Release Notes for Cisco Catalyst 9500 Series Switches, Cisco IOS XE Gibraltar 16.10.x

First Published: 2018-11-15

Release Notes for Cisco Catalyst 9500 Series Switches, Cisco IOS XE Gibraltar 16.10.x

Introduction

Cisco Catalyst 9500 Series Switches and Cisco Catalyst 9500 Series Switches - High Performance are Cisco's lead, fixed core and aggregation enterprise switching platforms. They have been purpose-built to address emerging trends of Security, IoT, Mobility, and Cloud.

They deliver complete convergence in terms of ASIC architecture with Unified Access Data Plane (UADP) 2.0 on Cisco Catalyst 9500 Series Switches and UADP 3.0 on Cisco Catalyst 9500 Series Switches - High Performance. The platform runs an Open Cisco IOS XE that supports model driven programmability. This series forms the foundational building block for SD-Access, which is Cisco’s lead enterprise architecture.

Note With the introduction of the High Performance models in the series, there may be differences in the supported and unsupported features, limitations, and caveats that apply to the Cisco Catalyst 9500 Series Switches and Cisco Catalyst 9500 Series Switches - High Performance models. Throughout this release note document, any such differences are expressly called out. If they are not, the information applies to all models in the series.

Whats New in Cisco IOS XE Gibraltar 16.10.1

Hardware Features in Cisco IOS XE Gibraltar 16.10.1

- Hardware Features Introduced on Cisco Catalyst 9500 Series Switches
- Hardware Features Introduced on Cisco Catalyst 9500 Series Switches-High Performance

Hardware Features Introduced on Cisco Catalyst 9500 Series Switches

(C9500-12Q, C9500-16X, C9500-24Q, C9500-40X)

Feature Name	Description and Documentation Link
Cisco 10GBASE SFP+ Modules • Cisco SFP-10G-LR-X module • Cisco SFP-10G-SR-X module	• Supported transceiver module product numbers—SFP-10G-LR-X, SFP-10G-SR-X • Compatible switch models— C9500-12Q (requires CVR-QSFP-SFP10G), C9500-16X, C9500-24Q (requires CVR-QSFP-SFP10G), C9500-40X • Compatible network modules—C9500-NM-8X, C9500-NM-2Q with CVR-QSFP-SFP10G. For information about the module, see the Cisco 10GBASE SFP+ Modules Data Sheet. For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix.
Cisco 40GBASE QSFP Modules	Supported transceiver module product number—QSFP-40G-CSR-S For information about the cable, see the Cisco 40GBASE QSFP Modules Data Sheet. For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix.
Support for Breakout Cables • QSFP-4X10G-AC7M • QSFP-4X10G-AC10M	• QSFP-4X10G-AC7M—Cisco 40GBASE-CR4 QSFP to 4 10GBASE-CU SFP+ direct-attach breakout cable. • QSFP-4X10G-AC10M—Cisco 40GBASE-CR4 QSFP to 4 10GBASE-CU SFP+ direct-attach breakout cable. For information about these breakout cables, see Cisco 40GBASE QSFP Modules Data Sheet. For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix. For related software configuration information, see Interface and Hardware Components → Configuring Interface Characteristics.
All interfaces on C9500-24Q are capable of breakout and support dual mode QSFP breakout configuration.	Starting with this release, all twenty-four ports of the C9500-24Q switch model support breakout cables. (Only the first twelve ports were supported in an earlier release). For related software configuration information, see Interface and Hardware Components → Configuring Interface Characteristics.

Hardware Features Introduced on Cisco Catalyst 9500 Series Switches-High Performance

(C9500-24Y4C, C9500-32C, C9500-32QC, and C9500-48Y4C)

Feature Name	Description and Documentation Link
Cisco 40GBASE QSFP Modules	Supported transceiver module product number—QSFP-40G-CSR-S For information about the cable, see the Cisco 40GBASE QSFP Modules Data Sheet. For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix.

Cisco QSFP 40-Gigabit Ethernet to SFP+ 10G Adapter Module (Cisco QSA Module)—CVR-QSFP-SFP10G	This module offers 10-GigabitEthernet and 1-GigabitEthernet connectivity for Quad Small Form-Factor Pluggable (QSFP)-only platforms by converting a QSFP port into an SFP or SFP+ port.
	
	Note 10-GigabitEthernet SFP+ support was introduced in an earlier release. Starting with this release 1-GigabitEthernet connectivity is also supported.
	
	• Supported adapter module product number—CVR-QSFP-SFP10G
	• Compatible transceiver modules:
	  • Cisco GLC-LH-SMD on Cisco CVR-QSFP-SFP10G
	  • Cisco GLC-SX-MMD on CVR-QSFP-SFP10G
	  • Cisco GLC-T and GLC-TE on CVR-QSFP-SFP10G
	• Compatible switch models—C9500-32C and C9500-32QC
	
	For information about the adapter, see the Cisco QSFP to SFP or SFP+ Adapter Module Data Sheet. For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix

Cisco DWDM-SFP10G-XX.XX modules on CVR-QSFP-SFP10G	• Supported transceiver module product number—Cisco SFP + DWDM-SFP10G-XX.XX suite of modules on CVR-QSFP-SFP10G • Compatible switch models—C9500-32C, C9500-32QC, C9500-48Y4C, C9500-24Y4C For information about the transceiver module, see Cisco 10GBASE Dense Wavelength-Division Multiplexing SFP+ Modules Data Sheet. For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix.

Feature Name	Description and Documentation Link
Support for Breakout Cables • Cisco QSFP-4SFP10G-CU • Cisco QSFP-4X10G-AC • Cisco QSFP-4X10G-AOC • Cisco QSFP-4x10G-LR-S • Cisco QSFP-4SFP25G-CUxM	• Supported breakout cables: • Cisco QSFP-4SFP10G-CU (0.5M 1M, 2M, 3M, 5M): QSFP to four SFP+ Copper breakout cables. • Cisco QSFP-4X10G-AC (7M, 10M): QSFP to four SFP+ passive optical breakout cables. • Cisco QSFP-4X10G-AOC (1M, 2M, 3M, 5M, 7M, 10M): QSFP to four SFP+ active optical breakout cables • Cisco QSFP-4x10G-LR-S to 10GBASE-LR - QSFP in 4x10G mode for interoperability with four 10GBASE-LR • Cisco QSFP-4SFP25G-CUxM: (1M, 2M, 3M, 5M): 100G QSFP to four SFP25G Copper Splitter Cables • Compatible switch models—C9500-32C For information about these breakout cables, see Cisco 40GBASE QSFP Modules Data Sheet and Cisco 100GBASE QSFP-100G Modules Data Sheet. For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix. For related software configuration information, see Interface and Hardware Components → Configuring Interface Characteristics.

Software Features in Cisco IOS XE Gibraltar 16.10.1

- Software Features Introduced on All Models
- Software Features Introduced on Cisco Catalyst 9500 Series Switches
- Software Features Introduced on Cisco Catalyst 9500 Series Switches-High Performance

Software Features Introduced on All Models

Feature Name	Description, Documentation Link and License Level Information
Border Gateway Protocol (BGP): • BGP-RT and VPN Distinguisher Attribute Rewrite Wildcard • BGP-VPN Distinguisher Attribute	These BGP features were introduced in this release: • BGP-RT and VPN Distinguisher Attribute Rewrite Wildcard—Introduces the ability to set a range of route target (RT) community attributes or virtual private network (VPN) distinguisher community attributes when mapping them. The VPN Distinguisher Attribute feature allows an administrator to map RTs to a VPN distinguisher that is carried using external Border Gateway Protocol (eBGP) and then mapped to RTs at an ingress Autonomous System Border Router (ASBR). See Routing → Configuring BGP-RT and VPN Distinguisher Attribute Rewrite Wildcard. • BGP-VPN Distinguisher Attribute—Enables a network administrator to keep source route targets (RTs) private from an Autonomous System Border Router (ASBR) in a destination autonomous system. An RT at an egress ASBR is mapped to a VPN distinguisher, the VPN distinguisher is carried through the eBGP, and then it is mapped to an RT at the ingress ASBR. See Routing → Configuring BGP-VPN Distinguisher Attribute. (Network Advantage)
Intermediate System to Intermediate System (IS-IS) Generic Cryptographic Authentication	IS-IS now supports Secure Hash Algorithm (SHA) authentication (SHA-1, SHA-256, SHA-384, and SHA-512), which is more secure than MD5 authentication or clear text authentication. See Routing → Configuring IS-IS Routing. (Network Advantage)
Media Access Control Security (MACsec): MACsec connection across intermediate switches	MACsec connections between end devices in a WAN MACsec deployment with intermediate switches as Catalyst 9000 Series Switches is supported. See Security → MACsec Encryption. 128-bit—(Network Essentials and Network Advantage) 256-bit—(Network Advantage)
Secure Shell File Transfer Protocol (SFTP)	Secure Shell (SSH) now includes support for SSH File Transfer Protocol (SFTP), a new standard file transfer protocol introduced in SSHv2. This feature provides a secure and authenticated method for copying device configuration or device image files. See Security → Configuring SSH File Transfer Protocol. (Network Essentials and Network Advantage)

Feature Name	Description, Documentation Link and License Level Information
Programmability • gNMI Wildcard Support • gNMI Namespace • Model Driven Telemetry - gRPC Dial-Out • YANG Data Models	These programmability features were introduced in the release: • gNMI Wildcard Support—Wildcard in gNMI XPaths are now allowed to be used to match all the elements of a node in the schema. GNMI utilizes wildcards for GET requests (now) and telemetry subscriptions (future) to collect all the data for a specified node. (Network Essentials and Network Advantage) • gNMI Namespace—gNMI protocol supports namesapces. Only valid RFC 7951-compliant prefixes are accepted or presented in either the JSON pointer or in the values of SET Request and GET Request. (Network Essentials and Network Advantage) • Model Driven Telemetry - gRPC Dial-Out—Expands existing Model Driven Telemetry capabilities with the addition of gRPC protocol support and Dial-Out (configured) telemetry subscriptions. (Network Essentials and Network Advantage) • YANG Data Models—For the list of Cisco IOS XE YANG models available with this release, navigate to https://github.com/YangModels/yang/tree/master/vendor/cisco/xe/16101. Revision statements embedded in the YANG files indicate if there has been a model revision. The README.md file in the same GitHub location highlights changes that have been made in the release. See → Programmability Configuration Guide, Cisco IOS XE Gibraltar 16.10.x.
New on the Web UI	• Spanning Tree Protocol (STP) in Layer 2 configuration—Provides path redundancy to build a loop-free topology for Ethernet networks. Security mechanisms like bridge protocol data units (BPDU) Guard and BPDU Filtering provide further protection by ensuring a more stable network. • VLAN Trunk Protocol (VTP)—Reduces administration in a switched network. When you configure a new VLAN on one VTP server, the VLAN is distributed through all switches in the domain. This reduces the need to configure the same VLAN everywhere.

Serviceability	
See → Command Reference, Cisco IOS XE Fuji 16.10.x (Catalyst 9500 Switches).	
debug commands	The **debug platform software fed switch active punt packet-capture** command was introduced. It enables debugging of packets during high CPU utilization.

Serviceability	
show logging commands	• The **show logging onboard switch uptime** command ws introduced. It displays a history of all reset reasons for all modules or switches in a system.
show processes commands	The **show processes platform**, **show processes cpu platform**, and **show processes cpu platform history** commands outputs were modified. The `size` columns in the outputs display the Resident Set Size (RSS) in KB.
show processes memory platform command	• **show processes memory platform** command was enhanced, the **accounting** keyword was added. • The **show processes memory platform**, **show processes memory platform location**, and **show processes memory platform sorted** commands were modified and the `Total` column was deleted from the output.
show tech-support	• The **show tech-support** command was modified to display the history of all reset reasons for all modules or switches in a system.

Software Features Introduced on Cisco Catalyst 9500 Series Switches

(C9500-12Q, C9500-16X, C9500-24Q, C9500-40X)

Feature Name	Description, Documentation Link and License Level Information
Graceful Insertion and Removal (GIR) Support for BGP	GIR is now supported for the BGP protocol. See High Availability → Configuring Graceful Insertion and Removal. (Network Advantage)
Password Authentication on USB 3.0 SSD	Enables you to configure security on a USB 3.0 SSD in order to protect the drive from unauthorized access and associated risks. See Interface and Hardware Components → Configuring USB 3.0 SSD. (Network Essentials and Network Advantage)

Feature Name	Description, Documentation Link and License Level Information
Security Enhanced (SE) Linux Permissive Mode	Makes it possible for the practical implementation of "principle of least privilege" by enforcing Mandatory Access Control (MAC) on the IOS-XE platform. SELinux provides the capability to define policies to control the access from an application process to any resource object, thereby allowing for the clear definition and confinement of process behavior. In this introductory release for the feature, operation in a permissive mode is available - with the intent of confining specific components (process or application) of the IOS-XE platform. In the permissive mode, access violation events are detected and system logs are generated, but the event or operation itself is not blocked. The solution operates mainly in an access violation detection mode. No user configuration is required for the feature. See Interface and Hardware Commands → show platform software audit. (Network Essentials and Network Advantage)

Serviceability	
See → Command Reference, Cisco IOS XE Fuji 16.10.x (Catalyst 9500 Switches).	
debug commands	• The debug ilpower command output was enhanced to display the power unit (mW). • The **debug platform condition feature multicast controlplane** command was introduced. It enables radioactive tracing for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) snooping features. • The **debug platform condition mac** command was introduced. It enables radioactive tracing for MAC learning. • The **debug platform rep** command was introduced. It enables debugging of Resilient Ethernet Protocol (REP) functions.
set platform commands	• The **set platform software nif-mgr switch** command was introduced. It sets the packet cache count per Cisco StackWise Virtual port. • The **set platform software fed switch** command was introduced. It sets the packet cache count per Cisco StackWise Virtual port.

Serviceability	

show ip bgp and **show ip bgp neighbor** commands	• **show ip bgp**
	  • The **bestpath-reason** keyword was introduced. This compares the best path with every other path and displays the reason why a path loses out to the best path.
	  • Command output was enhanced to display BGP path installation time stamp. This indicates the time at which the route's path was received from the neighbor.
	  • Command output was also enhanced to display the BGP Peak Prefix Watermark. These are peak watermarks and timestamps for the maximum number of route entries per neighbor.
	• **show ip bgp neighbor**
	  • Command output was enhanced to provide the time of soft inbound and outbound refresh.
	• For both **show ip bgp** and **show ip bgp neighbor** commands, the outputs were also enhanced to display the BGP Peak Prefix Watermark. These are peak watermarks and timestamps for the maximum number of route entries per neighbor.

Serviceability	
show platform commands	• The **show platform hardware fed switch forward interface** command was enhanced to trace packets across a stack and also trace packets captured in a PCAP file. • The **show platform hardware fed switch forward last summary** command was enhanced to display the details about all the copies of the packets and the corresponding outgoing ports. • The **show platform software fed switch** command was introduced. It displays the per port SDP/LMP control packet exchange history between FED and Network Interface Manager (NIF Mgr) software processes. • The **show platform software nif-mgr switch** command was introduced. It displays the control packet exchange history between the Network Interface Manager software process (NIF Mgr) and the StackWise Virtual Link (SVL) interfaces. • The **show platform software fed switch punt cause** command was introduced. It displays information about why the packets received on an interface are punted to the Router Processor (RP). • The **show platform software fed switch punt cpuq** command was introduced. It displays information about punt traffic on CPU queues. • The **show platform software fed switch punt rates interfaces** command was introduced. It displays the overall statistics of punt rate for all the interfaces. • The **show platform software fed punt cpuq rates** command was introduced. It displays the rate at which packets are punted, including the drops in the punted path. • The **show platform software fed switch punt packet-capture display** command was introduced. It displays packet information captured during high CPU utilization. • The **show platform integrity** command output was enhanced to display version information for individual packages in the software bundle.
show romvar command	The **show romvar** command was introduced. It displays all the ROMMON environment variables.

Serviceability	
show tech-support	• The **show tech-support acl** command was introduced. It displays access control list (ACL)-related information. • The **show tech-support bgp** command was enhanced to trigger various BGP show commands and log the outputs in the show tech file. • The **show tech-support diagnostic** command was introduced. It displays diagnostic information for technical support. • The **show tech-support platform** command was introduced. It displays detailed information about a platform. • The **show tech-support platform igmp_snooping** command was introduced. It displays Internet Group Management Protocol (IGMP) snooping information about a group. • The **show tech-support poe** command was introduced. It displays outputs of all the PoE-related troubleshooting commands. • The **show tech-support port** command output was updated. • The **show tech-support qos control-plane** command was introduced. It displays QoS-related information for the control-plane. • The **show tech-support qos** command was introduced. It displays the Quality of Service (QoS)-related information. • The **show tech-support stack** command was introduced. It displays all switch stack-related information.

Software Features Introduced on Cisco Catalyst 9500 Series Switches-High Performance

(C9500-24Y4C, C9500-32C, C9500-32QC, and C9500-48Y4C)

Feature Name	Description, Documentation Link and License Level Information
Breakout Support	Breakout cables enable a single 40G QSFP+ interface to be split into four 10G SFP+ interfaces and a single 100G QSFP28 interface into four 25G SFP28 interfaces. This feature is supported only on the C9500-32C model of the High Performance series . For information about the required software configuration and limitations, see the software configuration guide. See Interface and Hardware → Configuring Interface Characteristics. (Network Essentials and Network Advantage)

Feature Name	Description, Documentation Link and License Level Information
Cisco StackWise Virtual	Cisco StackWise Virtual is a network system virtualization technology that pairs two switches into one virtual switch to simplify operational efficiency with a single control and management plane. Starting with this release, the feature is supported on Cisco Catalyst 9500 Series Switches-High Performance. See High Availability → Configuring Cisco StackWise Virtual. (Network Advantage)
Encapsulated Remote Switched Port Analyzer (ERSPAN) • ERSPAN Type 2 - Truncation • ERSPAN Type 3 - Timestamp • ERSPAN Type 3 - Truncation	ERSPAN enables you to monitor traffic on ports or VLANs and to send monitored traffic to destination ports. Starting with this release, ERSPAN timestamp and truncation support, and the mtu ERSPAN monitor source session configuration mode command are introduced. See Network Management → Configuring ERSPAN. (DNA Advantage)
Layer 3 Subinterface	Layer 3 interfaces forward IPv4 and IPv6 packets to another device using static or dynamic routing protocols. You can use Layer 3 interfaces for IP routing and inter-VLAN routing of Layer 2 traffic. See VLAN → Configuring Layer 3 Subinterfaces. (Network Essentials and Network Advantage)
Virtual Extensible LAN (VXLAN) Border Gateway Protocol (BGP) Ethernet VPN (EVPN) (BGP EVPN with VxLAN)	VXLAN is a network overlay that allows layer 2 segments to be stretched across an IP core. All the benefits of layer 3 topologies are thereby available with VXLAN. The overlay protocol is VXLAN and BGP uses EVPN as the address family for communicating end host MAC and IP addresses. See Layer 2 → Configuring VXLAN BGP EVPN. (Network Advantage)

Important Notes

Cisco StackWise Virtual - Supported and Unsupported Features

(applies only to C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models)

When you enable Cisco StackWise Virtual on the device

- Layer 2, Layer 3, Security, Quality of Service, Multicast, Application, Monitoring and Management, Multiprotocol Label Switching, and High Availability are supported.

  Contact the Cisco Technical Support Centre for the specific list of features that are supported under each one of these technologies.

- Resilient Ethernet Protocol, Remote Switched Port Analyzer, and Sofware-Defined Access are NOT supported

Unsupported Features—All Models

- Bluetooth
- Bidirectional Protocol Independent Multicast (Bidir-PIM)
- IPsec VPN
- Performance Monitoring (PerfMon)
- Virtual Routing and Forwarding (VRF)-Aware web authentication

Unsupported Features—Cisco Catalyst 9500 Series Switches

- Border Gateway Protocol (BGP) Additional Paths
- Cisco TrustSec Network Device Admission Control (NDAC) on Uplinks
- Flexible NetFlow—NetFlow v5 Export Protocol, 4-byte (32-bit) AS Number Support, TrustSec NetFlow IPv4 Security Group Access Control List (SGACL) Deny and Drop Export
- Gateway Load Balancing Protocol (GLBP)
- Lawful Intercept (LI)
- Network-Powered Lighting (including COAP Proxy Server, 2-event Classification, Perpetual POE, Fast PoE)
- PIM Bidirectional Forwarding Detection (PIM BFD), PIM Snooping.
- Quality of Service—Classification (Layer 3 Packet Length, Time-to-Live (TTL)), per queue policer support, sharped profile enablement for egress per port queues, L2 Miss, Ingress Packet FIFO (IPF)
- Unicast over Point to Multipoint (P2MP) Generic Routing Encapsulation (GRE), Multicast over P2MP GRE.
- VLAN Translation—One-to-One Mapping

Unsupported Features—Cisco Catalyst 9500 Series Switches - High Performance

- Cisco Application Visibility and Control (AVC)
- Graceful Insertion and Removal (GIR)

- High Availability—In Service Software Upgrade (ISSU)
- MPLS Label Distribution Protocol (MPLS LDP) VRF-Aware Static Labels
- Next Generation Network-Based Application Recognition (NBAR) and Next Generation NBAR (NBAR2)
- QoS Options on GRE Tunnel Interfaces

Complete List of Supported Features

For the complete list of features supported on a platform, see the Cisco Feature Navigator at https://www.cisco.com/go/cfn.

When you search for the list of features by platform select

- CAT9500—to see all the features supported on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models
- CAT9500 HIGH PERFORMANCE (32C; 32QC; 48Y4C; 24Y4C)—to see all the features supported on the C9500-24Y4C, C9500-32C, C9500-32QC, and C9500-48Y4C models

Accessing Hidden Commands

Starting with Cisco IOS XE Fuji 16.8.1a, as an improved security measure, the way in which hidden commands can be accessed has changed.

Hidden commands have always been present in Cisco IOS XE, but were not equipped with CLI help. This means that entering enter a question mark (?) at the system prompt did not display the list of available commands. For information about CLI help, see Understanding the Help System. Such hidden commands are only meant to assist Cisco TAC in advanced troubleshooting and are therefore not documented.

Starting with Cisco IOS XE Fuji 16.8.1a, hidden commands are available under:

- Category 1—Hidden commands in privileged or User EXEC mode. Begin by entering the **service internal** command to access these commands.
- Category 2—Hidden commands in one of the configuration modes (global, interface and so on). These commands do not require the **service internal** command.

Further, the following applies to hidden commands under Category 1 and 2:

- The commands have CLI help. Entering enter a question mark (?) at the system prompt displays the list of available commands.

  Note: For Category 1, enter the service internal command before you enter the question mark; you do not have to do this for Category 2.

- The system generates a %PARSER-5-HIDDEN syslog message when the command is used. For example:

```
*Feb 14 10:44:37.917: %PARSER-5-HIDDEN: Warning!!! 'show processes memory old-header '
 is a hidden command.
Use of this command is not recommended/supported and will be removed in future.
```

Apart from category 1 and 2, there remain internal commands displayed on the CLI, for which the system does NOT generate the %PARSER-5-HIDDEN syslog message.

Important We recommend that you use any hidden command only under TAC supervision.

If you find that you are using a hidden command, open a TAC case for help with finding another way of collecting the same information as the hidden command (for a hidden EXEC mode command), or to configure the same functionality (for a hidden configuration mode command) using non-hidden commands.

Supported Hardware

Cisco Catalyst 9500 Series Switches—Model Numbers

The following table lists the supported hardware models and the default license levels they are delivered with. For more information about the available license levels, see section *License Levels*.

Base PIDs are the model numbers of the switch.

Bundled PIDs indicate the orderable part numbers for base PIDs that are bundled with a particular network module. Entering the **show version**, **show module**, or **show inventory** commands on such a switch (bundled PID), displays its base PID.

Table 1: Cisco Catalyst 9500 Series Switches

Switch Model	Default License Level[1]	Description
Base PIDs		
C9500-12Q-E	Network Essentials	12 40-Gigabit Ethernet QSFP+ ports and two power supply slots
C9500-12Q-A	Network Advantage	
C9500-16X-E	Network Essentials	16 1/10-Gigabit Ethernet SFP/SFP+ ports and two power supply slots
C9500-16X-A	Network Advantage	
C9500-24Q-E	Network Essentials	24-Port 40-Gigabit Ethernet QSFP+ ports and two power supply slots
C9500-24Q-A	Network Advantage	
C9500-40X-E	Network Essentials	40 1/10-Gigabit Ethernet SFP/SFP+ ports and two power supply slots
C9500-40X-A	Network Advantage	
Bundled PIDs		
C9500-16X-2Q-E	Network Essentials	16 10-Gigabit Ethernet SFP+ port switch and a 2-Port 40-Gigabit Ethernet (QSFP) network module on uplink ports
C9500-16X-2Q-A	Network Advantage	
C9500-24X-E	Network Essentials	16 10-Gigabit Ethernet SFP+ port switch and an 8-Port 10-Gigabit Ethernet (SFP) network module on uplink ports
C9500-24X-A	Network Advantage	

Switch Model	Default License Level[1]	Description
C9500-40X-2Q-E	Network Essentials	40 10-Gigabit Ethernet SFP+ port switch and a 2-Port 40-Gigabit Ethernet (QSFP) network module on uplink ports
C9500-40X-2Q-A	Network Advantage	
C9500-48X-E	Network Essentials	40 10-Gigabit Ethernet SFP+ port switch and an 8-Port 10-Gigabit Ethernet (SFP) network module on uplink ports
C9500-48X-A	Network Advantage	

[1] See section *Licensing → Table: Permitted Combinations*, in this document for information about the add-on licenses that you can order.

Table 2: Cisco Catalyst 9500 Series Switches-High Performance

Switch Model	Default License Level[2]	Description
C9500-24Y4C-E	Network Essentials	24 SFP28 ports that support 1/10/25-GigabitEthernet connectivity, four QSFP uplink ports that support 100/40-GigabitEthernet connectivity; two power supply slots.
C9500-24Y4C-A	Network Advantage	
C9500-32C-E	Network Essentials	32 QSFP28 ports that support 40/100 GigabitEthernet connectivity; two power supply slots.
C9500-32C-A	Network Advantage	
C9500-32QC-E	Network Essentials	32 QSFP28 ports, where you can have 24 ports that support 40-GigabitEthernet connectivity and 4 ports that support 100-GigabitEthernet connectivity, OR 32 ports that support 40-GigabitEthernet connectivity, OR 16 ports that support 100-GigabitEthernet connectivity; two power supply slots.
C9500-32QC-A	Network Advantage	
C9500-48Y4C-E	Network Essentials	48 SFP28 ports that support 1/10/25-GigabitEthernet connectivity; four QSFP uplink ports that supports up to 100/40-GigabitEthernet connectivity; two power supply slots.
C9500-48Y4C-A	Network Advantage	

[2] See section *Licensing → Table: Permitted Combinations*, in this document for information about the add-on licenses that you can order.

Network Modules

The following table lists optional network modules for uplink ports available with some configurations .

Network Module	Description
C9500-NM-8X	Cisco Catalyst 9500 Series Network Module 8-port 1/10 Gigabit Ethernet with SFP/SFP+ Note the supported switch models (Base PIDs): • C9500-40X • C9500-16X
C9500-NM-2Q	Cisco Catalyst 9500 Series Network Module 2-port 40 Gigabit Ethernet with QSFP+ Note the supported switch models (Base PIDs): • C9500-40X • C9500-16X

Optics Modules

Cisco Catalyst Series Switches support a wide range of optics and the list of supported optics is updated on a regular basis. Use the Transceiver Module Group (TMG) Compatibility Matrix tool, or consult the tables at this URL for the latest transceiver module compatibility information: https://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html

Compatibility Matrix

The following table provides software compatibility information between Cisco Catalyst 9500 Series Switches, Cisco Identity Services Engine, Cisco Access Control Server, and Cisco Prime Infrastructure.

Catalyst 9500, 9500-High Performance and 9500X	Cisco Identity Services Engine	Cisco Access Control Server	Cisco Prime Infrastructure
Gibraltar 16.10.1	2.3 Patch 1 2.4 Patch 1	5.4 5.5	PI 3.4 + PI 3.4 latest maintenance release + PI 3.4 latest device pack See Cisco Prime Infrastructure 3.4→ **Downloads**.
Fuji 16.9.8	2.5 2.1	5.4 5.5	PI 3.9 + PI 3.9 latest maintenance release + PI 3.9 latest device pack See Cisco Prime Infrastructure 3.9 → **Downloads**.

Catalyst 9500, 9500-High Performance and 9500X	Cisco Identity Services Engine	Cisco Access Control Server	Cisco Prime Infrastructure
Fuji 16.9.7	2.5 2.1	5.4 5.5	PI 3.9 + PI 3.9 latest maintenance release + PI 3.9 latest device pack See Cisco Prime Infrastructure 3.9 → **Downloads**.
Fuji 16.9.6	2.3 Patch 1 2.4 Patch 1	5.4 5.5	PI 3.4 + PI 3.4 latest maintenance release + PI 3.4 latest device pack See Cisco Prime Infrastructure 3.4→ **Downloads**.
Fuji 16.9.5	2.3 Patch 1 2.4 Patch 1	5.4 5.5	PI 3.4 + PI 3.4 latest maintenance release + PI 3.4 latest device pack See Cisco Prime Infrastructure 3.4→ **Downloads**.
Fuji 16.9.4	2.3 Patch 1 2.4 Patch 1	5.4 5.5	PI 3.4 + PI 3.4 latest maintenance release + PI 3.4 latest device pack See Cisco Prime Infrastructure 3.4→ **Downloads**.
Fuji 16.9.3	2.3 Patch 1 2.4 Patch 1	5.4 5.5	PI 3.4 + PI 3.4 latest maintenance release + PI 3.4 latest device pack See Cisco Prime Infrastructure 3.4→ **Downloads**.
Fuji 16.9.2	2.3 Patch 1 2.4 Patch 1	5.4 5.5	PI 3.4 + PI 3.4 latest maintenance release + PI 3.4 latest device pack See Cisco Prime Infrastructure 3.4→ **Downloads**.
Fuji 16.9.1	2.3 Patch 1 2.4 Patch 1	5.4 5.5	PI 3.4 + PI 3.4 latest device pack See Cisco Prime Infrastructure 3.4→ **Downloads**.
Fuji 16.8.1a	2.3 Patch 1 2.4	5.4 5.5	PI 3.3 + PI 3.3 latest maintenance release + PI 3.3 latest device pack See Cisco Prime Infrastructure 3.3→ **Downloads**.
Everest 16.6.4a	2.2 2.3	5.4 5.5	PI 3.1.6 + Device Pack 13 See Cisco Prime Infrastructure 3.1 → **Downloads**.

Catalyst 9500, 9500-High Performance and 9500X	Cisco Identity Services Engine	Cisco Access Control Server	Cisco Prime Infrastructure
Everest 16.6.4	2.2 2.3	5.4 5.5	PI 3.1.6 + Device Pack 13 See Cisco Prime Infrastructure 3.1 → **Downloads**.
Everest 16.6.3	2.2 2.3	5.4 5.5	PI 3.1.6 + Device Pack 13 See Cisco Prime Infrastructure 3.1 → **Downloads**
Everest 16.6.2	2.2 2.3	5.4 5.5	PI 3.1.6 + Device Pack 13 See Cisco Prime Infrastructure 3.1 → **Downloads**
Everest 16.6.1	2.2	5.4 5.5	PI 3.1.6 + Device Pack 13 See Cisco Prime Infrastructure 3.1 → **Downloads**
Everest 16.5.1a	2.1 Patch 3	5.4 5.5	-

Web UI System Requirements

The following subsections list the hardware and software required to access the Web UI:

Minimum Hardware Requirements

Processor Speed	DRAM	Number of Colors	Resolution	Font Size
233 MHz minimum[3]	512 MB[4]	256	1280 x 800 or higher	Small

[3] We recommend 1 GHz
[4] We recommend 1 GB DRAM

Software Requirements

Operating Systems

- Windows 10 or later
- Mac OS X 10.9.5 or later

Browsers

- Google Chrome—Version 59 or later (On Windows and Mac)

- Microsoft Edge
- Mozilla Firefox—Version 54 or later (On Windows and Mac)
- Safari—Version 10 or later (On Mac)

Upgrading the Switch Software

This section covers the various aspects of upgrading or downgrading the device software.

Note You cannot use the Web UI to install, upgrade, or downgrade device software.

Finding the Software Version

The package files for the Cisco IOS XE software are stored on the system board flash device (flash:).

You can use the **show version** privileged EXEC command to see the software version that is running on your switch.

Note Although the **show version** output always shows the software image running on the switch, the model name shown at the end of this display is the factory configuration and does not change if you upgrade the software license.

You can also use the **dir** *filesystem:* privileged EXEC command to see the directory names of other software images that you might have stored in flash memory.

Software Images

Release	Image Type	File Name
Cisco IOS XE Gibraltar 16.10.1	CAT9K_IOSXE	cat9k_iosxe.16.10.01.SPA.bin
	Licensed Data Payload Encryption (LDPE)	cat9k_iosxeldpe.16.10.01.SPA

Automatic Boot Loader Upgrade

When you upgrade from the existing release on your switch to a later or newer release for the first time, the boot loader may be automatically upgraded, based on the hardware version of the switch. If the boot loader is automatically upgraded, it will take effect on the next reload. If you go back to the older release after this, the boot loader is not downgraded. The updated boot loader supports all previous releases.

For subsequent Cisco IOS XE Everest 16.x.x, or Cisco IOS XE Fuji 16.x.x releases, if there is a new bootloader in that release, it may be automatically upgraded based on the hardware version of the switch when you boot up your switch with the new image for the first time.

Caution Do not power cycle your switch during the upgrade.

Scenario	Automatic Boot Loader Response

If you boot Cisco IOS XE Gibraltar 16.10.1 first time	On Cisco Catalyst 9500 Series Switches, the boot loader may be upgraded to version 16.10.1r [FC1]. For example:
	`ROM: IOS-XE ROMMON`
	`BOOTLDR: System Bootstrap, Version 16.10.1r[FC1], RELEASE SOFTWARE (P)`
	On Cisco Catalyst 9500 Series Switches - High Performance, the boot loader may be upgraded to version 16.10.1r [FC2]. For example:
	`ROM: IOS-XE ROMMON`
	`BOOTLDR: System Bootstrap, Version 16.10.1r[FC2], RELEASE SOFTWARE (P)`
	If the automatic boot loader upgrade occurs, while booting, you will see the following on the console:
	`!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!`
	`%IOSXEBOOT-4-BOOTLOADER_UPGRADE: (rp/0): ### Thu Jul 5 18:03:28 Universal 2018 PLEASE DO NOT POWER CYCLE`
	`### BOOT LOADER UPGRADING`
	`waiting for upgrades to complete...`

Software Installation Commands

Summary of Software Installation Commands Supported starting from Cisco IOS XE Everest 16.6.2 and later releases	
To install and activate the specified file, and to commit changes to be persistent across reloads: **`install add file`** *`filename`* [**`activate commit`**] To separately install, activate, commit, cancel, or remove the installation file: **`install ?`**	
add file tftp: *filename*	Copies the install file package from a remote location to the device and performs a compatibility check for the platform and image versions.
activate [**auto-abort-timer**]	Activates the file, and reloads the device. The **auto-abort-timer** keyword automatically rolls back image activation.
commit	Makes changes persistent over reloads.
rollback to committed	Rolls back the update to the last committed version.
abort	Cancels file activation, and rolls back to the version that was running before the current installation procedure started.
remove	Deletes all unused and inactive software installation files.

Note The **request platform software** commands are deprecated starting from Cisco IOS XE Gibraltar 16.10.1. The commands are visible on the CLI in this release and you can configure them, but we recommend that you use the **install** commands to upgrade or downgrade.

Summary of request platform software Commands **Note** **This table of commands is not supported on Cisco Catalyst 9500 Series Switches - High Performance.**	
`Device# request platform software package ?`	
clean	Cleans unnecessary package files from media
copy	Copies package to media
describe	Describes package content
expand	Expands all-in-one package to media
install	Installs the package
uninstall	Uninstalls the package
verify	Verifies In Service Software Upgrade (ISSU) software package compatibility

Upgrading in Install Mode

Follow these instructions to upgrade from one release to another, in install mode.

Before you begin

Note that you can use this procedure for the following upgrade scenarios:

When upgrading from ...	Use these commands...	To upgrade to...
Cisco IOS XE Everest 16.5.1a or Cisco IOS XE Everest 16.6.1	Only **request platform software** commands	Cisco IOS XE Gibraltar 16.10.1
Cisco IOS XE Everest 16.6.2 and later	On Cisco Catalyst 9500 Series Switches either **install** commands or **request platform software** commands On Cisco Catalyst 9500 Series Switches - High Performance[5], only **install** commands	

[5] Introduced in Cisco IOS XE Fuji 16.8.1a

The sample output in this section displays upgrade from

- Cisco IOS XE Everest 16.5.1a to Cisco IOS XE Gibraltar 16.10.1 using **request platform software** commands.

- Cisco IOS XE Everest 16.6.3 to Cisco IOS XE Gibraltar 16.10.1 using **install** commands.

Procedure

Step 1 Clean Up

Ensure that you have at least 1GB of space in flash to expand a new image. Clean up old installation files in case of insufficient space.

- **request platform software package clean**
- **install remove inactive**

The following sample output displays the cleaning up of unused files, by using the **request platform software package clean** command for upgrade scenario Cisco IOS XE Everest 16.5.1a to Cisco IOS XE Gibraltar 16.10.1.

```
Switch# request platform software package clean
Running command on switch 1
Cleaning up unnecessary package files
No path specified, will use booted path flash:packages.conf
Cleaning flash:
Scanning boot directory for packages ... done.
Preparing packages list to delete ...
cat9k-cc_srdriver.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-espbase.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-guestshell.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-rpbase.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-rpboot.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-sipbase.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-sipspa.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-srdriver.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-webui.16.05.01a.SPA.pkg
File is in use, will not delete.
cat9k-wlc.16.05.01a.SPA.pkg
File is in use, will not delete.
packages.conf
File is in use, will not delete.
done.

The following files will be deleted:
[1]:
/flash/cat9k-cc_srdriver.16.06.01..SPA.pkg
/flash/cat9k-espbase.16.06.01.SPA.pkg
/flash/cat9k-guestshell.16.06.01.SPA.pkg
/flash/cat9k-rpbase.16.06.01.SPA.pkg
/flash/cat9k-rpboot.16.06.01.SPA.pkg
/flash/cat9k-sipbase.16.06.01.SPA.pkg
/flash/cat9k-sipspa.16.06.01.SPA.pkg
/flash/cat9k-srdriver.16.06.01.SPA.pkg
/flash/cat9k-webui.16.06.01.SPA.pkg
/flash/cat9k_iosxe.16.05.01a.SPA.conf
/flash/cat9k_iosxe.16.06.01.SPA.bin
```

```
/flash/packages.conf.00-

Do you want to proceed? [y/n]y
[1]:
Deleting file flash:cat9k-cc_srdriver.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-espbase.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-guestshell.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-rpbase.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-rpboot.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-sipbase.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-sipspa.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-srdriver.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k-webui.16.06.01.SPA.pkg ... done.
Deleting file flash:cat9k_iosxe.16.05.01a.SPA.conf ... done.
Deleting file flash:cat9k_iosxe.16.06.01.SPA.bin ... done.
Deleting file flash:packages.conf.00- ... done.
SUCCESS: Files deleted.
Switch#
```

The following sample output displays the cleaning up of unused files, by using the **install remove inactive** command, for upgrade scenario Cisco IOS XE Everest 16.6.3 to Cisco IOS XE Gibraltar 16.10.1:

```
Switch# install remove inactive

install_remove: START Wed Oct 31 19:51:48 UTC 2017
Cleaning up unnecessary package files
Scanning boot directory for packages ... done.
Preparing packages list to delete ...
done.

The following files will be deleted:
[switch 1]:
/flash/cat9k-cc_srdriver.16.06.03.SPA.pkg
/flash/cat9k-espbase.16.06.03.SPA.pkg
/flash/cat9k-guestshell.16.06.03.SPA.pkg
/flash/cat9k-rpbase.16.06.03.SPA.pkg
/flash/cat9k-rpboot.16.06.03.SPA.pkg
/flash/cat9k-sipbase.16.06.03.SPA.pkg
/flash/cat9k-sipspa.16.06.03.SPA.pkg
/flash/cat9k-srdriver.16.06.03.SPA.pkg
/flash/cat9k-webui.16.06.03.SPA.pkg
/flash/cat9k-wlc.16.06.03.SPA.pkg
/flash/packages.conf

Do you want to remove the above files? [y/n]y
[switch 1]:
Deleting file flash:cat9k-cc_srdriver.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-espbase.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-guestshell.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-rpbase.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-rpboot.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-sipbase.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-sipspa.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-srdriver.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-webui.16.06.03.SPA.pkg ... done.
Deleting file flash:cat9k-wlc.16.06.03.SPA.pkg ... done.
Deleting file flash:packages.conf ... done.
SUCCESS: Files deleted.
--- Starting Post_Remove_Cleanup ---
Performing Post_Remove_Cleanup on all members
[1] Post_Remove_Cleanup package(s) on switch 1
[1] Finished Post_Remove_Cleanup on switch 1
Checking status of Post_Remove_Cleanup on [1]
```

```
Post_Remove_Cleanup: Passed on [1]
Finished Post_Remove_Cleanup

SUCCESS: install_remove Wed Oct 31 19:52:25 UTC 2018
Switch#
```

Step 2 Copy new image to flash

a) **copy tftp: flash:**

Use this command to copy the new image to flash: (or skip this step if you want to use the new image from your TFTP server)

```
Switch# copy tftp://10.8.0.6//cat9k_iosxe.16.10.01.SPA.bin flash:

Destination filename [cat9k_iosxe.16.10.01.SPA.bin]?
Accessing tftp://10.8.0.6//cat9k_iosxe.16.10.01.SPA.bin...
Loading /cat9k_iosxe.16.10.01.SPA.bin from 10.8.0.6 (via GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 601216545 bytes]

601216545 bytes copied in 50.649 secs (11870255 bytes/sec)
```

b) **dir flash**

Use this command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

Directory of flash:/

434184 -rw- 601216545 Oct 31 2018 10:18:11 -07:00 cat9k_iosxe.16.10.01.SPA.bin
11353194496 bytes total (8976625664 bytes free)
```

Step 3 Set boot variable

a) **boot system flash:packages.conf**

Use this command to set the boot variable to **flash:packages.conf**.

```
Switch(config)# boot system flash:packages.conf
Switch(config)# exit
```

b) **write memory**

Use this command to save boot settings.

```
Switch# write memory
```

c) **show boot system**

Use this command to verify the boot variable is set to **flash:packages.conf**.

The output should display **BOOT variable** = **flash:packages.conf**.

```
Switch# show boot system
```

Step 4 Software install image to flash

- **request platform software package install**
- **install add file activate commit**

The following sample output displays installation of the Cisco IOS XE Gibraltar 16.10.1 software image to flash, by using the **request platform software package install** command, for upgrade scenario Cisco IOS XE Everest 16.5.1a to Cisco IOS XE Gibraltar 16.10.1.

```
Switch# request platform software package install switch all file
flash:cat9k_iosxe.16.10.01.SPA.bin

--- Starting install local lock acquisition on switch 1 ---
Finished install local lock acquisition on switch 1

Expanding image file: flash:cat9k_iosxe.16.10.01.SPA.bin
[]: Finished copying to switch
[1]: Expanding file
[1]: Finished expanding all-in-one software package in switch 1
SUCCESS: Finished expanding all-in-one software package.
[1]: Performing install
SUCCESS: install finished
[1]: install package(s) on switch 1
--- Starting list of software package changes ---
Old files list:
Removed cat9k-cc_srdriver.16.05.01a.SPA.pkg
Removed cat9k-espbase.16.05.01a.SPA.pkg
Removed cat9k-guestshell.16.05.01a.SPA.pkg
Removed cat9k-rpbase.16.05.01a.SPA.pkg
Removed cat9k-rpboot.16.05.01a.SPA.pkg
Removed cat9k-sipbase.16.05.01a.SPA.pkg
Removed cat9k-sipspa.16.05.01a.SPA.pkg
Removed cat9k-srdriver.16.05.01a.SPA.pkg
Removed cat9k-webui.16.05.01a.SPA.pkg
Removed cat9k-wlc.16.05.01a.SPA.pkg
New files list:
Added cat9k-cc_srdriver.16.10.01.SPA.pkg
Added cat9k-espbase.16.10.01.SPA.pkg
Added cat9k-guestshell.16.10.01.SPA.pkg
Added cat9k-rpbase.16.10.01.SPA.pkg
Added cat9k-rpboot.16.10.01.SPA.pkg
Added cat9k-sipbase.16.10.01.SPA.pkg
Added cat9k-sipspa.16.10.01.SPA.pkg
Added cat9k-srdriver.16.10.01.SPA.pkg
Added cat9k-webui.16.10.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned. New software will load on reboot.
[1]: Finished install successful on switch 1
Checking status of install on [1]
[1]: Finished install in switch 1
SUCCESS: Finished install: Success on [1]
```

Note Old files listed in the logs are not removed from flash.

The following sample output displays installation of the Cisco IOS XE Gibraltar 16.10.1 software image to flash, by using the **install add file activate commit** command, for upgrade scenario Cisco IOS XE Everest 16.6.3 to Cisco IOS XE Gibraltar 16.10.1:

```
Switch# install add file flash:cat9k_iosxe.16.10.01.SPA.bin activate commit

install_add_activate_commit: START Wed Oct 31 19:54:51 UTC 2018

System configuration has been modified.
Press Yes(y) to save the configuration and proceed.
Press No(n) for proceeding without saving the configuration.
Press Quit(q) to exit, you may save configuration and re-enter the command. [y/n/q]yBuilding
 configuration...
```

```
[OK]Modified configuration has been saved

*Oct 31 19:54:55.633: %IOSXE-5-PLATFORM: Switch 1 R0/0: Oct 31 19:54:55 install_engine.sh:

%INSTALL-5-INSTALL_START_INFO: Started install one-shot
flash:cat9k_iosxe.16.10.01.SPA.bininstall_add_activate_commit: Adding PACKAGE

This operation requires a reload of the system. Do you want to proceed?
Please confirm you have changed boot config to flash:packages.conf [y/n]y

--- Starting initial file syncing ---
Info: Finished copying flash:cat9k_iosxe.16.10.01.SPA.bin to the selected switch(es)
Finished initial file syncing

--- Starting Add ---
Performing Add on all members
[1] Add package(s) on switch 1
[1] Finished Add on switch 1
Checking status of Add on [1]
Add: Passed on [1]
Finished Add

install_add_activate_commit: Activating PACKAGE
Following packages shall be activated:
/flash/cat9k-wlc.16.10.01.SPA.pkg
/flash/cat9k-webui.16.10.01.SPA.pkg
/flash/cat9k-srdriver.16.10.01.SPA.pkg
/flash/cat9k-sipspa.16.10.01.SPA.pkg
/flash/cat9k-sipbase.16.10.01.SPA.pkg
/flash/cat9k-rpboot.16.10.01.SPA.pkg
/flash/cat9k-rpbase.16.10.01.SPA.pkg
/flash/cat9k-guestshell.16.10.01.SPA.pkg
/flash/cat9k-espbase.16.10.01.SPA.pkg
/flash/cat9k-cc_srdriver.16.10.01.SPA.pkg

This operation requires a reload of the system. Do you want to proceed? [y/n]y
--- Starting Activate ---
Performing Activate on all members
[1] Activate package(s) on switch 1
[1] Finished Activate on switch 1
Checking status of Activate on [1]
Activate: Passed on [1]
Finished Activate

--- Starting Commit ---
Performing Commit on all members

*Oct 31 19:57:41.145: %IOSXE-5-PLATFORM: Switch 1 R0/0: Oct 31 19:57:41 rollback_timer.sh:

%INSTALL-5-INSTALL_AUTO_ABORT_TIMER_PROGRESS: Install auto abort timer will expire in 7200
 seconds [1] Commit package(s) on switch 1
[1] Finished Commit on switch 1
Checking status of Commit on [1]
Commit: Passed on [1]
Finished Commit

Install will reload the system now!
SUCCESS: install_add_activate_commit Wed Oct 31 19:57:48 UTC 2018
Switch#
```

Note The system reloads automatically after executing the **install add file activate commit** command. You do not have to manually reload the system.

Step 5 **dir flash:**

After the software has been successfully installed, use this command to verify that the flash partition has ten new `.pkg` files and three `.conf` files.

The following is sample output of the **dir flash:** command for upgrade scenario Cisco IOS XE Everest 16.5.1a to Cisco IOS XE Gibraltar 16.10.1:

```
Switch# dir flash:*.pkg

Directory of flash:/*.pkg
Directory of flash:/
475140 -rw- 2012104   Jul 26 2017 09:52:41 -07:00 cat9k-cc_srdriver.16.05.01a.SPA.pkg
475141 -rw- 70333380  Jul 26 2017 09:52:44 -07:00 cat9k-espbase.16.05.01a.SPA.pkg
475142 -rw- 13256     Jul 26 2017 09:52:44 -07:00 cat9k-guestshell.16.05.01a.SPA.pkg
475143 -rw- 349635524 Jul 26 2017 09:52:54 -07:00 cat9k-rpbase.16.05.01a.SPA.pkg
475149 -rw- 24248187  Jul 26 2017 09:53:02 -07:00 cat9k-rpboot.16.05.01a.SPA.pkg
475144 -rw- 25285572  Jul 26 2017 09:52:55 -07:00 cat9k-sipbase.16.05.01a.SPA.pkg
475145 -rw- 20947908  Jul 26 2017 09:52:55 -07:00 cat9k-sipspa.16.05.01a.SPA.pkg
475146 -rw- 2962372   Jul 26 2017 09:52:56 -07:00 cat9k-srdriver.16.05.01a.SPA.pkg
475147 -rw- 13284288  Jul 26 2017 09:52:56 -07:00 cat9k-webui.16.05.01a.SPA.pkg
475148 -rw- 13248     Jul 26 2017 09:52:56 -07:00 cat9k-wlc.16.05.01a.SPA.pkg

491524 -rw- 25711568  Oct 31 2018 11:49:33 -07:00  cat9k-cc_srdriver.16.10.01.SPA.pkg
491525 -rw- 78484428  Oct 31 2018 11:49:35 -07:00  cat9k-espbase.16.10.01.SPA.pkg
491526 -rw- 1598412   Oct 31 2018 11:49:35 -07:00  cat9k-guestshell.16.10.01.SPA.pkg
491527 -rw- 404153288 Oct 31 2018 11:49:47 -07:00  cat9k-rpbase.16.10.01.SPA.pkg
491533 -rw- 31657374  Oct 31 2018 11:50:09 -07:00  cat9k-rpboot.16.10.01.SPA.pkg
491528 -rw- 27681740  Oct 31 2018 11:49:48 -07:00  cat9k-sipbase.16.10.01.SPA.pkg
491529 -rw- 52224968  Oct 31 2018 11:49:49 -07:00  cat9k-sipspa.16.10.01.SPA.pkg
491530 -rw- 31130572  Oct 31 2018 11:49:50 -07:00  cat9k-srdriver.16.10.01.SPA.pkg
491531 -rw- 14783432  Oct 31 2018 11:49:51 -07:00  cat9k-webui.16.10.01.SPA.pkg
491532 -rw- 9160      Oct 31 2018 11:49:51 -07:00  cat9k-wlc.16.10.01.SPA.pkg

11353194496 bytes total (8963174400 bytes free)
```

The following is sample output of the **dir flash:** command for the Cisco IOS XE Everest 16.6.3 to Cisco IOS XE Fuji 16.9.1 upgrade scenario:

```
Switch# dir flash:

Directory of flash:/

475140 -rw- 2012104   Jul 26 2017 09:52:41 -07:00 cat9k-cc_srdriver.16.06.03.SPA.pkg
475141 -rw- 70333380  Jul 26 2017 09:52:44 -07:00 cat9k-espbase.16.06.03.SPA.pkg
475142 -rw- 13256     Jul 26 2017 09:52:44 -07:00 cat9k-guestshell.16.06.03.SPA.pkg
475143 -rw- 349635524 Jul 26 2017 09:52:54 -07:00 cat9k-rpbase.16.06.03.SPA.pkg
475149 -rw- 24248187  Jul 26 2017 09:53:02 -07:00 cat9k-rpboot.16.06.03.SPA.pkg
475144 -rw- 25285572  Jul 26 2017 09:52:55 -07:00 cat9k-sipbase.16.06.03.SPA.pkg
475145 -rw- 20947908  Jul 26 2017 09:52:55 -07:00 cat9k-sipspa.16.06.03.SPA.pkg
475146 -rw- 2962372   Jul 26 2017 09:52:56 -07:00 cat9k-srdriver.16.06.03.SPA.pkg
475147 -rw- 13284288  Jul 26 2017 09:52:56 -07:00 cat9k-webui.16.06.03.SPA.pkg
475148 -rw- 13248     Jul 26 2017 09:52:56 -07:00 cat9k-wlc.16.06.03.SPA.pkg

491524 -rw- 25711568  Oct 31 2018 11:49:33 -07:00  cat9k-cc_srdriver.16.10.01.SPA.pkg
491525 -rw- 78484428  Oct 31 2018 11:49:35 -07:00  cat9k-espbase.16.10.01.SPA.pkg
491526 -rw- 1598412   Oct 31 2018 11:49:35 -07:00  cat9k-guestshell.16.10.01.SPA.pkg
491527 -rw- 404153288 Oct 31 2018 11:49:47 -07:00  cat9k-rpbase.16.10.01.SPA.pkg
491533 -rw- 31657374  Oct 31 2018 11:50:09 -07:00  cat9k-rpboot.16.10.01.SPA.pkg
491528 -rw- 27681740  Oct 31 2018 11:49:48 -07:00  cat9k-sipbase.16.10.01.SPA.pkg
491529 -rw- 52224968  Oct 31 2018 11:49:49 -07:00  cat9k-sipspa.16.10.01.SPA.pkg
491530 -rw- 31130572  Oct 31 2018 11:49:50 -07:00  cat9k-srdriver.16.10.01.SPA.pkg
491531 -rw- 14783432  Oct 31 2018 11:49:51 -07:00  cat9k-webui.16.10.01.SPA.pkg
```

```
491532 -rw- 9160      Oct 31 2018 11:49:51 -07:00  cat9k-wlc.16.10.01.SPA.pkg

11353194496 bytes total (9544245248 bytes free)
Switch#
```

The following sample output displays the .conf files in the flash partition; note the three .conf files:

- packages.conf—the file that has been re-written with the newly installed .pkg files
- packages.conf.00—backup file of the previously installed image
- cat9k_iosxe.16.10.01.SPA.conf— a copy of packages.conf and not used by the system.

```
Switch# dir flash:*.conf

Directory of flash:/*.conf
Directory of flash:/

434197 -rw- 7406 Oct 31 2018 10:59:16 -07:00 packages.conf
434196 -rw- 7504 Oct 31 2018 10:59:16 -07:00 packages.conf.00-
516098 -rw- 7406 Oct 31 2018 10:58:08 -07:00 cat9k_iosxe.16.10.01.SPA.conf
11353194496 bytes total (8963174400 bytes free)
```

Step 6 Reload

a) **reload**

Use this command to reload the switch.

```
Switch# reload
```

b) **boot flash:**

If your switches are configured with auto boot, then the stack will automatically boot up with the new image. If not, you can manually boot flash:packages.conf

```
Switch: boot flash:packages.conf
```

c) **show version**

After the image boots up, use this command to verify the version of the new image.

Note When you boot the new image, the boot loader is automatically updated, but the new bootloader version is not displayed in the output until the next reload.

The following sample output of the **show version** command displays the Cisco IOS XE Gibraltar 16.10.1 image on the device:

```
Switch# show version
Cisco IOS XE Software, Version 16.10.01
Cisco IOS Software [Gibraltar], Catalyst L3 Switch Software (CAT9K_IOSXE), Version
16.10.1, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2018 by Cisco Systems, Inc.
Compiled Fri 09-Nov-18 19:43 by mcpre
```

Downgrading in Install Mode

Follow these instructions to downgrade from one release to another, in install mode. To perform a software image downgrade, you must be booted into IOS via " boot flash:packages.conf ."

Before you begin

Note that you can use this procedure for the following downgrade scenarios:

When downgrading from ...	Use these commands...	To downgrade to...
Cisco IOS XE Gibraltar 16.10.1	On Cisco Catalyst 9500 Series Switches, either **install** commands or **request platform software** commands On Cisco Catalyst 9500 Series Switches - High Performance[6], only **install** commands	Cisco IOS XE Fuji 16.9.x or an earlier release.

[6] Introduced in Cisco IOS XE Fuji 16.8.1a

The sample output in this section shows downgrade from Cisco IOS XE Gibraltar 16.10.1 to Cisco IOS XE Everest 16.6.1, by using the **install** commands.

Important New switch models that are introduced in a release cannot be downgraded. The release in which a switch model is introduced is the minimum software version for that model.

Procedure

Step 1 Clean Up

Ensure that you have at least 1GB of space in flash to expand a new image. Clean up old installation files in case of insufficient space.

- **install remove inactive**
- **request platform software package clean**

The following sample output displays the cleaning up of Cisco IOS XE Gibraltar 16.10.1 files using the **install remove inactive** command:

```
Switch# install remove inactive

install_remove: START Wed Oct 31 19:51:48 UTC 2018
Cleaning up unnecessary package files
Scanning boot directory for packages ... done.
Preparing packages list to delete ...
done.

The following files will be deleted:
[switch 1]:
/flash/cat9k-cc_srdriver.16.10.01.SPA.pkg
/flash/cat9k-espbase.16.10.01.SPA.pkg
/flash/cat9k-guestshell.16.10.01.SPA.pkg
/flash/cat9k-rpbase.16.10.01.SPA.pkg
/flash/cat9k-rpboot.16.10.01.SPA.pkg
/flash/cat9k-sipbase.16.10.01.SPA.pkg
```

```
/flash/cat9k-sipspa.16.10.01.SPA.pkg
/flash/cat9k-srdriver.16.10.01.SPA.pkg
/flash/cat9k-webui.16.10.01.SPA.pkg
/flash/cat9k-wlc.16.10.01.SPA.pkg
/flash/packages.conf

Do you want to remove the above files? [y/n]y
[switch 1]:
Deleting file flash:cat9k-cc_srdriver.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-espbase.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-guestshell.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-rpbase.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-rpboot.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-sipbase.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-sipspa.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-srdriver.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-webui.16.10.01.SPA.pkg ... done.
Deleting file flash:cat9k-wlc.16.10.01.SPA.pkg ... done.
Deleting file flash:packages.conf ... done.
SUCCESS: Files deleted.
--- Starting Post_Remove_Cleanup ---
Performing Post_Remove_Cleanup on all members
[1] Post_Remove_Cleanup package(s) on switch 1
[1] Finished Post_Remove_Cleanup on switch 1
Checking status of Post_Remove_Cleanup on [1]
Post_Remove_Cleanup: Passed on [1]
Finished Post_Remove_Cleanup

SUCCESS: install_remove Wed Oct 31 19:52:25 UTC 2018
Switch#
```

Step 2 Copy new image to flash

a) **copy tftp: flash:**

Use this command to copy the new image to flash: (or skip this step if you want to use the new image from your TFTP server)

```
Switch# copy tftp://10.8.0.6//cat9k_iosxe.16.06.01.SPA.bin flash:

Destination filename [cat9k_iosxe.16.06.01.SPA.bin]?
Accessing tftp://10.8.0.6//cat9k_iosxe.16.06.01.SPA.bin...
Loading /cat9k_iosxe.16.06.01.SPA.bin from 10.8.0.6 (via GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 508584771 bytes]
508584771 bytes copied in 101.005 secs (5035244 bytes/sec)
```

b) **dir flash:**

Use this command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

Directory of flash:/

434184 -rw- 508584771 Oct 31 2018 13:35:16 -07:00 cat9k_iosxe.16.06.01.SPA.bin
11353194496 bytes total (9055866880 bytes free)
```

Step 3 Downgrade software image

- **install add file activate commit**

- **request platform software package install**

The following example displays the installation of the Cisco IOS XE Everest 16.6.1 software image to flash, by using the **install add file activate commit** command.

```
Switch# install add file flash:cat9k_iosxe.16.06.01.SPA.bin activate commit

install_add_activate_commit: START Wed Oct 31 19:54:51 UTC 2018

System configuration has been modified.
Press Yes(y) to save the configuration and proceed.
Press No(n) for proceeding without saving the configuration.
Press Quit(q) to exit, you may save configuration and re-enter the command. [y/n/q]yBuilding
 configuration...

[OK]Modified configuration has been saved

*Oct 31 19:54:55.633: %IOSXE-5-PLATFORM: Switch 1 R0/0: Oct 30 19:54:55 install_engine.sh:
 %INSTALL-
5-INSTALL_START_INFO: Started install one-shot flash:cat9k_iosxe.16.06.01.SPA.bin
install_add_activate_commit: Adding PACKAGE

This operation requires a reload of the system. Do you want to proceed?
Please confirm you have changed boot config to flash:packages.conf [y/n]y

--- Starting initial file syncing ---
Info: Finished copying flash:cat9k_iosxe.16.06.01.SPA.bin to the selected switch(es)
Finished initial file syncing

--- Starting Add ---
Performing Add on all members
[1] Add package(s) on switch 1
[1] Finished Add on switch 1
Checking status of Add on [1]
Add: Passed on [1]
Finished Add

install_add_activate_commit: Activating PACKAGE
Following packages shall be activated:
/flash/cat9k-wlc.16.06.01.SPA.pkg
/flash/cat9k-webui.16.06.01.SPA.pkg
/flash/cat9k-srdriver.16.06.01.SPA.pkg
/flash/cat9k-sipspa.16.06.01.SPA.pkg
/flash/cat9k-sipbase.16.06.01.SPA.pkg
/flash/cat9k-rpboot.16.06.01.SPA.pkg
/flash/cat9k-rpbase.16.06.01.SPA.pkg
/flash/cat9k-guestshell.16.06.01.SPA.pkg
/flash/cat9k-espbase.16.06.01.SPA.pkg
/flash/cat9k-cc_srdriver.16.06.01.SPA.pkg

This operation requires a reload of the system. Do you want to proceed? [y/n]y
--- Starting Activate ---
Performing Activate on all members
[1] Activate package(s) on switch 1
[1] Finished Activate on switch 1
Checking status of Activate on [1]
Activate: Passed on [1]
Finished Activate

--- Starting Commit ---
Performing Commit on all members

*Oct 31 19:57:41.145: %IOSXE-5-PLATFORM: Switch 1 R0/0: Oct 31 19:57:41 rollback_timer.sh:
 %INSTALL-
```

```
5-INSTALL_AUTO_ABORT_TIMER_PROGRESS: Install auto abort timer will expire in 7200 seconds
[1] Commit package(s) on switch 1
[1] Finished Commit on switch 1
Checking status of Commit on [1]
Commit: Passed on [1]
Finished Commit

Install will reload the system now!
SUCCESS: install_add_activate_commit Wed Oct 31 19:57:48 UTC 2018
Switch#
```

Note The system reloads automatically after executing the **install add file activate commit** command. You do not have to manually reload the system.

Step 4 Reload

a) **reload**

Use this command to reload the switch.

```
Switch# reload
```

b) **boot flash:**

If your switches are configured with auto boot, then the stack will automatically boot up with the new image. If not, you can manually boot flash:packages.conf

```
Switch: boot flash:packages.conf
```

Note When you downgrade the software image, the boot loader does not automatically downgrade. It remains updated.

c) **show version**

After the image boots up, use this command to verify the version of the new image.

Note When you boot the new image, the boot loader is automatically updated, but the new bootloader version is not displayed in the output until the next reload.

The following sample output of the **show version** command displays the Cisco IOS XE Everest 16.6.1 image on the device:

```
Switch# show version
Cisco IOS XE Software, Version 16.06.01
Cisco IOS Software [Everest], Catalyst L3 Switch Software (CAT9K_IOSXE), Version 16.6.1,
 RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2017 by Cisco Systems, Inc.
Compiled Fri 16-Mar-18 06:38 by mcpre
<output truncated>
```

Licensing

This section provides information about the licensing packages for features available on Cisco Catalyst 9000 Series Switches.

License Levels

The software features available on Cisco Catalyst 9500 Series Switches and Cisco Catalyst 9500 Series Switches - High Performance fall under these base or add-on license levels.

Base Licenses

- Network Essentials
- Network Advantage—Includes features available with the Network Essentials license and more.

Add-On Licenses

Add-On Licenses require a Network Essentials or Network Advantage as a pre-requisite. The features available with add-on license levels provide Cisco innovations on the switch, as well as on the Cisco Digital Network Architecture Center (Cisco DNA Center).

- DNA Essentials
- DNA Advantage— Includes features available with the DNA Essentials license and more.

To find information about platform support and to know which license levels a feature is available with, use Cisco Feature Navigator. To access Cisco Feature Navigator, go to https://cfnng.cisco.com. An account on cisco.com is not required.

License Types

The following license types are available:

- Permanent—for a license level, and without an expiration date.
- Term—for a license level, and for a three, five, or seven year period.
- Evaluation—a license that is not registered.

License Levels - Usage Guidelines

- Base licenses (Network Essentials and Network-Advantage) are ordered and fulfilled only with a permanent license type.
- Add-on licenses (DNA Essentials and DNA Advantage) are ordered and fulfilled only with a term license type.
- An add-on license level is included when you choose a network license level. If you use DNA features, renew the license before term expiry, to continue using it, or deactivate the add-on license and then reload the switch to continue operating with the base license capabilities.
- When ordering an add-on license with a base license, note the combinations that are permitted and those that are not permitted:

Table 3: Permitted Combinations

	DNA Essentials	DNA Advantage
Network Essentials	Yes	No

Network Advantage	Yes[7]	Yes

[7] You will be able to purchase this combination only at the time of the DNA license renewal and not when you purchase DNA-Essentials the first time.

- Evaluation licenses cannot be ordered. They are not tracked via Cisco Smart Software Manager and expire after a 90-day period. Evaluation licenses can be used only once on the switch and cannot be regenerated. Warning system messages about an evaluation license expiry are generated only 275 days after expiration and every week thereafter. An expired evaluation license cannot be reactivated after reload. This applies only to *Smart Licensing*. The notion of evaluation licenses does not apply to *Smart Licensing Using Policy*.

Cisco Smart Licensing

Cisco Smart Licensing is a flexible licensing model that provides you with an easier, faster, and more consistent way to purchase and manage software across the Cisco portfolio and across your organization. And it's secure – you control what users can access. With Smart Licensing you get:

- Easy Activation: Smart Licensing establishes a pool of software licenses that can be used across the entire organization—no more PAKs (Product Activation Keys).
- Unified Management: My Cisco Entitlements (MCE) provides a complete view into all of your Cisco products and services in an easy-to-use portal, so you always know what you have and what you are using.
- License Flexibility: Your software is not node-locked to your hardware, so you can easily use and transfer licenses as needed.

To use Smart Licensing, you must first set up a Smart Account on Cisco Software Central (http://software.cisco.com).

Important Cisco Smart Licensing is the default and the only available method to manage licenses.

For a more detailed overview on Cisco Licensing, go to cisco.com/go/licensingguide.

Deploying Smart Licensing

The following provides a process overview of a day 0 to day N deployment directly initiated from a device that is running Cisco IOS XE Fuji 16.9.1 or later releases. Links to the configuration guide provide detailed information to help you complete each one of the smaller tasks.

Procedure

Step 1 Begin by establishing a connection from your network to Cisco Smart Software Manager on cisco.com.

See: Connecting to CSSM

Step 2 Create and activate your Smart Account, or login if you already have one.

To create and activate Smart Account, go to Cisco Software Central → Create Smart Accounts. Only authorized users can activate the Smart Account.

Step 3 Complete Cisco Smart Software Manager set up.

a) Accept the Smart Software Licensing Agreement.

b) Set up the required number of Virtual Accounts, users and access rights for the virtual account users.

Virtual accounts help you organize licenses by business unit, product type, IT group, and so on.

c) Generate the registration token in the Cisco Smart Software Manager portal and register your device with the token.

See: Registering the Device in CSSM

With this,

- The device is now in an authorized state and ready to use.
- The licenses that you have purchased are displayed in your Smart Account.

How Upgrading or Downgrading Software Affects Smart Licensing

Starting from Cisco IOS XE Fuji 16.9.1, Smart Licensing is the default and only license management solution; all licenses are managed as Smart Licenses.

Important Starting from Cisco IOS XE Fuji 16.9.1, the Right-To-Use (RTU) licensing mode is deprecated, and the associated **license right-to-use** command is no longer available on the CLI.

Note how upgrading to a release that supports Smart Licensing or moving to a release that does not support Smart Licensing affects licenses on a device:

- **When you upgrade from an earlier release to one that supports Smart Licensing**—all existing licenses remain in evaluation mode until registered in Cisco Smart Software Manager. After registration, they are made available in your Smart Account.

  See: Registering the Device in CSSM

- **When you downgrade to a release where Smart Licensing is not supported**—all smart licenses on the device are converted to traditional licenses and all smart licensing information on the device is removed.

Using Smart Licensing on an Out-of-the-Box Device

Starting from Cisco IOS XE Fuji 16.9.1, if an out-of-the-box device has the software version factory-provisioned, all licenses on such a device remain in evaluation mode until registered in Cisco Smart Software Manager.

See: Registering the Device in CSSM

Scaling Guidelines

For information about feature scaling guidelines, see the Cisco Catalyst 9500 Series Switches datasheet at:

https://www.cisco.com/c/en/us/products/collateral/switches/catalyst-9500-series-switches/datasheet-c78-738978.html

Limitations and Restrictions

With Cisco Catalyst 9500 Series Switches and Cisco Catalyst 9500 Series Switches - High Performance—If a feature is not supported on a switch model, you do not have to factor in any limitations or restrictons that may be listed here. If limitations or restrictions are listed for a feature that is supported, check if model numbers are specified, to know if they apply. If model numbers are not specified, the limitations or restrictons apply to all models in the series.

- Auto negotiation

  We recommend not changing Forward Error Correction (FEC) when auto negotiation is ON. This is applicable to 100G/40G/25G CU cables on the C9500-32C, C9500-32QC, C9500-24Y4C and C9500-48Y4C models of the series.

  Auto negotiation is always ON for GLC-T and GLC-TE and cannot be disabled. This is applicable to GLC-T and GLC-TE on C9500-48Y4C and C9500-24Y4C models of the series.

- Cisco StackWise Virtual
  - You cannot configure Cisco StackWise Virtual links on modular uplinks (C9500-NM-8X and C9500-NM-2Q).
  - On Cisco Catalyst 9500 Series Switches, you cannot use 4X10G breakout cables or the Cisco QSFP to SFP or SFP+ Adapter (QSA) module when Cisco StackWise Virtual is configured on the switch.
  - On Cisco Catalyst 9500 Series Switches - High Performance, you cannot use 4X25G and 4X10G breakout cables or the Cisco QSA module when Cisco StackWise Virtual is configured on the switch.

- Cisco TrustSec restrictions—Cisco TrustSec can be configured only on physical interfaces, not on logical interfaces.
- Control Plane Policing (CoPP)—The **show run** command does not display information about classes configured under `system-cpp policy`, when they are left at default values. Use the **show policy-map system-cpp-policy** or the **show policy-map control-plane** commands in privileged EXEC mode instead.
- Flexible NetFlow limitations
  - You cannot configure NetFlow export using the Ethernet Management port (GigabitEthernet0/0).
  - You can not configure a flow monitor on logical interfaces, such as switched virtual interfaces (SVIs), port-channel, loopback, tunnels.
  - You can not configure multiple flow monitors of same type (ipv4, ipv6 or datalink) on the same interface for same direction.

- Hardware limitations:
  - Use the MODE button to switch-off the beacon LED.
  - All port LED behavior is undefined until interfaces are fully initialized.

- 1G with Cisco QSA Module (CVR-QSFP-SFP10G) is not supported on the uplink ports of the C9500-24Y4C and C9500-48Y4C models.
- The following limitations apply to Cisco QSA Module (CVR-QSFP-SFP10G) when Cisco 1000Base-T Copper SFP (GLC-T) or Cisco 1G Fiber SFP Module for Multimode Fiber are plugged into the QSA module:
  - 1G Fiber modules over QSA do not support autonegotiation. Auto-negotiation should be disabled on the far-end devices.
  - Although visible in the CLI, the command [**no**] **speed nonegotiate** is not supported with 1G Fiber modules over QSA.
  - Only GLC-T over QSA supports auto-negotiation.
  - GLC-T supports only port speed of 1000 Mb/s over QSA. Port speeds of 10/100-Mb/s are not supported due to hardware limitation.
- When you use Cisco QSFP-4SFP10G-CUxM Direct-Attach Copper Cables, autonegotiation is enabled by default. If the other end of the line does not support autonegotation, the link does not come up.
- Autonegotiation is not supported on HundredGigabitEthernet1/0/49 to HundredGigabitEthernet1/0/52 uplink ports of the C9500-48Y4C models, and HundredGigabitEthernet1/0/25 to HundredGigabitEthernet1/0/28 uplink ports of the C9500-24Y4C models. Disable autonegotiation on the peer device if you are using QSFP-H40G-CUxx and QSFP-H40G-ACUxx cables.
- For QSFP-H100G-CUxx cables, the C9500-48Y4C and C9500-24Y4C models support the cables only if both sides of the connection are either C9500-48Y4C or C9500-24Y4C.

- Interoperability limitations—When you use Cisco QSFP-4SFP10G-CUxM Direct-Attach Copper Cables, if one end of the 40G link is a Catalyst 9400 Series Switch and the other end is a Catalyst 9500 Series Switch, the link does not come up, or comes up on one side and stays down on the other. To avoid this interoperability issue between devices, apply the the **speed nonegotiate** command on the Catalyst 9500 Series Switch interface. This command disables autonegotiation and brings the link up. To restore autonegotiation, use the **no speed nonegotiation** command.
- In-Service Software Upgrade (ISSU)—On Cisco Catalyst 9500 Series Switches (C9500-12Q, C9500-16X, C9500-24Q, C9500-40X), ISSU from Cisco IOS XE Fuji 16.9.x to Cisco IOS XE Gibraltar 16.10.x is not supported.
- QoS restrictions
  - When configuring QoS queuing policy, the sum of the queuing buffer should not exceed 100%.
  - For QoS policies, only switched virtual interfaces (SVI) are supported for logical interfaces.
  - QoS policies are not supported for port-channel interfaces, tunnel interfaces, and other logical interfaces.
- Secure Shell (SSH)
  - Use SSH Version 2. SSH Version 1 is not supported.
  - When the device is running SCP and SSH cryptographic operations, expect high CPU until the SCP read process is completed. SCP supports file transfers between hosts on a network and uses SSH for the transfer.

Since SCP and SSH operations are currently not supported on the hardware crypto engine, running encryption and decryption process in software causes high CPU. The SCP and SSH processes can show as much as 40 or 50 percent CPU usage, but they do not cause the device to shutdown.

- USB Authentication—When you connect a Cisco USB drive to the switch, the switch tries to authenticate the drive against an existing encrypted preshared key. Since the USB drive does not send a key for authentication, the following message is displayed on the console when you enter **password encryption aes** command:

```
Device(config)# password encryption aes
Master key change notification called without new or old key
```

- VLAN Restriction—It is advisable to have well-defined segregation while defining data and voice domain during switch configuration and to maintain a data VLAN different from voice VLAN across the switch stack. If the same VLAN is configured for data and voice domains on an interface, the resulting high CPU utilization might affect the device.
- Wired Application Visibility and Control limitations:
  - NBAR2 (QoS and Protocol-discovery) configuration is allowed only on wired physical ports. It is not supported on virtual interfaces, for example, VLAN, port channel nor other logical interfaces.
  - NBAR2 based match criteria ‘match protocol’ is allowed only with marking or policing actions. NBAR2 match criteria will not be allowed in a policy that has queuing features configured.
  - ‘Match Protocol’: up to 256 concurrent different protocols in all policies.
  - NBAR2 and Legacy NetFlow cannot be configured together at the same time on the same interface. However, NBAR2 and wired AVC Flexible NetFlow can be configured together on the same interface.
  - Only IPv4 unicast (TCP/UDP) is supported.
  - AVC is not supported on management port (Gig 0/0)
  - NBAR2 attachment should be done only on physical access ports. Uplink can be attached as long as it is a single uplink and is not part of a port channel.
  - Performance—Each switch member is able to handle 500 connections per second (CPS) at less than 50% CPU utilization. Above this rate, AVC service is not guaranteed.
  - Scale—Able to handle up to 5000 bi-directional flows per 24 access ports and 10000 bi-directional flows per 48 access ports.
- YANG data modeling limitation—A maximum of 20 simultaneous NETCONF sessions are supported.
- Secure Password Migration—Type 6 encrypted password is supported from Cisco IOS XE Gibraltar 16.10.1 and later releases. Autoconversion to password type 6 is supported from Cisco IOS XE Gibraltar 16.11.1 and later releases.

  If the startup configuration has a type 6 password and you downgrade to a version in which type 6 password is not supported, you can/may be locked out of the device.
- The File System Check (fsck) utility is not supported in install mode.

Caveats

Caveats describe unexpected behavior in Cisco IOS-XE releases. Caveats listed as open in a prior release are carried forward to the next release as either open or resolved.

Cisco Bug Search Tool

The Cisco Bug Search Tool (BST) allows partners and customers to search for software bugs based on product, release, and keyword, and aggregates key data such as bug details, product, and version. The BST is designed to improve the effectiveness in network risk management and device troubleshooting. The tool has a provision to filter bugs based on credentials to provide external and internal bug views for the search input.

To view the details of a caveat, click on the identifier.

Open Caveats in Cisco IOS XE Gibraltar 16.10.x

Identifier	Applicable Models	Description
CSCvh85225	All models	Smart licensing(SL)Actions done soon after system bootup can cause SL to get stuck, requiring reload
CSCvk20217	All models	ISSU / SSO convergence time for EoMPLS is high
CSCvk62006	Catalyst 9500	SF: ERSPAN fragments the packet and truncated remaining portion is not captured
CSCvi48988	Catalyst 9500	SNMP timeout when querying entSensorValueEntry
CSCvm08557	Catalyst 9500	After reloading gPTP/AVB ports stuck @ disabled (not dot1as capable)
CSCvm33622	Catalyst 9500	WCCP redirection to proxy server breaks in certain scenarios.
CSCvm65080	Catalyst 9500	usbflash1 entries are displayed multiple times in sh inventory o/p after multiple SSO
CSCvm69029	Catalyst 9500	Yang Get-config shows all the pwd configured on switch instead it should show only last updated pwd
CSCvm86748	Catalyst 9500	9500-40x :phyloop back fails for forty gig ports
CSCvn00802	Catalyst 9500	Standby member of stackwise-virtual crashes after removing allowed VLAN on trunk interfaces
CSCvn04524	Catalyst 9500	IP Source Guard blocks traffic after host IP renewal
CSCvn21168	Catalyst 9500	Configure for usb on the switch are gone after renumber the switch
CSCvi44797	Catalyst 9500 High Performance	C9500-48Y4C: TestPhyLoopback showing Untested for some 1G interfaces

Identifier	Applicable Models	Description
CSCvk39569	Catalyst 9500 High Performance	C9500-24Y4C/48Y4C :FEC CL91 config gets removed after upgrading to 16.9.1/16.10.1 & link goes down
CSCvk69890	Catalyst 9500 High Performance	show cli display incorrect BW for 4SFP10G interface
CSCvm02749	Catalyst 9500 High Performance	9500-32C Breakout P&S: Programming failure on set of interfaces post reload
CSCvm33199	Catalyst 9500 High Performance	9500-32C Breakout P&S: scaled ACL remains ERRORed out with ACL removal

Resolved Caveats in Cisco IOS XE Gibraltar 16.10.x

Caveat ID Number	Applicable Models	Description
CSCvj13139	All Models	Everest 16.6.2 // FMAN FP Fails to create objects for some prefixes
CSCvj73828	All Models	Output drops counter mismatch after applied "qos queue-softmax-multiplier 1200"
CSCvk00432	All Models	Memory leak in alloc_repexp_entry caused by alloc_ril_index failure
CSCvk33620	All Models	in MPLS VPNv6 scenario, egress PE device does not generate ICMPv6 Too Big message
CSCvh87270	Catalyst 9500	StackWise Virtual not forwarding IGMP traffic over the standby switch.
CSCvj15473	Catalyst 9500	Linux IOSD crash with sh vtp counters cmd
CSCvk33369	Catalyst 9500	Stack-merge on Stby and CONN_ERR_CONN_TIMEOUT_ERR on Active with multiple SWO
CSCvk59895	Catalyst 9500	COPP: The default and set rate are different for COPP queues
CSCvm09570	Catalyst 9500	SPAN Filter Drops All Traffic
CSCvm09611	Catalyst 9500	C9x00 crashed with multicast memory corruption.
CSCvm33622	Catalyst 9500	WCCP redirection to proxy server breaks in certain scenarios.
CSCvm35904	Catalyst 9500	16.6.3: Access Tunnel Create Interface code is considered to be update request in FMAN_FP
CSCvm36748	Catalyst 9500	FED crash at expired "FED MAC AGING TIMER" or "unknown" timer without a stack trace.

Caveat ID Number	Applicable Models	Description
CSCvm43200	Catalyst 9500	[SVL] Traffic is not forward out on standby switch over SVL after SSO
CSCvm48081	Catalyst 9500	WDAVC: FNF doesn't work in some stack scenarios.
CSCvm72517	Catalyst 9500	ECR Installation fails and Pending-Acknowledgement, Pending-Issue counters go up
CSCvm75378	Catalyst 9500	Cat9x00: IPv6 SPAN filter still applied in hardware when removing entire monitor session
CSCvm77162	Catalyst 9500	FED logs overrun 20,000 times with same trace
CSCvm79234	Catalyst 9500	Show version cli shows invalid USB-SSD disk size on a CAT9k switch
CSCvm91107	Catalyst 9500	Standby reloads and crashed @fnf_ios_config_dist_validate_sel_process_add
CSCve65787	Catalyst 9500 High Performance	Autoneg support for 100G/40G/25G Cu xcvr
CSCvk07538	Catalyst 9500 High Performance	Autoneg not supported on C9500-48Y4C/C9500-24Y4C uplink ports and it is disabled by default
CSCvk35488	Catalyst 9500 High Performance	C9500-24Y4C:"speed 10000" config is rejected on C9500-24Y4C bootup for SFP-10/25GBase-CSR
CSCvk39589	Catalyst 9500 High Performance	Transceiver is removed and inserted syslog when configured 10G mode for SFP-10/25GBase-CSR
CSCvk47361	Catalyst 9500 High Performance	16.10.1: Disable FEC by default for 100G LR4
CSCvk52742	Catalyst 9500 High Performance	1G SFP do not link up when connected to C9500-24Y4C/C9500-48Y4C

Troubleshooting

For the most up-to-date, detailed troubleshooting information, see the Cisco TAC website at this URL:

https://www.cisco.com/en/US/support/index.html

Go to **Product Support** and select your product from the list or enter the name of your product. Look under Troubleshoot and Alerts, to find information for the problem that you are experiencing.

Related Documentation

Information about Cisco IOS XE at this URL: https://www.cisco.com/c/en/us/products/ios-nx-os-software/ios-xe/index.html

All support documentation for Cisco Catalyst 9500 Series Switches is at this URL: https://www.cisco.com/c/en/us/support/switches/catalyst-9500-series-switches/tsd-products-support-series-home.html

Cisco Validated Designs documents at this URL: https://www.cisco.com/go/designzone

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: https://cfnng.cisco.com/mibs

Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
- To get the business impact you're looking for with the technologies that matter, visit Cisco Services.
- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.