v1.0.0-1
xr-cpa-driver-devobj-sensors	24.1.1v1.0.0-1
xr-cpa-driver-devobj-storage	24.1.1v1.0.0-1
xr-cpa-driver-devobj-test	24.1.1v1.0.0-1
xr-cpa-driver-devobj-timing	24.1.1v1.0.0-1
xr-cpa-driver-fpgalib-access	24.1.1v1.0.0-1
xr-cpa-driver-fpgalib-common	24.1.1v1.0.0-1
xr-cpa-driver-fpgalib-infra	24.1.1v1.0.0-1
xr-cpa-driver-fpgalib-kmod-oe	24.1.1v1.0.0-1
xr-cpa-driver-fpgalib-misc	24.1.1v1.0.0-1
xr-cpa-driver-fpgalib-optics	24.1.1v1.0.0-1
xr-cpa-driver-optics	24.1.1v1.0.0-1
xr-cpa-ethsw	24.1.1v1.0.0-1
xr-cpa-idprom	24.1.1v1.0.0-1
xr-cpa-tamlib	24.1.1v1.0.0-1
xr-ctc	24.1.1v1.0.0-1
xr-debug	24.1.1v1.0.0-1
xr-dhcp	24.1.1v1.0.0-1
xr-diags	24.1.1v1.0.0-1
xr-diskboot	24.1.1v1.0.0-1
xr-drivers	24.1.1v1.0.0-1
xr-eem	24.1.1v1.0.0-1
xr-elmi-stubs	24.1.1v1.0.0-1
xr-ema	24.1.1v1.0.0-1
xr-enhancedmanageability	24.1.1v1.0.0-1
xr-erp	24.1.1v1.0.0-1
xr-featurecapability	24.1.1v1.0.0-1
xr-fib	24.1.1v1.0.0-1
xr-filesysinv	24.1.1v1.0.0-1
xr-foundation-8000	24.1.1v1.0.0-1
xr-fpd	24.1.1v1.0.0-1
xr-gil	24.1.1v1.0.0-1
xr-ha-infra	24.1.1v1.0.0-1
xr-healthcheck	24.1.1v1.0.0-1

xr-host-core	24.1.1v1.0.0-1
xr-httpclient	24.1.1v1.0.0-1
xr-icpe-eth	24.1.1v1.0.0-1
xr-icpe-opt	24.1.1v1.0.0-1
xr-identifier	24.1.1v1.0.0-1
xr-infra-sla	24.1.1v1.0.0-1
xr-install	24.1.1v1.0.0-1
xr-ip-apps	24.1.1v1.0.0-1
xr-ip-core	24.1.1v1.0.0-1
xr-ip-infra-vrf	24.1.1v1.0.0-1
xr-ip-mibs	24.1.1v1.0.0-1
xr-ip-static	24.1.1v1.0.0-1
xr-ipc	24.1.1v1.0.0-1
xr-ipsla	24.1.1v1.0.0-1
xr-is-is	24.1.1v1.0.0-1
xr-k9sec	24.1.1v1.0.0-1
xr-l2snooptransport	24.1.1v1.0.0-1
xr-l2vpn	24.1.1v1.0.0-1
xr-ldp	24.1.1v1.0.0-1
xr-licensing	24.1.1v1.0.0-1
xr-link-oam	24.1.1v1.0.0-1
xr-linuxnetworking	24.1.1v1.0.0-1
xr-linuxsecurity	24.1.1v1.0.0-1
xr-lldp	24.1.1v1.0.0-1
xr-lpts	24.1.1v1.0.0-1
xr-manageabilityxml	24.1.1v1.0.0-1
xr-mandatory	24.1.1v1.0.0-1
xr-mcast	24.1.1v1.0.0-1
xr-mcastl2snoop	24.1.1v1.0.0-1
xr-mda	24.1.1v1.0.0-1
xr-mpls	24.1.1v1.0.0-1
xr-mpls-oam	24.1.1v1.0.0-1
xr-mpls-oam-client	24.1.1v1.0.0-1
xr-mpls-static	24.1.1v1.0.0-1
xr-netflow	24.1.1v1.0.0-1
xr-networkboot	24.1.1v1.0.0-1
xr-nosi	24.1.1v1.0.0-1
xr-ntp	24.1.1v1.0.0-1
xr-ofa	24.1.1v1.0.0-1
xr-ops-script-repo	24.1.1v1.0.0-1
xr-optics	24.1.1v1.0.0-1
xr-orrsdpf	24.1.1v1.0.0-1
xr-os-oe-apps	24.1.1v1.0.0-1
xr-os-oe-core	24.1.1v1.0.0-1
xr-os-oe-hardware	24.1.1v1.0.0-1
xr-ospf	24.1.1v1.0.0-1
xr-p4rt	24.1.1v1.0.0-1
xr-perf-meas	24.1.1v1.0.0-1
xr-perfmgmt	24.1.1v1.0.0-1
xr-pfi	24.1.1v1.0.0-1
xr-pird-stubs	24.1.1v1.0.0-1
xr-pkt-trace	24.1.1v1.0.0-1
xr-platforms-ras	24.1.1v1.0.0-1
xr-pm-alarm	24.1.1v1.0.0-1
xr-portmode	24.1.1v1.0.0-1
xr-procmgr	24.1.1v1.0.0-1
xr-python	24.1.1v1.0.0-1
xr-qos	24.1.1v1.0.0-1
xr-rid-mgr	24.1.1v1.0.0-1
xr-routing	24.1.1v1.0.0-1
xr-rpl	24.1.1v1.0.0-1
xr-rsvp-te	24.1.1v1.0.0-1
xr-sanitizer-tools	24.1.1v1.0.0-1
xr-security	24.1.1v1.0.0-1

```

xr-security-tams                24.1.1v1.0.0-1
xr-secy-driver                  24.1.1v1.0.0-1
xr-servicelayer                 24.1.1v1.0.0-1
xr-snmp                         24.1.1v1.0.0-1
xr-snmp-hw                      24.1.1v1.0.0-1
xr-span                         24.1.1v1.0.0-1
xr-spi-core                     24.1.1v1.0.0-1
xr-spi-hw                       24.1.1v1.0.0-1
xr-spp                          24.1.1v1.0.0-1
xr-sr                           24.1.1v1.0.0-1
xr-stats                       24.1.1v1.0.0-1
xr-stp                          24.1.1v1.0.0-1
xr-stubs                       24.1.1v1.0.0-1
xr-sysdb                       24.1.1v1.0.0-1
xr-syslog                      24.1.1v1.0.0-1
xr-telemetry                   24.1.1v1.0.0-1
xr-telnet                      24.1.1v1.0.0-1
xr-timing                      24.1.1v1.0.0-1
xr-tmpdir-cleanup              24.1.1v1.0.0-1
xr-track                       24.1.1v1.0.0-1
xr-transport                    24.1.1v1.0.0-1
xr-tty                         24.1.1v1.0.0-1
xr-tunnel-ip                   24.1.1v1.0.0-1
xr-tunnel-nve                  24.1.1v1.0.0-1
xr-upgradematrix               24.1.1v1.0.0-1
xr-utils                       24.1.1v1.0.0-1
xr-vether                      24.1.1v1.0.0-1
xr-vpnmib                      24.1.1v1.0.0-1
xr-xmlinfra                    24.1.1v1.0.0-1
xr-xrllibcurl                  24.1.1v1.0.0-1
xr-ztp                         24.1.1v1.0.0-1

```

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.

---

## Caveats

**Table 1: Cisco 8000 Series Router Specific Bugs**

Bug ID	Headline
<a href="#">CSCwj07339</a>	The call-home configurations displayed in the show run call-home command are missing in the show running-config command output.
<a href="#">CSCwi48499</a>	After reloading, a few interface ports fail to come up.

## Behavior Changes

- From this release, the default order of authentication methods for SSH clients on Cisco IOS XR routers running Cisco IOS XR SSH is changed to: **public-key**, **keyboard-interactive**, and **password**.

Prior to this release, the default order was: **public-key**, **password**, and **keyboard-interactive**.

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

Build Information:
  Built By       : sajshah
  Built On       : Mon Mar 11 22:35:57 UTC 2024
  Build Host     : iox-ucs-077
  Workspace      : /auto/ioxdepot6/GISO/giso_build_lindt/giso_custom_create/ponaidu_2024-03-12_05-32-47_UTC
  Version        : 24.1.1
  Label         : 24.1.1-renumber_3

cisco 8000 (Intel(R) Xeon(R) CPU D-1530 @ 2.40GHz)
cisco 8101-32H (Intel(R) Xeon(R) CPU D-1530 @ 2.40GHz) processor with 16GB of memory
R2 uptime is 21 hours, 16 minutes
Cisco 8100 32x100G QSFP28 1RU Fixed System w/o HBM
```

## 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
=====
Card Type                FPD Description                Req   SW   Min Req  Min Req
                          Reload Ver   SW Ver   Board Ver
-----
8101-32H                 Bios                            YES   1.15  1.15    0.0
                          BiosGolden                      YES   1.15  1.13    0.0
                          IoFpga                          YES   1.04  1.04    0.0
                          IoFpgaGolden                    YES   1.04  1.04    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   1.88  1.88    0.0
                          x86FpgaGolden                 YES   1.88  1.06    0.0
                          x86TamFw                      YES   6.13  6.13    0.0
                          x86TamFwGolden                YES   6.13  6.05    0.0
-----
8101-32H-0              Bios                            YES   0.241 0.241   0.0
```

	BiosGolden	YES	0.241	0.218	0.0
	IoFpga	YES	1.04	1.04	0.0
	IoFpgaGolden	YES	1.04	1.04	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	1.88	1.88	0.0
	x86FpgaGolden	YES	1.88	1.06	0.0
	x86TamFw	YES	6.13	6.13	0.0
	x86TamFwGolden	YES	6.13	6.05	0.0
-----					
PSU2KW-HVPI	PO-PrimMCU	NO	1.09	1.09	0.0
	PO-SecMCU	NO	1.10	1.10	0.0
-----					
PSU650W-ACPE	EM-PrimMCU	NO	1.25	1.25	0.0
	EM-SecMCU	NO	1.49	1.49	0.0
	LI-SecMCU	NO	2.55	2.55	0.0
-----					
PSU650W-ACPI	EM-PrimMCU	NO	1.25	1.25	0.0
	EM-SecMCU	NO	1.49	1.49	0.0
	LI-SecMCU	NO	2.54	2.54	0.0
-----					
PSU930W-DCPE	LI-SecMCU	NO	2.03	2.03	0.0
-----					
PSU930W-DCPI	LI-SecMCU	NO	3.03	3.03	0.0

## Cisco 8200 Series Router

RP/0/RP0/CPU0# show fpd package

```
=====
Field Programmable Device Package
=====
```

Card Type	FPD Description	Req Reload	SW Ver	Min Req SW Ver	Min Req Board Ver
-----					
8202	Bios	YES	1.29	1.29	0.0
	BiosGolden	YES	1.29	1.15	0.0
	IoFpga	YES	1.03	1.03	0.0
	IoFpgaGolden	YES	1.03	0.33	0.0
	MiFpga	YES	1.00	1.00	0.0
	MiFpgaGolden	YES	1.00	0.02	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	1.06	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
-----					
8202-0	Bios	YES	1.208	1.208	0.0
	BiosGolden	YES	1.208	1.207	0.0
	IoFpga	YES	1.03	1.03	0.0
	IoFpgaGolden	YES	1.03	0.33	0.0
	MiFpga	YES	1.00	1.00	0.0
	MiFpgaGolden	YES	1.00	0.02	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	1.06	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
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
=====

```

Card Type	FPD Description	Req Reload	SW Ver	Min Req SW Ver	Min Req 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	1.03	1.03	0.1
	IoFpgaGolden	NO	1.03	1.00	0.1
86-MPA-24Z-M	IoFpga	YES	1.03	1.03	0.1
	IoFpgaGolden	NO	1.03	1.00	0.1
86-MPA-4FH-M	IoFpga	YES	1.03	1.03	0.1
	IoFpgaGolden	NO	1.03	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
	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	8.04	1.04	0.0
	DT-PrimMCU	NO	8.02	1.02	0.0
	DT-SecMCU	NO	8.02	1.02	0.0

## Cisco 8800 Series Router

RP/0/RP0/CPU0# show fpd package

```
=====
                        Field Programmable Device Package
=====
```

Card Type	FPD Description	Req Reload	SW Ver	Min Req SW Ver	Min Req 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
	IoFpgaGolden	YES	1.14	1.00	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	1.48	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
	IoFpgaGolden	YES	1.14	1.00	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	1.48	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
	IoFpgaGolden	YES	1.14	1.00	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	1.48	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
	IoFpgaGolden	YES	1.14	1.00	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	1.48	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
	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	0.12	0.12	0.1
	IoFpgaGolden	YES	0.12	0.12	0.1
	SsdMicron7300M2	YES	2.60	2.60	0.0
	SsdMicron7450M2	YES	11.00	11.00	0.0
	x86Fpga	YES	0.05	0.05	0.1
	x86FpgaGolden	YES	0.05	0.05	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
	TimingFpga	YES	1.01	1.01	0.0
	TimingFpgaGolden	YES	1.01	1.00	0.0
	x86Fpga	YES	1.11	1.11	0.6
	x86FpgaGolden	YES	1.11	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
	IoFpgaGolden	YES	1.00	0.16	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
	IoFpgaGolden	YES	1.00	0.16	0.0
-----					
8808-FC1	IoFpga	YES	0.02	0.02	0.20
	IoFpgaGolden	YES	0.02	0.02	0.20
-----					
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
	IoFpgaGolden	YES	1.00	0.16	0.0
	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 24.1.1	<a href="#">Crosswork Optimization Engine 6.0</a>	<a href="#">Evolved Programmable Network Manager 7.1.1</a>

## 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.

## Supported Transceiver Modules

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

## 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>

