



## Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 24.2.1

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# Network Convergence System 5500 Series Routers

## What's New in Cisco IOS XR Release 24.2.1

Cisco IOS XR Release 24.2.1 is a new feature release for Cisco NCS 5500 Fixed Port and Modular Series routers.

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

### New in Documentation

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

### 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>Programmability</b>	
<a href="#">Preprogram Backup LSPs Using Service Layer API</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>The controller now quickly responds to a primary Label Switched Path (LSP) failure, ensuring minimal traffic disruption and efficient rerouting. This quick switching is possible because the controller can now use the Service Layer API to preprogram the backup LSP in the hardware.</p> <p>Upon detecting a failure, the controller switches the primary LSP to backup in a down state and promotes the backup LSP to primary using the provided API parameters.</p>
<b>Routing</b>	

Feature	Description
<a href="#">Multi-area Loopback Interface for OSPF</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native]).</p> <p>You can save IP addresses and resources, prevent the use of multiple node SIDs for labels associated with loopback interfaces, and save time configuring multiple loopback interfaces for an Area Border Router (ABR) in a network. These improvements are possible as you can now configure a single loopback interface for multiple areas. With this feature, an ABR can use a single loopback interface for all areas it connects to, eliminating the need for separate loopback interfaces for each area.</p> <p>Previously, each loopback interface was linked to only one area.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <b>multi-area-interface</b> command is extended to support loopback interfaces.</p>
<a href="#">Protect IS-IS Processes in OOR Conditions</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>This feature enables prompt alerts for out-of-resource (OOR) conditions in IS-IS processes that could otherwise cause network instability and disruption due to memory leaks and excessive link-state packets (LSPs). Additionally, you can disable the overload bit status flag in the router's LSP to prevent setting the overload-bit. We recommend consulting with Cisco for optimal results before making this change.</p> <p>Previously, during OOR conditions, IS-IS processes restarted themselves, but the OOR conditions could persist.</p> <p>This ability to protect IS-IS processes in OOR conditions is enabled by default and you can't disable it.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The feature introduces fields that indicate the memory state of the IS-IS protocol in the <b>show isis protocol</b> command.</li> <li>• <b>oor-set-overload-bit disable</b> command.</li> </ul> <p><b>YANG Data Model</b></p> <ul style="list-style-type: none"> <li>• New XPath for <code>Cisco-IOS-XR-clns-isis-cfg</code></li> <li>• <code>Cisco-IOS-XR-um-router-isis-cfg</code></li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>

Feature	Description
<a href="#">Seamless Bidirectional Forwarding Detection</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Native])</p> <p>This feature introduces support for NCS 5500 routers as a Seamless BFD (S-BFD) reflector.</p> <p>Seamless BFD simplifies the negotiation and state establishment aspects of BFD by predetermining session discriminators and maintaining session state only at the headend. This approach ensures quicker connectivity tests and reduces complexity in session establishment.</p> <p>Previously, support for Seamless BFD reflector was not available.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>This feature introduces the <a href="#">sbfd</a> command.</p>
<b>Segment Routing</b>	
<a href="#">Data Plane Validation for SR-MPLS IPv6-based Controller Instantiated LSPs</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native]).</p> <p>You can now verify the network configuration and paths and policies set up, without interrupting or potentially disrupting live network traffic, for SR-MPLS (Segment Routing over Multiprotocol Label Switching) IPv6-based Label Switched Paths (LSPs). With this feature, you can validate controller instantiated LSPs programmed directly into the forwarding hardware.</p> <p>Previously, SR data plane validation was possible over IPv4-based LSPs.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <b>dataplane-only</b> keyword is introduced in the <a href="#">traceroute sr-mpls</a> and <a href="#">ping sr-mpls</a> commands.</p> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Cisco-IOS-XR-mpls-traceroute-act.yang</a></li> <li>• <a href="#">Cisco-IOS-XR-mpls-ping-act.yang</a></li> </ul> <p>See (<a href="#">GitHub</a>, <a href="#">Yang Data Models Navigator</a>)</p>

Feature	Description
<a href="#">Delay Measurement for IP Endpoint over SRv6 Network</a>	<p>Introduced in the release on: NCS 5500 fixed port routers.</p> <p>In Segment Routing over an IPv6 network (SRv6), you can measure packet delay from the source to a specific IP endpoint. You can use this information for troubleshooting, network maintenance, and optimizing network performance.</p> <p>Additionally, you can use flow labels to verify the delay of each subsequent hop path towards the IP endpoint of that path. So that, when network traffic is distributed across multiple available paths towards an IP endpoint, delay measurement tracks the delay of each of these paths towards the IP endpoint.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>source-address ipv6</b> keyword is introduced in the <b>performance-measurement endpoint</b> command.</li> <li>• The <b>segment-list name</b> keyword is introduced in the <b>segment-routing traffic-eng explicit</b> command.</li> <li>• The <b>flow-label</b> keyword is introduced in the <b>performance-measurement delay-profile name</b> command.</li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-um-performance-measurement-cfg</code></li> <li>• <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>
<a href="#">Display Neighbor Router Capabilities in OSPF Networks</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native]).</p> <p>You can now improve the user experience, understand the features and functionalities supported by neighboring routers, reduce operational work hours and human errors by gaining better visibility into the routing capabilities of directly connected neighboring routers in an OSPF network. These improvements are now possible when you enable Segment Routing on a neighboring connected router.</p> <p>Previously, there was no straightforward method to display the segment routing and other capabilities of neighboring routers in an OSPF network.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>capabilities</b> keyword is introduced in the <b>show ospf neighbor</b> command.</li> </ul> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-ipv4-ospf-oper.yang</code></li> </ul> <p>See (<a href="#">GitHub</a>, <a href="#">Yang Data Models Navigator</a>)</p>

Feature	Description
<a href="#">Dual-Stack Support with SRv6 Unicast and IPv4 Multicast Core</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>This feature introduces dual-stack support with SRv6 for unicast traffic and IPv4 for multicast communication.</p> <p>The dual-stack simplifies the routing process by combining the advantages of both IPv4 and SRv6 protocols, and facilitates smoother interoperability between the two protocols. The dual-stack enables efficient unicast communication through SRv6 by allowing precise control over the path that a packet takes through a network and streamlines the network routing, while using the deployment support of IPv4 for multicast traffic.</p>
<a href="#">Liveness Monitoring for IP Endpoint over SRv6 Network</a>	<p>Introduced in the release on: NCS 5500 fixed port routers.</p> <p>In Segment Routing over an IPv6 network (SRv6), you can keep track of the operational status of both the forward and reverse paths of a particular node or IP endpoint. You can use this information for troubleshooting, network maintenance, and optimizing network performance.</p> <p>Additionally, you can use flow labels to verify the liveness of each subsequent hop path toward the IP endpoint of that path. So that, when network traffic is distributed across multiple available paths towards an IP endpoint, liveness detection tracks the operational status of each of these paths towards the IP endpoint.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>reverse-path</b> and <b>segment-list name</b> keywords are introduced in the <b>segment-routing traffic-eng explicit</b> command.</li> <li>• The <b>source-address ipv6</b> is introduced in the <b>performance-measurement endpoint</b> command.</li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-um-performance-measurement-cfg</code></li> <li>• <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>

Feature	Description
<a href="#">MPLS OAM support for SR-TE Policies using MPLS IPv6-based LSPs</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You can now verify the network configuration and paths and SR-TE policies set up, without interrupting or potentially disrupting live network traffic, for SR-MPLS (Segment Routing over Multiprotocol Label Switching) IPv6-based Label Switched Paths (LSPs).</p> <p>Previously, MPLS OAM support was only for IPv4-based LSPs.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <a href="#">traceroute sr-mpls</a> and <a href="#">ping sr-mpls</a> commands are extended to support IPv6 nexthop addresses.</p> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Cisco-IOS-XR-mpls-traceroute-act.yang</a></li> <li>• <a href="#">Cisco-IOS-XR-mpls-ping-act.yang</a></li> </ul> <p>See (<a href="#">GitHub</a>, <a href="#">Yang Data Models Navigator</a>)</p>
<a href="#">SR ECMP-FEC Optimization for IPv6 Prefixes</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>You can now minimize ECMP-FEC resource consumption and duplication of resources during underlay programming for an SR-MPLS network for IPv6 prefixes. The feature supports sharing the same ECMP-FEC, regular FEC, and Egress Encapsulation DB (EEDB) entries for all paths with the same outgoing MPLS label among IPv6 prefixes. This improvement is now possible by using the <a href="#">hw-module fib mpls label lsr-optimized</a> command.</p> <p>In earlier releases, ECMP-FEC optimization for IPv4 prefixes was available.</p>
<a href="#">SRv6 Traffic Class DSCP Marking Enhancement for QoS</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers</p> <p>This feature allows you to set the traffic class values to use the full range of DSCP (6 bits) for SRv6 packets that are encapsulated.</p> <p>The feature extends the existing <a href="#">policy-map</a> setting of 3-bit traffic class DSCP marking to 6 bits using the new <a href="#">policy-map-extend</a> option in the configuration for L2 and L3 traffic for SRv6.</p> <p>This is a mutually inclusive feature for L2 and L3 traffic. Therefore, this feature cannot be used in the individual configuration for L2 and L3 traffic.</p> <p>This feature introduces this change:</p> <p><b>CLI:</b> The <a href="#">policy-map-extend</a> keyword is introduced in the <a href="#">hw-module profile segment-routing srv6 mode microsegment f3216 encapsulation traffic-class</a> command.</p>

Feature	Description
<a href="#">User-Defined Generic Metric Support for IS-IS Flex Algo</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>This feature adds support for user-defined generic metric as a metric type for IS-IS Flexible Algorithm. You can now have more control over traffic flows using user-defined generic metrics. You can define a family of user-defined generic metrics that can advertise different types of administrative metrics such as jitter, reliability, and fiscal cost depending on the traffic class for Flexible Algorithms. You can selectively define and assign semantics of these metrics as per the network requirement.</p> <p>The feature introduces the following changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>The feature introduces the <a href="#">generic-metric flex-algo</a> and <a href="#">metric-type generic</a> commands.</li> </ul> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li><code>Cisco-IOS-XR-um-router-isis-cfg.yang</code></li> </ul>
<b>BGP</b>	
<a href="#">Increased Maximum Limit for BGP Additional Paths</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You can now configure a maximum of 96 BGP additional paths instead of 32, which enhances network resiliency, and provides an improved load balancing capability.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>The <b>advertise-limit</b> keyword is introduced in the <a href="#">additional-paths</a> command.</li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li><code>Cisco-IOS-XR-um-router-bgp-cfg.yang</code></li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<b>Interface and Hardware Component</b>	
<a href="#">50G Optics Support for Quad Port Mode on NC57 Line Cards</a>	<p>Introduced in this release on: NCS 5500 modular routers; NCS 5700 line cards [Mode: Compatibility; Native]</p> <p>This feature provides higher bandwidth on the following NC57 line cards with the support for 50G optics on the 8-port quads of these line cards:</p> <ul style="list-style-type: none"> <li>NC-57-48Q2D-S</li> <li>NC-57-48Q2D-SE</li> </ul> <p><b>CLI:</b> This feature modifies the <a href="#">hw-module quad</a> command.</p>



Feature	Description
<a href="#">Carrier Delay on Physical Interfaces</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>With the carrier-delay timer functionality, the Ethernet interface state remains stable for the configured delay duration, even if the hardware link state fluctuates. This prevents interface flapping and improves network reliability.</p> <p>If you haven't configured the timer, the default carrier delay automatically delays the hardware link-up notifications by 200 ms. This time delay ensures that a stable hardware link state is established.</p> <p>If you want to change the delay of the interface state change notification, you can use the <a href="#">carrier-delay</a> command to set a different value.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">carrier-delay</a></li> <li>• The default value of <b>up</b> keyword is implemented as 200 ms in the <a href="#">carrier-delay</a> command.</li> </ul>
<b>IP Addresses and Services</b>	
<a href="#">TCP Dump File Converter</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers(NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You can now convert an entire TCP dump of packet traces in binary files into readable formats such as text or cap, which makes it easier to analyze them for troubleshooting using third-party or open-source tools. This feature saves time and effort by preventing the need to examine each packet for failure.</p> <p>This feature introduces the <a href="#">tcp dump-file convert</a> command.</p>
<b>L2VPN and Ethernet Services</b>	
<a href="#">Default Encapsulation Mode of ITU-T Y.1564</a>	<p>Introduced in this release on:NCS 5500 fixed port routers</p> <p>The default encapsulation mode helps to set a baseline to know how the Ethernet service behaves for default operations in Service Activation Test.</p>

Feature	Description
<a href="#">Frame Delay Range for ITU-T Y.1564 Test</a>	<p>Introduced in this release on: NCS 5500 fixed port routers</p> <p>You now have the ability to conduct a finer analysis of frame delay by measuring the Frame Delay Range (FDR) within a designated percentile. This metric captures the variation between the minimum frame delay observed and the delay at your chosen percentile. Also, delay times are organized into bins, which you can configure in terms of width and count to suit your analysis needs. By customizing these parameters, you can obtain an in-depth look at the distribution of observed delays, providing a nuanced understanding of network performance.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The following keywords are added to the <b>frame delay</b> command:</p> <ul style="list-style-type: none"> <li>• <b>bins</b></li> <li>• <b>width</b></li> <li>• <b>frame- delay-range percentile</b></li> <li>• <b>minimum-delay</b></li> </ul> <p><b>Yang Data Models:</b></p> <p>The following data models are enhanced for this feature:</p> <ul style="list-style-type: none"> <li>• Cisco-IOS-XR-ethernet-sat-oper.yang</li> <li>• Cisco-IOS-XR-ethernet-sat-cfg.yang</li> </ul>
<a href="#">Layer 2 Fast Reroute on NCS 5500 modular routers (NCS 5700 line cards [Mode: Native])</a>	<p>Introduced in this release on: NCS 5500 modular routers (NCS 5700 line cards [Mode: Native])</p> <p>This feature support is now extended to NCS 5500 modular routers (NCS 5700 line cards [Mode: Native]).</p>
<a href="#">User-Specified MTU Support for EMIX Traffic in Service Activation Tests</a>	<p>Introduced in this release on: NCS 5500 fixed port routers</p> <p>Defining the MTU packet size in Service Activation Tests (SAT) allows for tailored testing that matches the network's maximum frame capacity. This precision testing ensures accurate service performance validation and a reliable network service rollout.</p> <p>This feature introduces the following changes:</p> <p><b>CLI:</b></p> <p><b>packet-size emix Sequence h</b></p>
<p><b>L3VPN</b></p>	
<a href="#">L3VPN over GRE Tunnels</a>	<p>Introduced in this release on: NCS 5500 modular routers (NCS 5700 line cards [Mode: Native])</p> <p>Generic Routing Encapsulation (GRE) allows you to configure point-to-point and multiple traffic types connections to send the various types of network traffic.</p> <p>GRE supports L3VPN by encapsulating various network layer protocols, allowing IPv4 and IPv6 protocols to transport within the same GRE tunnel.</p>

Feature	Description
MPLS Layer 3 VPNs CLI enhancements	<p>You can now verify that MPLS labels are correctly programmed in the control plane (or software) and the data plane (hardware forwarding tables) using the <b>show mpls forwarding labels</b> command.</p> <p>Previously the command only showed the MPLS label information for software, additional steps were required to verify the label status in the hardware, by checking in the SDK.</p>
<b>Modular QoS</b>	
Enhanced Running Configuration Display for Policy Maps and Class Maps	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards)</p> <p>Now, you can view each class map or policy map running configuration instance on a separate line.</p> <p>The feature modifies the output display of this command:</p> <p><b>CLI: show run formal</b></p>
Set IP Marking for SRv6 Encapsulation	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers.</p> <p>With this feature support for IP marking for SRv6 packets that are encapsulated, there are some important updates to the QoS behavior.</p> <p>This is an explicit packet marking feature that applies only to ingress QoS policies.</p> <p>As part of this feature, you can set the IPv6 traffic class [0-63] values to use the full range of DSCP (6 bits) using the <b>policy-map-extend</b> command.</p> <p><b>CLI:</b> This feature introduces these changes:</p> <ul style="list-style-type: none"> <li>• <b>set ip encapsulation</b></li> <li>• The <b>policy-map-extend</b> keyword is introduced in the <b>srv6 mode microsegment f3216 encapsulation traffic-class</b> command.</li> </ul>
Set VXLAN Outer IP Header DSCP Value to 0	<p>Introduced in this release on: NCS 5500 fixed port routers;NCS 5500 modular routers.</p> <p>When a PE device transports IP traffic over a VXLAN tunnel that originates on the device, it automatically sets the DSCP value in the VXLAN outer IP header to 0 (CS0).</p>
<b>Netflow</b>	
Monitor GTP-U Traffic in 5G Network	<p>NCS 5500 fixed port routers; NCS 5700 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You now get a comprehensive view of your 5G network's performance and gain detailed insights into slice utilization, deployed QoS policies, and their impact on traffic. This includes verifying deployed QoS policies, assessing 5G slice mechanisms, and tracking GTP-U endpoints for specific applications. This feature specifically applies to 5G network slicing when the GTP User Plane carries data within the core network and to the radio access network. This is achieved by exporting GTP-U related Information Elements using Netflow and IPFIX records to collectors for analysis.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>gtp</b> keyword is introduced in the <b>record ipv4</b> and <b>record ipv6</b> commands.</li> </ul>

Feature	Description
<b>System Management</b>	
<a href="#">Increasing Commit Limit</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>The maximum number of commits is increased in the router that allows you to configure complex topology changes without interruptions caused by the default blocking of commit changes during rebase or ASCII backup operations. You can prevent the commit operation from getting blocked by using the <b>cfs check</b> command, which increases the commit (pacount) count from 20 to 40, and the commit file diff size (configuration data) from 2 MB to 4 MB, and by using the <b>clear configuration ascii inconsistency</b> command, which performs an ASCII backup after 55 minutes.</p> <p>The feature modifies the following commands:</p> <ul style="list-style-type: none"> <li>• <b>cfs check</b></li> <li>• <b>clear configuration ascii inconsistency</b></li> </ul>
<a href="#">Isolate Foreign Masters Causing Packet Timing Signal Fail</a>	<p>Introduced in this release on: NCS 5500 fixed port routers, NCS 5500 modular routers, NCS 5500 line cards, and NCS 5700 line cards [Mode: Compatibility; Native]</p> <p>This feature permits the flexible selection of timing sources by filtering out Foreign Master (FM) clocks that exhibit unstable timing. This filtering causes the secondary clocks to produce a signal deemed Packet Timing Signal Fail (PTSF)-unusable, from consideration within the Best Master Clock Algorithm (BMCA). The system continuously monitors these clocks for timing stabilization, and upon detecting enhanced stability, it may reevaluate and possibly reintegrate them as suitable time sources.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <b>detect-ptsf-unusable</b></li> <li>• The <b>show ptp foreign-masters</b> command output is enhanced to include phase difference values and servo status.</li> </ul> <p><b>YANG Data Models:</b></p> <p>The following data models are enhanced:</p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-ptp-cfg.yang</code></li> <li>• <code>Cisco-IOS-XR-um-ptp-cfg.yang</code></li> </ul>

Feature	Description
<a href="#">PTP Phase Difference Threshold Between Passive and Secondary Ports</a>	<p>Introduced in this release on: NCS 5500 fixed port routers NCS 5500 modular routers NCS 5500 line cards NCS 5700 line cards [Mode: Compatibility; Native]</p> <p>Passive ports can now be included in the Delay Request-Response Mechanism (DRRM), which allows for the monitoring of PTP phase differences between a passive port and a secondary port. If these PTP phase differences surpass a predefined limit, system logs are triggered. This feature enables you to detect potential errors such as fiber asymmetry or a clock failure in the PTP network.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <b>phase-difference-threshold-breach</b></li> <li>• The <b>show ptp foreign-masters</b> command output is enhanced to include phase difference values and servo status.</li> </ul> <p><b>YANG Data Models:</b></p> <p>The following data models are enhanced:</p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-ptp-cfg.yang</code></li> <li>• <code>Cisco-IOS-XR-um-ptp-cfg.yang</code></li> </ul>
<a href="#">PTP and SyncE on NC-57-48Q2D-S and NC-57-48Q2D-SE-S</a>	<p>Introduced in this release on: NCS 5500 modular routers (NCS 5500 line cards [Mode: Native])</p> <p>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. And, SyncE provides synchronization signals transmitted over the Ethernet physical layer to downstream devices, while the Synchronization Status Message (SSM) indicates the quality level of the transmitting clock to the neighboring nodes, informing the nodes about the level of the network's reliability. Ethernet Synchronization Message Channel (ESMC) is the logical channel that uses an Ethernet PDU (protocol data unit) to exchange SSM information over the SyncE link.</p> <p>Support for PTP and SyncE profiles G.8262, G.8262.1, G.8265.1, G.8275.1, G.8275.2, G8273.2 are extended to the following line cards:</p> <ul style="list-style-type: none"> <li>• <a href="#">NC-57-48Q2D-S</a></li> <li>• <a href="#">NC-57-48Q2D-SE-S</a></li> </ul>
<p><b>System Security</b></p>	
<a href="#">Layer 2 Untagged Sub-interface configuration in IEEE 802.1X Port-based Authentication</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5700 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>This feature enhances network security by extending the 802.1X port-based authentication to Layer 2 untagged sub-interfaces. It ensures that data transmission is only possible from authenticated devices, including those on interfaces without VLAN tags. Consequently, this reinforces access control policies across all devices attempting to connect to the network.</p>
<p><b>System Monitoring</b></p>	

Feature	Description
<a href="#">Improved Packet Loss Detection and Monitoring</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <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 <b>tolerance</b> and <b>window-size</b> keywords are introduced in the <b>use-case</b> command.</p> <p><b>YANG Data Model:</b></p> <p>New xpaths for <code>Cisco-IOS-XR-healthcheck-cfg.yang</code> data model.</p> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<a href="#">Traffic Statistics with Packet Drop Location</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>We help you save debugging time to locate packet drops by automatically detecting nonzero traffic drops from the commands running in the background and giving you the exact location of the packet drop.</p> <p>In earlier releases, you used multiple show commands with their respective locations to detect packet drops.</p> <p>This feature introduces the <b>show drops all</b> command.</p>
<b>Feature</b>	<b>Description</b>
<b>Application Hosting</b>	
<a href="#">CPU-Based Packet Generator</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers(NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You can now use a CPU-based packet generator for IOS-XR routers to simplify the diagnostic process for routers experiencing problems. This tool allows you to generate a wide range of traffic streams directly within the production environment without physically isolating the routers and moving them to a lab setup. This tool is beneficial in environments that use routers from different vendors or different models from the same vendor.</p> <p>The feature introduces the <b>packetgen</b> command with different options to generate different types of packets.</p>
<b>Programmability</b>	

Feature	Description
<a href="#">Preprogram Backup LSPs Using Service Layer API</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>This feature extends the Service Layer API, allowing the controller to preprogram backup Label Switched Paths (LSPs) in the hardware. When the <i>Path Priority</i> flag indicates a transition from the backup LSP to the primary LSP, the controller switches the traffic to the backup LSP.</p>
<b>Routing</b>	
<a href="#">Multi-area Loopback Interface for OSPF</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native]).</p> <p>You can save IP addresses and resources, prevent the use of multiple node SIDs for labels associated with loopback interfaces, and save time configuring multiple loopback interfaces for an Area Border Router (ABR) in a network. These improvements are possible as you can now configure a single loopback interface for multiple areas. With this feature, an ABR can use a single loopback interface for all areas it connects to, eliminating the need for separate loopback interfaces for each area.</p> <p>Previously, each loopback interface was linked to only one area.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <b>multi-area-interface</b> command is extended to support loopback interfaces.</p>
<a href="#">Protect IS-IS Processes in OOR Conditions</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>This feature enables prompt alerts for out-of-resource (OOR) conditions in IS-IS processes that could otherwise cause network instability and disruption due to memory leaks and excessive link-state packets (LSPs). Additionally, you can disable the overload bit status flag in the router's LSP to prevent setting the overload-bit. Consult Cisco for optimal results before making this change.</p> <p>Previously, during OOR conditions, IS-IS processes restarted themselves, but the OOR conditions could persist.</p> <p>This ability to protect IS-IS processes in OOR conditions is enabled by default and you can't disable it.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The feature introduces fields that indicate the memory state of the IS-IS protocol in the <b>show isis protocol</b> command.</li> <li>• <b>oor-set-overload-bit disable</b> command.</li> </ul> <p><b>YANG Data Model</b></p> <ul style="list-style-type: none"> <li>• New XPaths for <code>Cisco-IOS-XR-clns-isis-cfg</code></li> <li>• <code>Cisco-IOS-XR-um-router-isis-cfg</code></li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>

Feature	Description
<a href="#">Seamless Bidirectional Forwarding Detection</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Native]).</p> <p>This feature introduces support for NCS 5500 routers as a Seamless BFD (S-BFD) reflector.</p> <p>Seamless BFD simplifies the negotiation and state establishment aspects of BFD by predetermining session discriminators and maintaining session state only at the headend. This approach ensures quicker connectivity tests and reduces complexity in session establishment.</p> <p>Previously, support for Seamless BFD reflector was not available.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>This feature introduces the <a href="#">sbfd</a> command.</p>
<b>Segment Routing</b>	
<a href="#">Data Plane Validation for SR-MPLS IPv6-based Controller Instantiated LSPs</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native]).</p> <p>You can now verify the network configuration and paths and policies set up, without interrupting or potentially disrupting live network traffic, for SR-MPLS (Segment Routing over Multiprotocol Label Switching) IPv6-based Label Switched Paths (LSPs). With this feature, you can validate controller instantiated LSPs programmed directly into the forwarding hardware.</p> <p>Previously, SR data plane validation was possible over IPv4-based LSPs.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <b>dataplane-only</b> keyword is introduced in the <a href="#">traceroute sr-mpls</a> and <a href="#">ping sr-mpls</a> commands.</p> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Cisco-IOS-XR-mpls-traceroute-act.yang</a></li> <li>• <a href="#">Cisco-IOS-XR-mpls-ping-act.yang</a></li> </ul> <p>See (<a href="#">GitHub</a>, <a href="#">Yang Data Models Navigator</a>)</p>



Feature	Description
<a href="#">Delay Measurement for IP Endpoint over SRv6 Network</a>	<p>Introduced in the release on: NCS 5500 fixed port routers.</p> <p>In Segment Routing over an IPv6 network (SRv6), you can measure packet delay from the source to a specific IP endpoint. You can use this information for troubleshooting, network maintenance, and optimizing network performance.</p> <p>Additionally, you can use flow labels to verify the delay of each subsequent hop path towards the IP endpoint of that path. So that, when network traffic is distributed across multiple available paths towards an IP endpoint, delay measurement tracks the delay of each of these paths towards the IP endpoint.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>source-address ipv6</b> keyword is introduced in the <b>performance-measurement endpoint</b> command.</li> <li>• The <b>segment-list name</b> keyword is introduced in the <b>segment-routing traffic-eng explicit</b> command.</li> <li>• The <b>flow-label</b> keyword is introduced in the <b>performance-measurement delay-profile name</b> command.</li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-um-performance-measurement-cfg</code></li> <li>• <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>
<a href="#">Display Neighbor Router Capabilities in OSPF Networks</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native]).</p> <p>You can now improve the user experience, understand the features and functionalities supported by neighboring routers, reduce operational work hours and human errors by gaining better visibility into the routing capabilities of directly connected neighboring routers in an OSPF network. These improvements are now possible when you enable Segment Routing on a neighboring connected router.</p> <p>Previously, there was no straightforward method to display the segment routing and other capabilities of neighboring routers in an OSPF network.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>capabilities</b> keyword is introduced in the <b>show ospf neighbor</b> command.</li> </ul> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-ipv4-ospf-oper.yang</code></li> </ul> <p>See (<a href="#">GitHub</a>, <a href="#">Yang Data Models Navigator</a>)</p>

Feature	Description
<a href="#">Dual-Stack Support with SRv6 Unicast and IPv4 Multicast Core</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>This feature introduces dual-stack support with SRv6 for unicast traffic and IPv4 for multicast communication.</p> <p>The dual-stack simplifies the routing process by combining the advantages of both IPv4 and SRv6 protocols, and facilitates smoother interoperability between the two protocols. The dual-stack enables efficient unicast communication through SRv6 by allowing precise control over the path that a packet takes through a network and streamlines the network routing, while using the deployment support of IPv4 for multicast traffic.</p>
<a href="#">Liveness Monitoring for IP Endpoint over SRv6 Network</a>	<p>Introduced in the release on: NCS 5500 fixed port routers.</p> <p>In Segment Routing over an IPv6 network (SRv6), you can keep track of the operational status of both the forward and reverse paths of a particular node or IP endpoint. You can use this information for troubleshooting, network maintenance, and optimizing network performance.</p> <p>Additionally, you can use flow labels to verify the liveness of each subsequent hop path toward the IP endpoint of that path. So that, when network traffic is distributed across multiple available paths towards an IP endpoint, liveness detection tracks the operational status of each of these paths towards the IP endpoint.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>reverse-path</b> and <b>segment-list name</b> keywords are introduced in the <b>segment-routing traffic-eng explicit</b> command.</li> <li>• The <b>source-address ipv6</b> is introduced in the <b>performance-measurement endpoint</b> command.</li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-um-performance-measurement-cfg</code></li> <li>• <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>

Feature	Description
<a href="#">MPLS OAM support for SR-TE Policies using MPLS IPv6-based LSPs</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You can now verify the network configuration and paths and SR-TE policies set up, without interrupting or potentially disrupting live network traffic, for SR-MPLS (Segment Routing over Multiprotocol Label Switching) IPv6-based Label Switched Paths (LSPs).</p> <p>Previously, MPLS OAM support was only for IPv4-based LSPs.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The <a href="#">traceroute sr-mpls</a> and <a href="#">ping sr-mpls</a> commands are extended to support IPv6 nexthop addresses.</p> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Cisco-IOS-XR-mpls-traceroute-act.yang</a></li> <li>• <a href="#">Cisco-IOS-XR-mpls-ping-act.yang</a></li> </ul> <p>See (<a href="#">GitHub</a>, <a href="#">Yang Data Models Navigator</a>)</p>
<a href="#">SR ECMP-FEC Optimization for IPv6 Prefixes</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>You can now minimize ECMP-FEC resource consumption and duplication of resources during underlay programming for an SR-MPLS network for IPv6 prefixes. The feature supports sharing the same ECMP-FEC, regular FEC, and Egress Encapsulation DB (EEDB) entries for all paths with the same outgoing MPLS label among IPv6 prefixes. This improvement is now possible by using the <a href="#">hw-module fib mpls label lsr-optimized</a> command.</p> <p>In earlier releases, ECMP-FEC optimization for IPv4 prefixes was available.</p>
<a href="#">SRv6 Traffic Class DSCP Marking Enhancement for QoS</a>	<p><i>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers</i></p> <p>This feature allows you to set the traffic class values to use the full range of DSCP (6 bits) for SRv6 packets that are encapsulated.</p> <p>The feature extends the existing <a href="#">policy-map</a> setting of 3-bit traffic class DSCP marking to 6 bits using the new <a href="#">policy-map-extend</a> option in the configuration for L2 and L3 traffic for SRv6.</p> <p>This is a mutually inclusive feature for L2 and L3 traffic. Therefore, this feature cannot be used in the individual configuration for L2 and L3 traffic.</p> <p>This feature introduces this change:</p> <p><b>CLI:</b> The <a href="#">policy-map-extend</a> keyword is introduced in the <a href="#">hw-module profile segment-routing srv6 mode microsegment f3216 encapsulation traffic-class</a> command.</p>

Feature	Description
<a href="#">User-Defined Generic Metric Support for IS-IS Flex Algo</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>This feature adds support for user-defined generic metric as a metric type for IS-IS Flexible Algorithm. You can now have more control over traffic flows using user-defined generic metrics. You can define a family of user-defined generic metrics that can advertise different types of administrative metrics such as jitter, reliability, and fiscal cost depending on the traffic class for Flexible Algorithms. You can selectively define and assign semantics of these metrics as per the network requirement.</p> <p>The feature introduces the following changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>The feature introduces the <a href="#">generic-metric flex-algo</a> and <a href="#">metric-type generic</a> commands.</li> </ul> <p><b>YANG Data Models:</b></p> <ul style="list-style-type: none"> <li><code>Cisco-IOS-XR-um-router-isis-cfg.yang</code></li> </ul>
<b>BGP</b>	
<a href="#">Increased Maximum Limit for BGP Additional Paths</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You can now configure a maximum of 96 BGP additional paths instead of 32, which enhances network resiliency, and provides an improved load balancing capability.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>The <b>advertise-limit</b> keyword is introduced in the <a href="#">additional-paths</a> command.</li> </ul> <p><b>YANG Data Model:</b></p> <ul style="list-style-type: none"> <li><code>Cisco-IOS-XR-um-router-bgp-cfg.yang</code></li> </ul> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<b>Interface and Hardware Component</b>	
<a href="#">50G Optics Support for Quad Port Mode on NC57 Line Cards</a>	<p>Introduced in this release on: NCS 5500 modular routers( NCS 5700 line cards [Mode: Compatibility; Native] )</p> <p>This feature provides higher bandwidth on the following NC57 line cards with the support for 50G optics on the 8-port quads of these line cards:</p> <ul style="list-style-type: none"> <li>NC-57-48Q2D-S</li> <li>NC-57-48Q2D-SE</li> </ul> <p><b>CLI:</b> This feature modifies the <a href="#">hw-module quad</a> command.</p>

Feature	Description
<a href="#">Carrier Delay on Physical Interfaces</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>With the carrier-delay timer functionality, the Ethernet interface state remains stable for the configured delay duration, even if the hardware link state fluctuates. This prevents interface flapping and improves network reliability.</p> <p>If you haven't configured the timer, the default carrier delay automatically delays the hardware link-up notifications by 200 ms. This time delay ensures that a stable hardware link state is established.</p> <p>If you want to change the delay of the interface state change notification, you can use the <a href="#">carrier-delay</a> command to set a different value.</p> <p>The feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">carrier-delay</a></li> <li>• The default value of <b>up</b> keyword is implemented as 200 ms in the <a href="#">carrier-delay</a> command.</li> </ul>
<b>IP Addresses and Services</b>	
<a href="#">TCP Dump File Converter</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers(NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You can now convert an entire TCP dump of packet traces in binary files into readable formats such as text or cap, which makes it easier to analyze them for troubleshooting using third-party or open-source tools. This feature saves time and effort by preventing the need to examine each packet for failure.</p> <p>This feature introduces the <a href="#">tcp dump-file convert</a> command.</p>
<b>L2VPN and Ethernet Services</b>	
<a href="#">Default Encapsulation Mode of ITU-T Y.1564</a>	<p>Introduced in this release on:NCS 5500 fixed port routers</p> <p>The default encapsulation mode helps to set a baseline to know how the Ethernet service behaves for default operations in Service Activation Test.</p>

Feature	Description
<a href="#">Frame Delay Range for ITU-T Y.1564 Test</a>	<p>Introduced in this release on: NCS 5500 fixed port routers</p> <p>You now have the ability to conduct a finer analysis of frame delay by measuring the Frame Delay Range (FDR) within a designated percentile. This metric captures the variation between the minimum frame delay observed and the delay at your chosen percentile. Also, delay times are organized into bins, which you can configure in terms of width and count to suit your analysis needs. By customizing these parameters, you can obtain an in-depth look at the distribution of observed delays, providing a nuanced understanding of network performance.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <p>The following keywords are added to the <b>frame delay</b> command:</p> <ul style="list-style-type: none"> <li>• <b>bins</b></li> <li>• <b>width</b></li> <li>• <b>frame- delay-range percentile</b></li> <li>• <b>minimum-delay</b></li> </ul> <p><b>Yang Data Models:</b></p> <p>The following data models are enhanced for this feature:</p> <ul style="list-style-type: none"> <li>• Cisco-IOS-XR-ethernet-sat-oper.yang</li> <li>• Cisco-IOS-XR-ethernet-sat-cfg.yang</li> </ul>
<a href="#">Layer 2 Fast Reroute on NCS 5500 modular routers (NCS 5700 line cards [Mode: Native])</a>	<p>Introduced in this release on: NCS 5500 modular routers (NCS 5700 line cards [Mode: Native])</p> <p>This feature support is now extended to NCS 5500 modular routers (NCS 5700 line cards [Mode: Native]).</p>
<a href="#">User-Specified MTU Support for EMIX Traffic in Service Activation Tests</a>	<p>Introduced in this release on: NCS 5500 fixed port routers</p> <p>Defining the MTU packet size in Service Activation Tests (SAT) allows for tailored testing that matches the network's maximum frame capacity. This precision testing ensures accurate service performance validation and a reliable network service rollout.</p> <p>This feature introduces the following changes:</p> <p><b>CLI:</b></p> <p><b>packet-size emix Sequence h</b></p>
<p><b>L3VPN</b></p>	
<a href="#">L3VPN over GRE Tunnels</a>	<p>Introduced in this release on: NCS 5500 modular routers (NCS 5700 line cards [Mode: Native])</p> <p>Generic Routing Encapsulation (GRE) allows you to configure point-to-point and multiple traffic types connections to send the various types of network traffic.</p> <p>GRE supports L3VPN by encapsulating various network layer protocols, allowing IPv4 and IPv6 protocols to transport within the same GRE tunnel.</p>

Feature	Description
MPLS Layer 3 VPNs CLI enhancements	<p>You can now verify that MPLS labels are correctly programmed in the control plane (or software) and the data plane (hardware forwarding tables) using the <b>show mpls forwarding labels</b> command.</p> <p>Previously the command only showed the MPLS label information for software, additional steps were required to verify the label status in the hardware, by checking in the SDK.</p>
<b>Modular QoS</b>	
Enhanced Running Configuration Display for Policy Maps and Class Maps	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards)</p> <p>Now, you can view each class map or policy map running configuration instance on a separate line.</p> <p>The feature modifies the output display of this command:</p> <p><b>CLI: show run formal</b></p>
Set IP Marking for SRv6 Encapsulation	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers.</p> <p>With this feature support for IP marking for SRv6 packets that are encapsulated, there are some important updates to the QoS behavior.</p> <p>This is an explicit packet marking feature that applies only to ingress QoS policies.</p> <p>As part of this feature, you can set the IPv6 traffic class [0-63] values to use the full range of DSCP (6 bits) using the <b>policy-map-extend</b> command.</p> <p><b>CLI:</b> This feature introduces these changes:</p> <ul style="list-style-type: none"> <li>• <b>set ip encapsulation</b></li> <li>• The <b>policy-map-extend</b> keyword is introduced in the <b>srv6 mode microsegment f3216 encapsulation traffic-class</b> command.</li> </ul>
Set VXLAN Outer IP Header DSCP Value to 0	<p>Introduced in this release on: NCS 5500 fixed port routers;NCS 5500 modular routers.</p> <p>When a PE device transports IP traffic over a VXLAN tunnel that originates on the device, it automatically sets the DSCP value in the VXLAN outer IP header to 0 (CS0).</p>
<b>Multicast</b>	
<b>Netflow</b>	

Feature	Description
<a href="#">Monitor GTP-U Traffic in 5G Network</a>	<p>NCS 5500 fixed port routers; NCS 5700 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>You now get a comprehensive view of your 5G network's performance and gain detailed insights into slice utilization, deployed QoS policies, and their impact on traffic. This includes verifying deployed QoS policies, assessing 5G slice mechanisms, and tracking GTP-U endpoints for specific applications. This feature specifically applies to 5G network slicing when the GTP User Plane carries data within the core network and to the radio access network. This is achieved by exporting GTP-U related Information Elements using Netflow and IPFIX records to collectors for analysis.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• The <b>gtp</b> keyword is introduced in the <b>record ipv4</b> and <b>record ipv6</b> commands.</li> </ul>
<b>System Management</b>	
<a href="#">Increasing Commit Limit</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <p>The maximum number of commits is increased in the router that allows you to configure complex topology changes without interruptions caused by the default blocking of commit changes during rebase or ASCII backup operations. You can prevent the commit operation from getting blocked by using the <b>cfs check</b> command, which increases the commit (pacount) count from 20 to 40, and the commit file diff size (configuration data) from 2 MB to 4 MB, and by using the <b>clear configuration ascii inconsistency</b> command, which performs an ASCII backup after 55 minutes.</p> <p>The feature modifies the following commands:</p> <ul style="list-style-type: none"> <li>• <b>cfs check</b></li> <li>• <b>clear configuration ascii inconsistency</b></li> </ul>



Feature	Description
<p><a href="#">Isolate Foreign Masters Causing Packet Timing Signal Fail</a></p>	<p>Introduced in this release on: NCS 5500 fixed port routers, NCS 5500 modular routers, NCS 5500 line cards, and NCS 5700 line cards [Mode: Compatibility; Native]</p> <p>This feature permits the flexible selection of timing sources by filtering out Foreign Master (FM) clocks that exhibit unstable timing. This filtering causes the secondary clocks to produce a signal deemed Packet Timing Signal Fail (PTSF)-unusable, from consideration within the Best Master Clock Algorithm (BMCA). The system continuously monitors these clocks for timing stabilization, and upon detecting enhanced stability, it may reevaluate and possibly reintegrate them as suitable time sources.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <b>detect-ptsf-unusable</b></li> <li>• The <b>show ptp foreign-masters</b> command output is enhanced to include phase difference values and servo status.</li> </ul> <p><b>YANG Data Models:</b></p> <p>The following data models are enhanced:</p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-ptp-cfg.yang</code></li> <li>• <code>Cisco-IOS-XR-um-ptp-cfg.yang</code></li> </ul>
<p><a href="#">PTP Phase Difference Threshold Between Passive and Secondary Ports</a></p>	<p>Introduced in this release on: NCS 5500 fixed port routers, NCS 5500 modular routers, NCS 5500 line cards, and NCS 5700 line cards [Mode: Compatibility; Native]</p> <p>Passive ports can now be included in the Delay Request-Response Mechanism (DRRM), which allows for the monitoring of PTP phase differences between a passive port and a secondary port. If these PTP phase differences surpass a predefined limit, system logs are triggered. This feature enables you to detect potential errors such as fiber asymmetry or a clock failure in the PTP network.</p> <p>This feature introduces these changes:</p> <p><b>CLI:</b></p> <ul style="list-style-type: none"> <li>• <b>phase-difference-threshold-breach</b></li> <li>• The <b>show ptp foreign-masters</b> command output is enhanced to include phase difference values and servo status.</li> </ul> <p><b>YANG Data Models:</b></p> <p>The following data models are enhanced:</p> <ul style="list-style-type: none"> <li>• <code>Cisco-IOS-XR-ptp-cfg.yang</code></li> <li>• <code>Cisco-IOS-XR-um-ptp-cfg.yang</code></li> </ul>
<p><b>System Security</b></p>	

Feature	Description
<a href="#">Layer 2 Untagged Sub-interface configuration in IEEE 802.1X Port-based Authentication</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>This feature enhances network security by extending the 802.1X port-based authentication to Layer 2 untagged sub-interfaces. It ensures that data transmission is only possible from authenticated devices, including those on interfaces without VLAN tags. Consequently, this reinforces access control policies across all devices attempting to connect to the network.</p>
<b>System Monitoring</b>	
<a href="#">Improved Packet Loss Detection and Monitoring</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards).</p> <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 <b>tolerance</b> and <b>window-size</b> keywords are introduced in the <b>use-case</b> command.</p> <p><b>YANG Data Model:</b></p> <p>New xpaths for <code>Cisco-IOS-XR-healthcheck-cfg.yang</code> data model.</p> <p>(see <a href="#">GitHub</a>, <a href="#">YANG Data Models Navigator</a>)</p>
<a href="#">Traffic Statistics with Packet Drop Location</a>	<p>Introduced in this release on: NCS 5500 fixed port routers; NCS 5500 modular routers (NCS 5500 line cards; NCS 5700 line cards [Mode: Compatibility; Native])</p> <p>We help you save debugging time to locate packet drops by automatically detecting nonzero traffic drops from the commands running in the background and giving you the exact location of the packet drop.</p> <p>In earlier releases, you used multiple show commands with their respective locations to detect packet drops.</p> <p>This feature introduces the <b>show drops all</b> command.</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>	
openconfig-local-routing.yang Version 2.0.1	<p>The OpenConfig data model, which is part of the openconfig-network-instance.yang data model is revised from version 1.2.0 to 2.0.1. This revision enables you to configure the preference for the order selection when multiple sources, such as protocols and static routes, contribute to the same prefix entry. A lower number signifies a better preference. When the preference value is not specified, default preference value is considered which is one.</p> <p>This data model supports event-driven and Model-driven telemetry.</p>
Cisco-IOS-XR-infra-statsd-oper.yang	<p>The native yang data model streams cached counters using a TARGET_DEFINED subscription.</p> <p>It enables you to fetch interface statistics, such as bytes-received, packets-received and other details, from a cache which is periodically updated from hardware using generic-counters container. The hardware-timestamp field indicates the timestamp of the most recent hardware counter readings. If hardware-timestamp field is 0, the last-data-time field indicates the timestamp of the most recent counter readings, which could be either from hardware or software.</p> <p>This data model supports event-driven telemetry.</p>
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> <p>The tolerance container - This is a new container in the packet-drop container to configure the NPU packet loss tolerance.</p> <p>The tolerance-level-low, tolerance-level-medium and tolerance-level-high leaves - These new leaves are added to the tolerance container. These leaves enable you to configure different NPU packet loss tolerance values for low, medium and high tolerance NPU traps</p>
openconfig-if-ip.yang Version 3.5.0	<p>This OpenConfig data model is revised from version 3.0.0 to 3.5.0. This update introduces the ability to configure both global unicast and link-local IP addresses using the config/type leaf.</p>
Cisco-IOS-XR-ipv4-ospf-oper.yang	<p>This native data model is enhanced with new leaves <i>sr-capable</i>, <i>ri-capabilities-tlv</i>, <i>te-capable</i>, <i>gr-capable</i>, <i>grh-capable</i>, and <i>host-name</i> in the <i>OSPF-SH-NEIGHBOR-DETAIL</i> and <i>OSPF-SH-NEIGHBOR</i> groupings to display neighbor router capabilities in OSPF networks.</p>

Feature	Description
Cisco-IOS-XR-mpls-traceroute-act.yang	This unified data model is enhanced with a new container, <i>ipv6</i> , and leaves such as <i>next-hop</i> , <i>lsp-endpoint</i> , and <i>force-ipv6-explicit-null</i> in the <i>type-ipv6-next-hop</i> interface to extend support to Segment Routing OAM to verify network configuration for SR-MPLS IPv6-based LSPs.
Cisco-IOS-XR-mpls-ping-act.yang	This unified data model is enhanced with a new container, <i>ipv6</i> , and leaves such as <i>next-hop</i> , <i>lsp-endpoint</i> , and <i>force-ipv6-explicit-null</i> in the <i>type-ipv6-next-hop</i> interface to extend support to Segment Routing OAM to verify network configuration for SR-MPLS IPv6-based LSPs.
Cisco-IOS-XR-um-router-isis-cfg	This unified data model is enhanced with new containers <i>generic-metric</i> , and <i>generic-metric-level</i> to define a family of user-defined generic metrics that can advertise different types of administrative metrics such as jitter, reliability, and fiscal cost depending on the traffic class for Flexible Algorithms.
Cisco-IOS-XR-evpn-oper.yang	This native data model is enhanced to stream event-driven telemetry (EDT) data for the operational state of Layer 2 Ethernet VPN (EVPN) MAC routes using <i>mac</i> container. EDT data is streamed when an on-change event on the MAC route is detected such as adding, deleting or modifying a MAC address.
Cisco-IOS-XR-ptp-cfg.yang	This native yang data model for PTP is enhanced with new leaves - <i>detect-ptsf-unusable</i> and <i>phase-difference-threshold-breach</i> to allow the exclusion of Foreign Masters (FMs) with unstable timing from Best Master Clock Algorithm (BMCA) and to measure the phase difference between passive port and secondary port.
Cisco-IOS-XR-um-ptp-cfg.yang	This unified data model for PTP is enhanced with new leaves - <i>detect-ptsf-unusable</i> and <i>phase-difference-threshold-breach</i> to allow the exclusion of Foreign Masters (FMs) with unstable timing from Best Master Clock Algorithm (BMCA) and to measure the phase difference between passive port and secondary port.
Cisco-IOS-XR-ethernet-sat-oper.yang	This YANG data model is enhanced with new container <i>frame-delay</i> to categorize frame delay range for ITU-T Y.1564.
Cisco-IOS-XR-ethernet-sat-cfg.yang	This native data model is enhanced with new container <i>frame-delay</i> to categorize frame delay range for ITU-T Y.1564.

## Hardware Introduced

Hardware	Description
Optics	<p><b>Note:</b> 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 <a href="#">Transceiver Module Group (TMG) Compatibility Matrix</a>.</p> <p>This release introduces the following optics:</p> <ul style="list-style-type: none"> <li>• QSFP-100G-BX20(U/D)4-I</li> </ul>

## Features Supported on Cisco NC5700 Line Cards

The following table lists the features supported on Cisco NC5700 line cards in compatibility mode (NC5700 line cards with previous generation NCS 5500 line cards in the same NCS 5500 modular routers) and native mode (NCS 5500 modular routers with only NCS 5700 line cards and NCS 5700 fixed port routers).

To enable the native mode on Cisco NCS 5500 series modular routers having Cisco NCS 5700 line cards, use the **hw-module profile npu native-mode-enable** command in the configuration mode. Ensure that you reload the router after configuring the native mode.

**Table 1: Features Supported on Cisco NC5700 Line Cards**

Feature	Compatible Mode	Native Mode
CPU-Based Packet Generator	✓	✓
Multi-area Loopback Interface for OSPF	✓	✓
Protect IS-IS Processes in OOR Conditions	✓	✓
Seamless Bidirectional Forwarding Detection	×	✓
Data Plane Validation for SR-MPLS IPv6-based Controller Instantiated LSPs	✓	✓
Display Neighbor Router Capabilities in OSPF Networks	✓	✓
MPLS OAM support for SR-TE Policies using MPLS IPv6-based LSPs	✓	✓
User-Defined Generic Metric Support for IS-IS Flex Algo	✓	✓
Increased Maximum Limit for BGP Additional Paths	✓	✓
Carrier Delay on Physical Interfaces	✓	✓
Support for 50G Port Speed on NC57 Line Cards	✓	✓
TCP Dump File Converter	✓	✓
Layer 2 Fast Reroute on Cisco NCS 5700 series routers and line cards	×	✓
L3VPN over GRE Tunnels	×	✓
Set VXLAN Outer IP Header DSCP Value to 0	×	✓

Feature	Compatible Mode	Native Mode
Monitor GTP-U Traffic in 5G Network	✓	✓
Isolate Foreign Masters Causing Packet Timing Signal Fail	✓	✓
PTP Phase Difference Threshold Between Passive and Secondary Ports	✓	✓
PTP and SyncE on NC-57-48Q2D-S and NC-57-48Q2D-SE-S	✗	✓
Layer 2 Untagged Sub-interface configuration in IEEE 802.1X Port-based Authentication	✓	✓

For the complete list of features supported on Cisco NC5700 line cards until Cisco IOS XR Release 24.2.1, see:

- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 24.1.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.11.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.11.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.10.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.10.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.9.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.9.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.8.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.8.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.7.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.7.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.6.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.6.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.5.3](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.5.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.5.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.4.2](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.4.1](#)
- [Release Notes for Cisco NCS 5500 Series Routers, IOS XR Release 7.3.1](#)

## Caveats

There are no caveats in this release.

## Behavior Changes

- From this release, the **set qos-group** action can be used with the new parameter **policy-map-extend** in the **hw-module profile segment-routing srv6 mode encapsulation traffic class** command. Prior to this release, the **set qos-group** action cannot be used in conjunction with the parameter **policy-map-extend** in the **hw-module profile segment-routing srv6 mode encapsulation traffic class** command.
- From this release, for the **tx-interval** value in **performance-measurement liveness-profile**, the allowed range for CPU sessions is from 15000 to 15000000 micro seconds. The modified range applies to both the **liveness-profile sr-policy default** and **liveness-profile name** commands. Prior to this release, the allowed range for CPU sessions was from 30000 to 15000000 micro seconds
- Cisco IOS XR enforces the existence of the leaves referenced by OpenConfig list key leafrefs. If the referenced leaves do not exist in the OpenConfig datastore, the following error is returned:  
Leaf `name` inside the `config` container must also be set to value `default` to satisfy the leafref constraint on the list key.
- To configure load-balancing parameters, use the **cef load-balancing** command in Global configuration mode.
- When multiple IS-IS instances are configured on a router, by default, **show isis** commands display information from all IS-IS instances. To display information from only one specific IS-IS instance, use the **set default-isis-instance** command in the EXEC mode.

## Release Package

This table lists the Cisco IOS XR Software feature set matrix (packages) with associated filenames.

Visit the [Cisco Software Download page](#) to download the Cisco IOS XR software images.

**Table 2: Release 24.2.1 Packages for Cisco NCS 5500 Series Router**

Composite Package		
Feature Set	Filename	Description
Cisco IOS XR IP Unicast Routing Core Bundle	ncs5500-mini-x.iso	Contains base image contents that includes: <ul style="list-style-type: none"> <li>• Host operating system</li> <li>• System Admin boot image</li> <li>• IOS XR boot image</li> <li>• BGP packages</li> </ul>
Individually-Installable Optional Packages		
Feature Set	Filename	Description
Cisco IOS XR Manageability Package	ncs5500-mgbl-3.0.0.0-r2421.x86_64.rpm	Extensible Markup Language (XML) Parser, Telemetry, Netconf, gRPC and HTTP server packages.

Cisco IOS XR MPLS Package	ncs5500-mpls-2.1.0.0-r2421.x86_64.rpm ncs5500-mpls-te-rsvp-2.2.0.0-r2421.x86_64.rpm	MPLS and MPLS Traffic Engineering (MPLS-TE) RPM.
Cisco IOS XR Security Package	ncs5500-k9sec-3.1.0.0-r2421.x86_64.rpm	Support for Encryption, Decryption, Secure Shell (SSH), Secure Socket Layer (SSL), and Public-key infrastructure (PKI)
Cisco IOS XR ISIS package	ncs5500-isis-1.2.0.0-r2421.x86_64.rpm	Support ISIS
Cisco IOS XR OSPF package	ncs5500-ospf-2.0.0.0-r2421.x86_64.rpm	Support OSPF
Lawful Intercept (LI) Package	ncs5500-li-1.0.0.0-r2421.x86_64.rpm	Includes LI software images
Multicast Package	ncs5500-mcast-1.0.0.0-r2421.x86_64rpm	Support Multicast
EIGRP	ncs5500-eigrp-1.0.0.0-r2421.x86_64.rpm	Supports Enhanced Interior Gateway Routing Protocol
Lawful Intercept Control	ncs5500-lictrl-1.0.0.0-r2421x86_64.rpm	Supports Lawful Intercept Control
Healthcheck	ncs5500-healthcheck-1.0.0.0-r2421.x86_64.rpm	Supports System Health Check

**Table 3: Release 24.2.1 TAR files for Cisco NCS 5500 Series Router**

Feature Set	Filename
NCS 5500 IOS XR Software 3DES	NCS5500-iosxr-k9-24.2.1.tar
NCS 5500 IOS XR Software	NCS5500-iosxr-24.2.1.tar
NCS 5500 IOS XR Software	NCS5500-docs-24.2.1.tar

## Determine Software Version

To verify the software version running on the router, use **show version** command in the EXEC mode.

```
Router# show version
Cisco IOS XR Software, Version 24.2.1
Copyright (c) 2013-2024 by Cisco Systems, Inc.

Build Information:
  Built By       : swtools
  Built On      : Tue Jun 11 09:18:56 PDT 2024
  Built Host    : iox-ucs-032
  Workspace     : /auto/srcarchive11/prod/24.2.1/ncs5500/ws
  Version       : 24.2.1
  Location      : /opt/cisco/XR/packages/
  Label        : 24.2.1

cisco NCS-5500 () processor
System uptime is 17 hours 31 minutes
```



## Determine Firmware Support

Use the **show hw-module fpd** command in EXEC and Admin mode to view the hardware components with their current FPD version and status. The status of the hardware must be CURRENT; Running and Programed version must be the same.

You can also use the **show fpd package** command in Admin mode to check the fpd versions.

### NCS 5500 Modular Routers

Router# **show fpd package**

```

=====
                          Field Programmable Device Package
                          =====
Card Type                FPD Description                Req    SW    Min Req  Min Req
                          =====  =====  =====  =====
                          Req    Ver    SW Ver  Board Ver
                          =====  =====  =====  =====
-----
NC55-12X100G-SE-PR      Bootloader (A)                YES    1.20    1.20    0.0
                          IOFPGA (A)                    YES    0.12    0.12    0.0
                          MIFPGA                        YES    0.03    0.03    0.0
                          SATA-INTEL_240G (A)           NO    1132.00  1132.00  0.0
                          SATA-INTEL_480G (A)           NO    1132.00  1132.00  0.0
                          SATA-M500IT-MC (A)            NO    3.00    3.00    0.0
                          SATA-M500IT-MU-A (A)          NO    5.00    5.00    0.0
                          SATA-M500IT-MU-B (A)          NO    4.00    4.00    0.0
                          SATA-M5100 (A)                NO    75.00    75.00    0.0
                          SATA-M600-MCT (A)            NO    5.00    5.00    0.0
                          SATA-M600-MU (A)              NO    6.00    6.00    0.0
                          SATA-Micron (A)               NO    1.00    1.00    0.0
                          SATA-SMART-128G (A)          NO    1241.00  1241.00  0.0
-----
NC55-12X100GE-PROT     Bootloader (A)                YES    1.22    1.22    0.0
                          IOFPGA (A)                    YES    0.15    0.15    0.0
                          MIFPGA                        YES    0.09    0.09    0.0
                          SATA-INTEL_240G (A)           NO    1132.00  1132.00  0.0
                          SATA-INTEL_480G (A)           NO    1132.00  1132.00  0.0
                          SATA-M500IT-MC (A)            NO    3.00    3.00    0.0
                          SATA-M500IT-MU-A (A)          NO    5.00    5.00    0.0
                          SATA-M500IT-MU-B (A)          NO    4.00    4.00    0.0
                          SATA-M5100 (A)                NO    75.00    75.00    0.0
                          SATA-M600-MCT (A)            NO    5.00    5.00    0.0
                          SATA-M600-MU (A)              NO    6.00    6.00    0.0
                          SATA-Micron (A)               NO    1.00    1.00    0.0
                          SATA-SMART-128G (A)          NO    1241.00  1241.00  0.0
-----
NC55-18H18F            Bootloader (A)                YES    1.20    1.20    0.0
                          IOFPGA (A)                    YES    0.22    0.22    0.0
                          MIFPGA                        YES    0.03    0.03    0.0
                          SATA-INTEL_240G (A)           NO    1132.00  1132.00  0.0
                          SATA-INTEL_480G (A)           NO    1132.00  1132.00  0.0
                          SATA-M500IT-MC (A)            NO    3.00    3.00    0.0
                          SATA-M500IT-MU-A (A)          NO    5.00    5.00    0.0
                          SATA-M500IT-MU-B (A)          NO    4.00    4.00    0.0
                          SATA-M5100 (A)                NO    75.00    75.00    0.0
                          SATA-M600-MCT (A)            NO    5.00    5.00    0.0
                          SATA-M600-MU (A)              NO    6.00    6.00    0.0
                          SATA-Micron (A)               NO    1.00    1.00    0.0
                          SATA-SMART-128G (A)          NO    1241.00  1241.00  0.0
-----
NC55-24H12F-SE        Bootloader (A)                YES    1.20    1.20    0.0
                          IOFPGA (A)                    YES    0.09    0.09    0.0
                          MIFPGA                        YES    0.03    0.03    0.0

```

	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-24X100G-SE	Bootloader (A)	YES	1.20	1.20	0.0
	IOFPGA (A)	YES	0.13	0.13	0.0
	MIFPGA	YES	0.03	0.03	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-32T16Q4H-A	Bootloader (A)	YES	0.05	0.05	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.93	0.93	0.0
	MIFPGA	YES	0.60	0.60	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
	TimingIC-A	YES	7.216	7.216	0.0
	TimingIC-B	YES	7.216	7.216	0.0
-----					
NC55-32T16Q4H-AT	Bootloader (A)	YES	0.05	0.05	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.93	0.93	0.0
	MIFPGA	YES	0.60	0.60	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
	TimingIC-A	YES	7.216	7.216	0.0
	TimingIC-B	YES	7.216	7.216	0.0
-----					
NC55-36X100G	Bootloader (A)	YES	1.22	1.22	0.0
	IOFPGA (A)	YES	0.15	0.15	0.0
	MIFPGA	YES	0.09	0.09	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0

	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-36X100G-A-SE	Bootloader (A)	YES	0.15	0.15	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.26	0.26	0.0
	MIFPGA	YES	0.03	0.03	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-36X100G-S	Bootloader (A)	YES	1.20	1.20	0.0
	IOFPGA (A)	YES	0.12	0.12	0.0
	MIFPGA	YES	0.07	0.07	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-5504-FC	Bootloader (A)	YES	1.75	1.75	0.0
	IOFPGA (A)	YES	0.10	0.10	0.0
-----					
NC55-5504-FC2	Bootloader (A)	YES	1.13	1.13	0.0
	IOFPGA (A)	YES	0.47	0.47	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-5508-FC	Bootloader (A)	YES	1.74	1.74	0.0
	IOFPGA (A)	YES	0.17	0.17	0.0
-----					
NC55-5508-FC2	Bootloader (A)	YES	1.80	1.80	0.0
	IOFPGA (A)	YES	0.19	0.19	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0

	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-5516-FC	Bootloader (A)	YES	1.75	1.75	0.0
	IOFPGA (A)	YES	0.26	0.26	0.0
-----					
NC55-5516-FC2	Bootloader (A)	YES	1.80	1.80	0.0
	IOFPGA (A)	YES	0.24	0.24	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-6X100GE-PROT	Bootloader (A)	YES	1.22	1.22	0.0
	IOFPGA (A)	YES	0.15	0.15	0.0
	MIFPGA	YES	0.09	0.09	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-6X200-DWDM-S	Bootloader (A)	YES	1.20	1.20	0.0
	CFP2_PORT_0	NO	5.56	5.56	2.1
	CFP2_PORT_1	NO	5.56	5.56	2.1
	CFP2_PORT_2	NO	5.56	5.56	2.1
	CFP2_PORT_3	NO	5.56	5.56	2.1
	CFP2_PORT_4	NO	5.56	5.56	2.1
	CFP2_PORT_5	NO	5.56	5.56	2.1
	DENALI0	NO	13.48	13.48	0.0
	DENALI1	NO	13.48	13.48	0.0
	DENALI2	NO	13.48	13.48	0.0
	IOFPGA (A)	YES	0.14	0.14	0.0
	MORGOth	YES	5.26	5.26	0.0
	MSFPGA0	YES	2.22	2.22	0.0
	MSFPGA1	YES	2.22	2.22	0.0
	MSFPGA2	YES	2.22	2.22	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-MOD-A-S	Bootloader (A)	YES	1.03	1.03	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0

	IOFPGA (A)	YES	0.14	0.14	0.0
	MIFPGA	YES	0.16	0.16	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-MOD-A-SE-S	Bootloader (A)	YES	1.03	1.03	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.14	0.14	0.0
	MIFPGA	YES	0.16	0.16	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC55-MPA-12T-S	MPAFPGA	YES	0.28	0.28	0.0
-----					
NC55-MPA-1TH2H-S	CFP2-D-DCO_2	NO	38.27397	38.27397	0.1
	CFP2-D10-DCO_2	NO	67.30726	67.30726	0.1
	CFP2-D15-DCO_2	NO	67.30726	67.30726	0.1
	CFP2-DE-DCO_2	NO	38.27397	38.27397	0.1
	CFP2-DETS-DCO_2	NO	38.27397	38.27397	0.1
	CFP2-DS-DCO_2	NO	38.27397	38.27397	0.1
	CFP2-DS100-DCO_2	NO	38.27397	38.27397	0.1
	MPAFPGA	YES	0.54	0.54	0.0
-----					
NC55-MPA-2TH-HX-S	CFP2-D-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-D-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-D10-DCO_0	NO	67.30726	67.30726	0.1
	CFP2-D10-DCO_1	NO	67.30726	67.30726	0.1
	CFP2-D15-DCO_0	NO	67.30726	67.30726	0.1
	CFP2-D15-DCO_1	NO	67.30726	67.30726	0.1
	CFP2-DE-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DE-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-DETS-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DETS-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-DS-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DS-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-DS100-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DS100-DCO_1	NO	38.27397	38.27397	0.1
	MPAFPGA	YES	0.54	0.54	0.0
-----					
NC55-MPA-2TH-S	CFP2-D-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-D-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-D10-DCO_0	NO	67.30726	67.30726	0.1
	CFP2-D10-DCO_1	NO	67.30726	67.30726	0.1
	CFP2-D15-DCO_0	NO	67.30726	67.30726	0.1
	CFP2-D15-DCO_1	NO	67.30726	67.30726	0.1
	CFP2-DE-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DE-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-DETS-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DETS-DCO_1	NO	38.27397	38.27397	0.1

	CFP2-DETS-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-DS-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DS-DCO_1	NO	38.27397	38.27397	0.1
	CFP2-DS100-DCO_0	NO	38.27397	38.27397	0.1
	CFP2-DS100-DCO_1	NO	38.27397	38.27397	0.1
	MPAFPGA	YES	0.54	0.54	0.0
NC55-MPA-4H-HD-S	MPAFPGA	YES	0.55	0.55	0.0
NC55-MPA-4H-HX-S	MPAFPGA	YES	0.54	0.54	0.0
NC55-MPA-4H-S	MPAFPGA	YES	0.54	0.54	0.0
NC55-OIP-2	CPLD-MPAFPGA	YES	2.00	2.00	0.0
	MPAFPGA	YES	4.09	4.09	0.0
NC55-OIP-4	MPAFPGA	YES	0.10	0.10	0.0
NC55-PWR-3KW-2HV	DT-LogicMCU (A)	NO	3.01	3.01	0.2
	DT-PrimCU (A)	NO	3.00	3.00	0.2
	DT-SecMCU (A)	NO	3.01	3.01	0.2
NC55-PWR-3KW-DC	DT-SecMCU (A)	NO	4.12	4.12	0.1
NC55-PWR-4.4KW-DC	QCS-LogicMCU (A)	NO	3.00	3.00	0.1
	QCS-PrimCU (A)	NO	3.00	3.00	0.1
	QCS-SecMCU (A)	NO	3.00	3.00	0.1
NC55-RP	Bootloader (A)	YES	9.31	9.31	0.0
	IOFPGA (A)	YES	0.09	0.09	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
NC55-RP-E	Bootloader (A)	YES	1.24	1.24	0.0
	IOFPGA (A)	YES	0.23	0.23	0.0
	OMGFPGA (A)	YES	0.61	0.61	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
NC55-RP-PROTO	Bootloader (A)	YES	9.31	9.31	0.0
	IOFPGA (A)	YES	0.06	0.06	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0

	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
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NC55-RP2-E	Bootloader (A)	YES	0.08	0.08	0.0
	IOFPGA (A)	YES	0.50	0.50	0.0
	OMGFPGA (A)	YES	0.52	0.52	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
	TimingIC-A	YES	7.216	7.216	0.0
	TimingIC-B-0	YES	7.216	7.216	0.0
	TimingIC-B-1	YES	7.216	7.216	0.0
-----					
NC55-SC	Bootloader (A)	YES	1.74	1.74	0.0
	IOFPGA (A)	YES	0.11	0.11	0.0
-----					
NC57-1600W-ACFW	PrimMCU-ACFW (A)	NO	1.02	1.02	0.0
	SecMCU-ACFW (A)	NO	1.07	1.07	0.0
-----					
NC57-1600W-DCFW	PrimMCU-DCFW (A)	NO	1.07	1.00	0.0
-----					
NC57-18DD-SE	Bootloader (A)	YES	1.03	1.03	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.22	0.22	0.0
	MIFPGA	YES	0.11	0.11	0.0
	QDD_BRT_FW_CO_P00	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P01	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P02	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P03	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P04	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P05	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P06	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P07	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P08	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P09	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P10	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P11	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P12	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P13	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P14	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P15	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P16	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P17	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P18	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P19	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P20	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P21	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P22	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P23	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P24	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P25	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P26	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P27	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P28	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P29	YES	70.130	70.130	0.0
	QDD_FW_CO_P00	YES	61.23	61.23	0.0

QDD_FW_CO_P01	YES	61.23	61.23	0.0
QDD_FW_CO_P02	YES	61.23	61.23	0.0
QDD_FW_CO_P03	YES	61.23	61.23	0.0
QDD_FW_CO_P04	YES	61.23	61.23	0.0
QDD_FW_CO_P05	YES	61.23	61.23	0.0
QDD_FW_CO_P06	YES	61.23	61.23	0.0
QDD_FW_CO_P07	YES	61.23	61.23	0.0
QDD_FW_CO_P08	YES	61.23	61.23	0.0
QDD_FW_CO_P09	YES	61.23	61.23	0.0
QDD_FW_CO_P10	YES	61.23	61.23	0.0
QDD_FW_CO_P11	YES	61.23	61.23	0.0
QDD_FW_CO_P12	YES	61.23	61.23	0.0
QDD_FW_CO_P13	YES	61.23	61.23	0.0
QDD_FW_CO_P14	YES	61.23	61.23	0.0
QDD_FW_CO_P15	YES	61.23	61.23	0.0
QDD_FW_CO_P16	YES	61.23	61.23	0.0
QDD_FW_CO_P17	YES	61.23	61.23	0.0
QDD_FW_CO_P18	YES	61.23	61.23	0.0
QDD_FW_CO_P19	YES	61.23	61.23	0.0
QDD_FW_CO_P20	YES	61.23	61.23	0.0
QDD_FW_CO_P21	YES	61.23	61.23	0.0
QDD_FW_CO_P22	YES	61.23	61.23	0.0
QDD_FW_CO_P23	YES	61.23	61.23	0.0
QDD_FW_CO_P24	YES	61.23	61.23	0.0
QDD_FW_CO_P25	YES	61.23	61.23	0.0
QDD_FW_CO_P26	YES	61.23	61.23	0.0
QDD_FW_CO_P27	YES	61.23	61.23	0.0
QDD_FW_CO_P28	YES	61.23	61.23	0.0
QDD_FW_CO_P29	YES	61.23	61.23	0.0
SATA-INTEL_240G(A)	NO	1132.00	1132.00	0.0
SATA-INTEL_480G(A)	NO	1132.00	1132.00	0.0
SATA-M500IT-MC(A)	NO	3.00	3.00	0.0
SATA-M500IT-MU-A(A)	NO	5.00	5.00	0.0
SATA-M500IT-MU-B(A)	NO	4.00	4.00	0.0
SATA-M5100(A)	NO	75.00	75.00	0.0
SATA-M600-MCT(A)	NO	5.00	5.00	0.0
SATA-M600-MU(A)	NO	6.00	6.00	0.0
SATA-Micron(A)	NO	1.00	1.00	0.0
SATA-SMART-128G(A)	NO	1241.00	1241.00	0.0

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NC57-24DD	Bootloader(A)	YES	1.03	1.03	0.0
	DBFPGA(A)	YES	0.14	0.14	0.0
	IOFPGA(A)	YES	0.23	0.23	0.0
	MIFPGA	YES	0.11	0.11	0.0
	QDD_BRT_FW_CO_P00	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P01	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P02	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P03	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P04	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P05	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P06	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P07	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P08	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P09	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P10	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P11	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P12	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P13	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P14	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P15	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P16	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P17	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P18	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P19	YES	70.130	70.130	0.0



QDD_BRT_FW_CO_P20	YES	70.130	70.130	0.0	
QDD_BRT_FW_CO_P21	YES	70.130	70.130	0.0	
QDD_BRT_FW_CO_P22	YES	70.130	70.130	0.0	
QDD_BRT_FW_CO_P23	YES	70.130	70.130	0.0	
QDD_FW_CO_P00	YES	61.23	61.23	0.0	
QDD_FW_CO_P01	YES	61.23	61.23	0.0	
QDD_FW_CO_P02	YES	61.23	61.23	0.0	
QDD_FW_CO_P03	YES	61.23	61.23	0.0	
QDD_FW_CO_P04	YES	61.23	61.23	0.0	
QDD_FW_CO_P05	YES	61.23	61.23	0.0	
QDD_FW_CO_P06	YES	61.23	61.23	0.0	
QDD_FW_CO_P07	YES	61.23	61.23	0.0	
QDD_FW_CO_P08	YES	61.23	61.23	0.0	
QDD_FW_CO_P09	YES	61.23	61.23	0.0	
QDD_FW_CO_P10	YES	61.23	61.23	0.0	
QDD_FW_CO_P11	YES	61.23	61.23	0.0	
QDD_FW_CO_P12	YES	61.23	61.23	0.0	
QDD_FW_CO_P13	YES	61.23	61.23	0.0	
QDD_FW_CO_P14	YES	61.23	61.23	0.0	
QDD_FW_CO_P15	YES	61.23	61.23	0.0	
QDD_FW_CO_P16	YES	61.23	61.23	0.0	
QDD_FW_CO_P17	YES	61.23	61.23	0.0	
QDD_FW_CO_P18	YES	61.23	61.23	0.0	
QDD_FW_CO_P19	YES	61.23	61.23	0.0	
QDD_FW_CO_P20	YES	61.23	61.23	0.0	
QDD_FW_CO_P21	YES	61.23	61.23	0.0	
QDD_FW_CO_P22	YES	61.23	61.23	0.0	
QDD_FW_CO_P23	YES	61.23	61.23	0.0	
SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0	
SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0	
SATA-M500IT-MC (A)	NO	3.00	3.00	0.0	
SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0	
SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0	
SATA-M5100 (A)	NO	75.00	75.00	0.0	
SATA-M600-MCT (A)	NO	5.00	5.00	0.0	
SATA-M600-MU (A)	NO	6.00	6.00	0.0	
SATA-Micron (A)	NO	1.00	1.00	0.0	
SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0	
-----					
NC57-36H-SE	Bootloader (A)	YES	1.03	1.03	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.05	0.05	0.0
	MIFPGA	YES	0.03	0.03	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC57-36H6D-S	Bootloader (A)	YES	0.02	0.02	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.47	0.47	0.0
	MIFPGA	YES	0.40	0.40	0.0
	QDD_BRT_FW_CO_P24	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P25	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P26	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P27	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P28	YES	70.130	70.130	0.0
	QDD_BRT_FW_CO_P29	YES	70.130	70.130	0.0

	QDD_BRT_FW_C0_P30	YES	70.130	70.130	0.0
	QDD_BRT_FW_C0_P31	YES	70.130	70.130	0.0
	QDD_BRT_FW_C0_P32	YES	70.130	70.130	0.0
	QDD_BRT_FW_C0_P33	YES	70.130	70.130	0.0
	QDD_BRT_FW_C0_P34	YES	70.130	70.130	0.0
	QDD_BRT_FW_C0_P35	YES	70.130	70.130	0.0
	QDD_FW_C0_P24	YES	61.23	61.23	0.0
	QDD_FW_C0_P25	YES	61.23	61.23	0.0
	QDD_FW_C0_P26	YES	61.23	61.23	0.0
	QDD_FW_C0_P27	YES	61.23	61.23	0.0
	QDD_FW_C0_P28	YES	61.23	61.23	0.0
	QDD_FW_C0_P29	YES	61.23	61.23	0.0
	QDD_FW_C0_P30	YES	61.23	61.23	0.0
	QDD_FW_C0_P31	YES	61.23	61.23	0.0
	QDD_FW_C0_P32	YES	61.23	61.23	0.0
	QDD_FW_C0_P33	YES	61.23	61.23	0.0
	QDD_FW_C0_P34	YES	61.23	61.23	0.0
	QDD_FW_C0_P35	YES	61.23	61.23	0.0
	SATA-INTEL_240G(A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G(A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC(A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A(A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B(A)	NO	4.00	4.00	0.0
	SATA-M5100(A)	NO	75.00	75.00	0.0
	SATA-M600-MCT(A)	NO	5.00	5.00	0.0
	SATA-M600-MU(A)	NO	6.00	6.00	0.0
	SATA-Micron(A)	NO	1.00	1.00	0.0
	SATA-SMART-128G(A)	NO	1241.00	1241.00	0.0
	TimingIC-A	YES	7.216	7.216	0.0
	TimingIC-B	YES	7.216	7.216	0.0
-----					
NC57-48Q2D-S	ALDRINFPGA(A)	YES	1.06	1.06	0.0
	Bootloader(A)	YES	1.00	1.00	0.0
	DBFPGA(A)	YES	0.14	0.14	0.0
	IOFPGA(A)	YES	0.105	0.105	0.0
	MIFPGA	YES	0.21	0.21	0.0
	SATA-INTEL_240G(A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G(A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC(A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A(A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B(A)	NO	4.00	4.00	0.0
	SATA-M5100(A)	NO	75.00	75.00	0.0
	SATA-M600-MCT(A)	NO	5.00	5.00	0.0
	SATA-M600-MU(A)	NO	6.00	6.00	0.0
	SATA-Micron(A)	NO	1.00	1.00	0.0
	SATA-SMART-128G(A)	NO	1241.00	1241.00	0.0
	TimingIC-A	YES	7.216	7.216	0.0
	TimingIC-B	YES	7.216	7.216	0.0
-----					
NC57-48Q2D-SE-S	ALDRINFPGA(A)	YES	1.06	1.06	0.0
	Bootloader(A)	YES	1.00	1.00	0.0
	DBFPGA(A)	YES	0.14	0.14	0.0
	IOFPGA(A)	YES	0.105	0.105	0.0
	MIFPGA	YES	0.21	0.21	0.0
	SATA-INTEL_240G(A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G(A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC(A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A(A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B(A)	NO	4.00	4.00	0.0
	SATA-M5100(A)	NO	75.00	75.00	0.0
	SATA-M600-MCT(A)	NO	5.00	5.00	0.0
	SATA-M600-MU(A)	NO	6.00	6.00	0.0
	SATA-Micron(A)	NO	1.00	1.00	0.0
	SATA-SMART-128G(A)	NO	1241.00	1241.00	0.0

	TimingIC-A	YES	7.216	7.216	0.0
	TimingIC-B	YES	7.216	7.216	0.0
-----					
NC57-MOD-RP2-E	Bootloader (A)	YES	0.14	0.14	0.0
	IOFPGA	YES	0.51	0.51	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
-----					
NC57-MOD-S	Bootloader (A)	YES	2.03	2.03	0.0
	DBFPGA (A)	YES	0.14	0.14	0.0
	IOFPGA (A)	YES	0.42	0.42	0.0
	MIFPGA	YES	0.18	0.18	0.0
	QDD_BRT_FW_C0_P08	YES	70.130	70.130	0.0
	QDD_BRT_FW_C0_P09	YES	70.130	70.130	0.0
	QDD_FW_C0_P08	YES	61.23	61.23	0.0
	QDD_FW_C0_P09	YES	61.23	61.23	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
	TimingIC-A	YES	7.216	7.216	0.0
	TimingIC-B	YES	7.216	7.216	0.0
-----					
NC57-MPA-12L-S	MPAFPGA	YES	0.28	0.28	0.0
-----					
NC57-MPA-1FH1D-S	CFP2-M25-DCO_1	NO	67.30726	67.30726	0.1
	MPAFPGA	YES	0.80	0.80	0.0
	QDD_BRT_FW_C1_P00	YES	70.130	70.130	0.0
	QDD_BRT_FW_C2_P00	YES	70.130	70.130	0.0
	QDD_BRT_FW_C3_P00	YES	70.130	70.130	0.0
	QDD_FW_C1_P00	YES	61.23	61.23	0.0
	QDD_FW_C2_P00	YES	61.23	61.23	0.0
	QDD_FW_C3_P00	YES	61.23	61.23	0.0
-----					
NC57-MPA-2D4H-S	MPAFPGA	YES	0.07	0.07	0.0
	QDD_FW_C1_P00	YES	61.23	61.23	0.0
	QDD_FW_C1_P01	YES	61.23	61.23	0.0
	QDD_FW_C1_P02	YES	61.23	61.23	0.0
	QDD_FW_C1_P03	YES	61.23	61.23	0.0
	QDD_FW_C2_P00	YES	61.23	61.23	0.0
	QDD_FW_C2_P01	YES	61.23	61.23	0.0
	QDD_FW_C2_P02	YES	61.23	61.23	0.0
	QDD_FW_C2_P03	YES	61.23	61.23	0.0
	QDD_FW_C3_P00	YES	61.23	61.23	0.0
	QDD_FW_C3_P01	YES	61.23	61.23	0.0
	QDD_FW_C3_P02	YES	61.23	61.23	0.0
	QDD_FW_C3_P03	YES	61.23	61.23	0.0
-----					
NCS-57C3-MOD-SYS	ALDRINFPGA (A)	YES	1.04	1.04	0.0
	Bootloader (A)	YES	0.16	0.16	0.0

DBFPGA (A)	YES	0.56	0.56	0.0
IOFPGA	YES	0.101	0.101	0.0
MIFPGA	YES	0.19	0.19	0.0
SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
SATA-M5100 (A)	NO	75.00	75.00	0.0
SATA-M600-MCT (A)	NO	5.00	5.00	0.0
SATA-M600-MU (A)	NO	6.00	6.00	0.0
SATA-Micron (A)	NO	1.00	1.00	0.0
SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
SSFP_E1F_0	NO	13.01	13.01	0.0
SSFP_E1F_1	NO	13.01	13.01	0.0
SSFP_E1F_10	NO	13.01	13.01	0.0
SSFP_E1F_11	NO	13.01	13.01	0.0
SSFP_E1F_12	NO	13.01	13.01	0.0
SSFP_E1F_13	NO	13.01	13.01	0.0
SSFP_E1F_14	NO	13.01	13.01	0.0
SSFP_E1F_15	NO	13.01	13.01	0.0
SSFP_E1F_16	NO	13.01	13.01	0.0
SSFP_E1F_17	NO	13.01	13.01	0.0
SSFP_E1F_18	NO	13.01	13.01	0.0
SSFP_E1F_19	NO	13.01	13.01	0.0
SSFP_E1F_2	NO	13.01	13.01	0.0
SSFP_E1F_20	NO	13.01	13.01	0.0
SSFP_E1F_21	NO	13.01	13.01	0.0
SSFP_E1F_22	NO	13.01	13.01	0.0
SSFP_E1F_23	NO	13.01	13.01	0.0
SSFP_E1F_24	NO	13.01	13.01	0.0
SSFP_E1F_25	NO	13.01	13.01	0.0
SSFP_E1F_26	NO	13.01	13.01	0.0
SSFP_E1F_27	NO	13.01	13.01	0.0
SSFP_E1F_28	NO	13.01	13.01	0.0
SSFP_E1F_29	NO	13.01	13.01	0.0
SSFP_E1F_3	NO	13.01	13.01	0.0
SSFP_E1F_30	NO	13.01	13.01	0.0
SSFP_E1F_31	NO	13.01	13.01	0.0
SSFP_E1F_32	NO	13.01	13.01	0.0
SSFP_E1F_33	NO	13.01	13.01	0.0
SSFP_E1F_34	NO	13.01	13.01	0.0
SSFP_E1F_35	NO	13.01	13.01	0.0
SSFP_E1F_36	NO	13.01	13.01	0.0
SSFP_E1F_37	NO	13.01	13.01	0.0
SSFP_E1F_38	NO	13.01	13.01	0.0
SSFP_E1F_39	NO	13.01	13.01	0.0
SSFP_E1F_4	NO	13.01	13.01	0.0
SSFP_E1F_40	NO	13.01	13.01	0.0
SSFP_E1F_41	NO	13.01	13.01	0.0
SSFP_E1F_42	NO	13.01	13.01	0.0
SSFP_E1F_43	NO	13.01	13.01	0.0
SSFP_E1F_44	NO	13.01	13.01	0.0
SSFP_E1F_45	NO	13.01	13.01	0.0
SSFP_E1F_46	NO	13.01	13.01	0.0
SSFP_E1F_47	NO	13.01	13.01	0.0
SSFP_E1F_5	NO	13.01	13.01	0.0
SSFP_E1F_6	NO	13.01	13.01	0.0
SSFP_E1F_7	NO	13.01	13.01	0.0
SSFP_E1F_8	NO	13.01	13.01	0.0
SSFP_E1F_9	NO	13.01	13.01	0.0
SSFP_OC3_STM1_0	NO	12.01	12.01	0.0
SSFP_OC3_STM1_1	NO	12.01	12.01	0.0
SSFP_OC3_STM1_10	NO	12.01	12.01	0.0

SSFP_OC3_STM1_11	NO	12.01	12.01	0.0
SSFP_OC3_STM1_12	NO	12.01	12.01	0.0
SSFP_OC3_STM1_13	NO	12.01	12.01	0.0
SSFP_OC3_STM1_14	NO	12.01	12.01	0.0
SSFP_OC3_STM1_15	NO	12.01	12.01	0.0
SSFP_OC3_STM1_16	NO	12.01	12.01	0.0
SSFP_OC3_STM1_17	NO	12.01	12.01	0.0
SSFP_OC3_STM1_18	NO	12.01	12.01	0.0
SSFP_OC3_STM1_19	NO	12.01	12.01	0.0
SSFP_OC3_STM1_2	NO	12.01	12.01	0.0
SSFP_OC3_STM1_20	NO	12.01	12.01	0.0
SSFP_OC3_STM1_21	NO	12.01	12.01	0.0
SSFP_OC3_STM1_22	NO	12.01	12.01	0.0
SSFP_OC3_STM1_23	NO	12.01	12.01	0.0
SSFP_OC3_STM1_24	NO	12.01	12.01	0.0
SSFP_OC3_STM1_25	NO	12.01	12.01	0.0
SSFP_OC3_STM1_26	NO	12.01	12.01	0.0
SSFP_OC3_STM1_27	NO	12.01	12.01	0.0
SSFP_OC3_STM1_28	NO	12.01	12.01	0.0
SSFP_OC3_STM1_29	NO	12.01	12.01	0.0
SSFP_OC3_STM1_3	NO	12.01	12.01	0.0
SSFP_OC3_STM1_30	NO	12.01	12.01	0.0
SSFP_OC3_STM1_31	NO	12.01	12.01	0.0
SSFP_OC3_STM1_32	NO	12.01	12.01	0.0
SSFP_OC3_STM1_33	NO	12.01	12.01	0.0
SSFP_OC3_STM1_34	NO	12.01	12.01	0.0
SSFP_OC3_STM1_35	NO	12.01	12.01	0.0
SSFP_OC3_STM1_36	NO	12.01	12.01	0.0
SSFP_OC3_STM1_37	NO	12.01	12.01	0.0
SSFP_OC3_STM1_38	NO	12.01	12.01	0.0
SSFP_OC3_STM1_39	NO	12.01	12.01	0.0
SSFP_OC3_STM1_4	NO	12.01	12.01	0.0
SSFP_OC3_STM1_40	NO	12.01	12.01	0.0
SSFP_OC3_STM1_41	NO	12.01	12.01	0.0
SSFP_OC3_STM1_42	NO	12.01	12.01	0.0
SSFP_OC3_STM1_43	NO	12.01	12.01	0.0
SSFP_OC3_STM1_44	NO	12.01	12.01	0.0
SSFP_OC3_STM1_45	NO	12.01	12.01	0.0
SSFP_OC3_STM1_46	NO	12.01	12.01	0.0
SSFP_OC3_STM1_47	NO	12.01	12.01	0.0
SSFP_OC3_STM1_5	NO	12.01	12.01	0.0
SSFP_OC3_STM1_6	NO	12.01	12.01	0.0
SSFP_OC3_STM1_7	NO	12.01	12.01	0.0
SSFP_OC3_STM1_8	NO	12.01	12.01	0.0
SSFP_OC3_STM1_9	NO	12.01	12.01	0.0
TimingIC-A	YES	23.112	23.112	0.0
TimingIC-B	YES	7.216	7.216	0.0

---

NCS-57C3-MODS-SYS	ALDRINFPGA (A)	YES	1.04	1.04	0.0
	Bootloader (A)	YES	0.16	0.16	0.0
	DBFPGA (A)	YES	0.56	0.56	0.0
	IOFPGA	YES	0.101	0.101	0.0
	MIFPGA	YES	0.19	0.19	0.0
	SATA-INTEL_240G (A)	NO	1132.00	1132.00	0.0
	SATA-INTEL_480G (A)	NO	1132.00	1132.00	0.0
	SATA-M500IT-MC (A)	NO	3.00	3.00	0.0
	SATA-M500IT-MU-A (A)	NO	5.00	5.00	0.0
	SATA-M500IT-MU-B (A)	NO	4.00	4.00	0.0
	SATA-M5100 (A)	NO	75.00	75.00	0.0
	SATA-M600-MCT (A)	NO	5.00	5.00	0.0
	SATA-M600-MU (A)	NO	6.00	6.00	0.0
	SATA-Micron (A)	NO	1.00	1.00	0.0
	SATA-SMART-128G (A)	NO	1241.00	1241.00	0.0
	SSFP_E1F_0	NO	13.01	13.01	0.0

SSFP_E1F_1	NO	13.01	13.01	0.0
SSFP_E1F_10	NO	13.01	13.01	0.0
SSFP_E1F_11	NO	13.01	13.01	0.0
SSFP_E1F_12	NO	13.01	13.01	0.0
SSFP_E1F_13	NO	13.01	13.01	0.0
SSFP_E1F_14	NO	13.01	13.01	0.0
SSFP_E1F_15	NO	13.01	13.01	0.0
SSFP_E1F_16	NO	13.01	13.01	0.0
SSFP_E1F_17	NO	13.01	13.01	0.0
SSFP_E1F_18	NO	13.01	13.01	0.0
SSFP_E1F_19	NO	13.01	13.01	0.0
SSFP_E1F_2	NO	13.01	13.01	0.0
SSFP_E1F_20	NO	13.01	13.01	0.0
SSFP_E1F_21	NO	13.01	13.01	0.0
SSFP_E1F_22	NO	13.01	13.01	0.0
SSFP_E1F_23	NO	13.01	13.01	0.0
SSFP_E1F_24	NO	13.01	13.01	0.0
SSFP_E1F_25	NO	13.01	13.01	0.0
SSFP_E1F_26	NO	13.01	13.01	0.0
SSFP_E1F_27	NO	13.01	13.01	0.0
SSFP_E1F_28	NO	13.01	13.01	0.0
SSFP_E1F_29	NO	13.01	13.01	0.0
SSFP_E1F_3	NO	13.01	13.01	0.0
SSFP_E1F_30	NO	13.01	13.01	0.0
SSFP_E1F_31	NO	13.01	13.01	0.0
SSFP_E1F_32	NO	13.01	13.01	0.0
SSFP_E1F_33	NO	13.01	13.01	0.0
SSFP_E1F_34	NO	13.01	13.01	0.0
SSFP_E1F_35	NO	13.01	13.01	0.0
SSFP_E1F_36	NO	13.01	13.01	0.0
SSFP_E1F_37	NO	13.01	13.01	0.0
SSFP_E1F_38	NO	13.01	13.01	0.0
SSFP_E1F_39	NO	13.01	13.01	0.0
SSFP_E1F_4	NO	13.01	13.01	0.0
SSFP_E1F_40	NO	13.01	13.01	0.0
SSFP_E1F_41	NO	13.01	13.01	0.0
SSFP_E1F_42	NO	13.01	13.01	0.0
SSFP_E1F_43	NO	13.01	13.01	0.0
SSFP_E1F_44	NO	13.01	13.01	0.0
SSFP_E1F_45	NO	13.01	13.01	0.0
SSFP_E1F_46	NO	13.01	13.01	0.0
SSFP_E1F_47	NO	13.01	13.01	0.0
SSFP_E1F_5	NO	13.01	13.01	0.0
SSFP_E1F_6	NO	13.01	13.01	0.0
SSFP_E1F_7	NO	13.01	13.01	0.0
SSFP_E1F_8	NO	13.01	13.01	0.0
SSFP_E1F_9	NO	13.01	13.01	0.0
SSFP_OC3_STM1_0	NO	12.01	12.01	0.0
SSFP_OC3_STM1_1	NO	12.01	12.01	0.0
SSFP_OC3_STM1_10	NO	12.01	12.01	0.0
SSFP_OC3_STM1_11	NO	12.01	12.01	0.0
SSFP_OC3_STM1_12	NO	12.01	12.01	0.0
SSFP_OC3_STM1_13	NO	12.01	12.01	0.0
SSFP_OC3_STM1_14	NO	12.01	12.01	0.0
SSFP_OC3_STM1_15	NO	12.01	12.01	0.0
SSFP_OC3_STM1_16	NO	12.01	12.01	0.0
SSFP_OC3_STM1_17	NO	12.01	12.01	0.0
SSFP_OC3_STM1_18	NO	12.01	12.01	0.0
SSFP_OC3_STM1_19	NO	12.01	12.01	0.0
SSFP_OC3_STM1_2	NO	12.01	12.01	0.0
SSFP_OC3_STM1_20	NO	12.01	12.01	0.0
SSFP_OC3_STM1_21	NO	12.01	12.01	0.0
SSFP_OC3_STM1_22	NO	12.01	12.01	0.0
SSFP_OC3_STM1_23	NO	12.01	12.01	0.0

SSFP_OC3_STM1_24	NO	12.01	12.01	0.0
SSFP_OC3_STM1_25	NO	12.01	12.01	0.0
SSFP_OC3_STM1_26	NO	12.01	12.01	0.0
SSFP_OC3_STM1_27	NO	12.01	12.01	0.0
SSFP_OC3_STM1_28	NO	12.01	12.01	0.0
SSFP_OC3_STM1_29	NO	12.01	12.01	0.0
SSFP_OC3_STM1_3	NO	12.01	12.01	0.0
SSFP_OC3_STM1_30	NO	12.01	12.01	0.0
SSFP_OC3_STM1_31	NO	12.01	12.01	0.0
SSFP_OC3_STM1_32	NO	12.01	12.01	0.0
SSFP_OC3_STM1_33	NO	12.01	12.01	0.0
SSFP_OC3_STM1_34	NO	12.01	12.01	0.0
SSFP_OC3_STM1_35	NO	12.01	12.01	0.0
SSFP_OC3_STM1_36	NO	12.01	12.01	0.0
SSFP_OC3_STM1_37	NO	12.01	12.01	0.0
SSFP_OC3_STM1_38	NO	12.01	12.01	0.0
SSFP_OC3_STM1_39	NO	12.01	12.01	0.0
SSFP_OC3_STM1_4	NO	12.01	12.01	0.0
SSFP_OC3_STM1_40	NO	12.01	12.01	0.0
SSFP_OC3_STM1_41	NO	12.01	12.01	0.0
SSFP_OC3_STM1_42	NO	12.01	12.01	0.0
SSFP_OC3_STM1_43	NO	12.01	12.01	0.0
SSFP_OC3_STM1_44	NO	12.01	12.01	0.0
SSFP_OC3_STM1_45	NO	12.01	12.01	0.0
SSFP_OC3_STM1_46	NO	12.01	12.01	0.0
SSFP_OC3_STM1_47	NO	12.01	12.01	0.0
SSFP_OC3_STM1_5	NO	12.01	12.01	0.0
SSFP_OC3_STM1_6	NO	12.01	12.01	0.0
SSFP_OC3_STM1_7	NO	12.01	12.01	0.0
SSFP_OC3_STM1_8	NO	12.01	12.01	0.0
SSFP_OC3_STM1_9	NO	12.01	12.01	0.0
TimingIC-A	YES	23.112	23.112	0.0
TimingIC-B	YES	7.216	7.216	0.0

This sample output is for **show hw-module fpd** command from the Admin mode:

```
sysadmin-vm:0_RP0# show hw-module fpd
```

```
Auto-upgrade:Enabled
```

```
Attribute codes: B golden, P protect, S secure, A Anti Theft aware
```

```
FPD Versions
```

```
=====
```

Location	Card type	HWver	FPD device	ATR	Status	Running	Programd	Reload	Loc
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	ADM1_Config		CURRENT	0.50	0.50		NOT REQ
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	ADM2_Config		CURRENT	0.50	0.50		NOT REQ
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	ADM3_Config		CURRENT	0.50	0.50		NOT REQ
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	IoFpga		CURRENT	0.09	0.09		0/RP0
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	IoFPgaGolden	B	CURRENT		0.08		0/RP0
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	Primary-BIOS	S	CURRENT	1.11	1.11		0/RP0
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	StdbbyFpga	S	CURRENT	0.24	0.24		0/RP0
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	StdbbyFpgaGolden	BS	CURRENT		0.24		0/RP0
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	TamFw	S	CURRENT	6.05	6.05		0/RP0
0/RP0/CPU0	NCS-57B1-5DSE-SYS	1.0	TamFwGolden	BS	CURRENT		6.05		0/RP0
0/PM0	PSU2KW-ACPI	0.0	PO-PrimMCU		CURRENT	1.03	1.03		NOT REQ
0/PM0	PSU2KW-ACPI	0.0	PO-SecMCU		CURRENT	1.13	1.13		NOT REQ
0/PM1	PSU2KW-ACPI	0.0	PO-PrimMCU		CURRENT	1.03	1.03		NOT REQ
0/PM1	PSU2KW-ACPI	0.0	PO-SecMCU		CURRENT	1.13	1.13		NOT REQ

## 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 4: Compatibility Matrix**

Cisco IOS XR	Crosswork	EPNM
Release 24.2.1	<a href="#">Crosswork Optimization Engine 6.0</a>	<a href="#">Evolved Programmable Network Manager 7.1.1</a>

## Important Notes

- The total number of bridge-domains (2\*BDs) and GRE tunnels put together should not exceed 1518. Here the number 1518 represents the multi-dimensional scale value.
- The offline diagnostics functionality is not supported in NCS 5500 platform. Therefore, the **hw-module service offline location** command will not work. However, you can use the **(sysadmin)# hw-module shutdown location** command to bring down the LC.
- The statistics collection may time out due to CPU overload during route churn. In such scenarios, statistics collection will resume when the CPU becomes available after the route churn is complete.

## 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](#).



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**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.

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## Supported Transceiver Modules

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

## Upgrading Cisco IOS XR Software

Cisco IOS XR Software is installed and activated from modular packages, allowing specific features or software patches to be installed, upgraded, or downgraded without affecting unrelated processes. Software packages can be upgraded or downgraded on all supported card types, or on a single card (node).

Before starting the software upgrade, use the **show install health** command in the admin mode. This command validates if the statuses of all relevant parameters of the system are ready for the software upgrade without interrupting the system.



**Note**

- If you use a TAR package to upgrade from a Cisco IOS XR release prior to 7.x, the output of the **show install health** command in admin mode displays the following error messages:

```
sysadmin-vm:0_RSP0# show install health
. . .
ERROR /install_repo/gl/xr -rw-r--r--. 1 8413 floppy 3230320 Mar 14 05:45 <platform>-isis-2.2.0.0-r702.x86_64
ERROR /install_repo/gl/xr -rwxr-x---. 1 8413 165 1485781 Mar 14 06:02 <platform>-k9sec-3.1.0.0-r702.x86_64
ERROR /install_repo/gl/xr -rw-r--r--. 1 8413 floppy 345144 Mar 14 05:45 <platform>-li-1.0.0.0-r702.x86_64
```

You can ignore these messages and proceed with the installation operation.

- Quad configurations will be lost when you perform a software downgrade on a NCS-55A1-48Q6H device from IOS XR Release 7.5.1 onwards to a release prior to IOS XR Release 7.5.1 due to non-backward compatibility change. The lost configuration can be applied manually after the downgrade.

**Note**

A quad is a group of four ports with common speeds, 1G/10G or 25G. You can configure the ports speed by using the **hw-module quad** command.

## 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.

## 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 NCS 5500 router documentation is located at the following URL:

<https://www.cisco.com/c/en/us/td/docs/iosxr/ios-xr.html>





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