Interface and Hardware Components Configuration Guide, Cisco IOS XE Gibraltar 16.10.x (Catalyst 9500 Switches)

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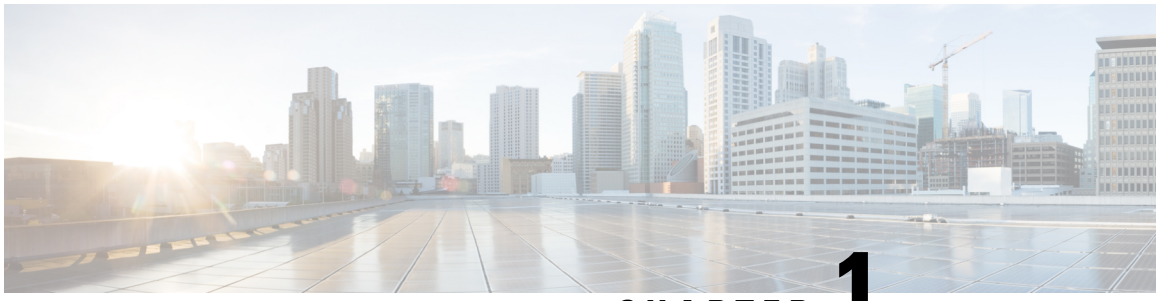

CHAPTER 1

Configuring Interface Characteristics

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Information About Interface Characteristics

The following sections provide information about interface characteristics.

Interface Types

This section describes the different types of interfaces supported by the device. The rest of the chapter describes configuration procedures for physical interface characteristics.

Port-Based VLANs

A VLAN is a switched network that is logically segmented by function, team, or application, without regard to the physical location of the users. Packets received on a port are forwarded only to ports that belong to the same VLAN as the receiving port. Network devices in different VLANs cannot communicate with one another without a Layer 3 device to route traffic between the VLANs.

VLAN partitions provide hard firewalls for traffic in the VLAN, and each VLAN has its own MAC address table. A VLAN comes into existence when a local port is configured to be associated with the VLAN, when the VLAN Trunking Protocol (VTP) learns of its existence from a neighbor on a trunk, or when a user creates a VLAN.

To configure VLANs, use the **vlan** *vlan-id* global configuration command to enter VLAN configuration mode. The VLAN configurations for normal-range VLANs (VLAN IDs 1 to 1005) are saved in the VLAN database. If VTP is version 1 or 2, to configure extended-range VLANs (VLAN IDs 1006 to 4094), you must first set VTP mode to transparent. Extended-range VLANs created in transparent mode are not added to the VLAN database but are saved in the device running configuration. With VTP version 3, you can create extended-range

VLANs in client or server mode in addition to transparent mode. These VLANs are saved in the VLAN database.

Add ports to a VLAN by using the **switchport** command in interface configuration mode.

- Identify the interface.
- For a trunk port, set trunk characteristics, and, if desired, define the VLANs to which it can belong.
- For an access port, set and define the VLAN to which it belongs.

Switch Ports

Switch ports are Layer 2-only interfaces associated with a physical port. Switch ports belong to one or more VLANs. A switch port can be an access port or a trunk port. You can configure a port as an access port or trunk port or let the Dynamic Trunking Protocol (DTP) operate on a per-port basis to set the switchport mode by negotiating with the port on the other end of the link. Switch ports are used for managing the physical interface and associated Layer 2 protocols and do not handle routing or bridging.

Configure switch ports by using the **switchport** interface configuration commands.

Access Ports

An access port belongs to and carries the traffic of only one VLAN (unless it is configured as a voice VLAN port). Traffic is received and sent in native formats with no VLAN tagging. Traffic arriving on an access port is assumed to belong to the VLAN assigned to the port. If an access port receives a tagged packet (Inter-Switch Link [ISL] or IEEE 802.1Q tagged), the packet is dropped, and the source address is not learned.

The types of access ports supported are:

- Static access ports are manually assigned to a VLAN (or through a RADIUS server for use with IEEE 802.1x.

You can also configure an access port with an attached Cisco IP Phone to use one VLAN for voice traffic and another VLAN for data traffic from a device attached to the phone.

Trunk Ports

A trunk port carries the traffic of multiple VLANs and by default is a member of all VLANs in the VLAN database. The IEEE 802.1Q trunk port type is supported. An IEEE 802.1Q trunk port supports simultaneous tagged and untagged traffic. An IEEE 802.1Q trunk port is assigned a default port VLAN ID (PVID), and all untagged traffic travels on the port default PVID. All untagged traffic and tagged traffic with a NULL VLAN ID are assumed to belong to the port default PVID. A packet with a VLAN ID equal to the outgoing port default PVID is sent untagged. All other traffic is sent with a VLAN tag.

Although by default, a trunk port is a member of every VLAN known to the VTP, you can limit VLAN membership by configuring an allowed list of VLANs for each trunk port. The list of allowed VLANs does not affect any other port but the associated trunk port. By default, all possible VLANs (VLAN ID 1 to 4094) are in the allowed list. A trunk port can become a member of a VLAN only if VTP knows of the VLAN and if the VLAN is in the enabled state. If VTP learns of a new, enabled VLAN and the VLAN is in the allowed list for a trunk port, the trunk port automatically becomes a member of that VLAN and traffic is forwarded to and from the trunk port for that VLAN. If VTP learns of a new, enabled VLAN that is not in the allowed list for a trunk port, the port does not become a member of the VLAN, and no traffic for the VLAN is forwarded to or from the port.

Tunnel Ports

Tunnel ports are used in IEEE 802.1Q tunneling to segregate the traffic of customers in a service-provider network from other customers who are using the same VLAN number. You configure an asymmetric link from a tunnel port on a service-provider edge switch to an IEEE 802.1Q trunk port on the customer switch. Packets entering the tunnel port on the edge switch, already IEEE 802.1Q-tagged with the customer VLANs, are encapsulated with another layer of an IEEE 802.1Q tag (called the metro tag), containing a VLAN ID unique in the service-provider network, for each customer. The double-tagged packets go through the service-provider network keeping the original customer VLANs separate from those of other customers. At the outbound interface, also a tunnel port, the metro tag is removed, and the original VLAN numbers from the customer network are retrieved.

Tunnel ports cannot be trunk ports or access ports and must belong to a VLAN unique to each customer.

Routed Ports

A routed port is a physical port that acts like a port on a router; it does not have to be connected to a router. A routed port is not associated with a particular VLAN, as is an access port. A routed port behaves like a regular router interface, except that it does not support VLAN subinterfaces. Routed ports can be configured with a Layer 3 routing protocol. A routed port is a Layer 3 interface only and does not support Layer 2 protocols, such as DTP and STP.

Configure routed ports by putting the interface into Layer 3 mode with the **no switchport** interface configuration command. Then assign an IP address to the port, enable routing, and assign routing protocol characteristics by using the **ip routing** and **router** *protocol* global configuration commands.

Note Entering a **no switchport** interface configuration command shuts down the interface and then re-enables it, which might generate messages on the device to which the interface is connected. When you put an interface that is in Layer 2 mode into Layer 3 mode, the previous configuration information related to the affected interface might be lost.

The number of routed ports that you can configure is not limited by software. However, the interrelationship between this number and the number of other features being configured might impact CPU performance because of hardware limitations.

Note The Network Essentials license supports static routing, Open Shortest Path First (OSPF), and Routing Information Protocol (RIP). For full Layer 3 routing, you must enable the Network Advantage license on the standalone device, or the active device .

Switch Virtual Interfaces

A switch virtual interface (SVI) represents a VLAN of switch ports as one interface to the routing function in the system. You can associate only one SVI with a VLAN. You configure an SVI for a VLAN only to route between VLANs or to provide IP host connectivity to the device. By default, an SVI is created for the default VLAN (VLAN 1) to permit remote device administration. Additional SVIs must be explicitly configured.

Note You cannot delete interface VLAN 1.

SVIs provide IP host connectivity only to the system. SVIs are created the first time that you enter the **vlan** interface configuration command for a VLAN interface. The VLAN corresponds to the VLAN tag associated with data frames on an ISL or IEEE 802.1Q encapsulated trunk or the VLAN ID configured for an access port. Configure a VLAN interface for each VLAN for which you want to route traffic, and assign it an IP address.

You can also use the interface range command to configure existing VLAN SVIs within the range. The commands entered under the interface range command are applied to all existing VLAN SVIs within the range. You can enter the command **interface range create vlan** *x - y* to create all VLANs in the specified range that do not already exist. When the VLAN interface is created, **interface range vlan** *id* can be used to configure the VLAN interface.

Although the device supports a total of 1005 VLANs and SVIs, the interrelationship between the number of SVIs and routed ports and the number of other features being configured might impact CPU performance because of hardware limitations.

When you create an SVI, it does not become active until it is associated with a physical port.

EtherChannel Port Groups

EtherChannel port groups treat multiple switch ports as one switch port. These port groups act as a single logical port for high-bandwidth connections between devices or between devices and servers. An EtherChannel balances the traffic load across the links in the channel. If a link within the EtherChannel fails, traffic previously carried over the failed link changes to the remaining links. You can group multiple trunk ports into one logical trunk port, group multiple access ports into one logical access port, group multiple tunnel ports into one logical tunnel port, or group multiple routed ports into one logical routed port. Most protocols operate over either single ports or aggregated switch ports and do not recognize the physical ports within the port group. Exceptions are the DTP, the Cisco Discovery Protocol (CDP), and the Port Aggregation Protocol (PAgP), which operate only on physical ports.

When you configure an EtherChannel, you create a port-channel logical interface and assign an interface to the EtherChannel. For Layer 3 interfaces, you manually create the logical interface by using the **interface port-channel** global configuration command. Then you manually assign an interface to the EtherChannel by using the **channel-group** interface configuration command. For Layer 2 interfaces, use the **channel-group** interface configuration command to dynamically create the port-channel logical interface. This command binds the physical and logical ports together.

Network Modules

The device supports two network modules that include10-Gigabit Ethernet and 40-Gigabit Ethernet uplink ports. Though they are named Ethernet, all ports are only fiber ports.

The following are the network modules supported:

- 8x10G
- 2x40G

Using the Switch USB Ports

The device has two USB ports on the front panel — a USB mini-Type B console port and a USB 2.0 host port and a USB 3.0 port on the rear panel. Note that C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches do not have a USB port on the rear.

USB Mini-Type B Console Port

The device has the following console ports:

- USB mini-Type B console connection
- RJ-45 console port

Console output appears on devices connected to both ports, but console input is active on only one port at a time. By default, the USB connector takes precedence over the RJ-45 connector.

Note Windows PCs require a driver for the USB port. See the hardware installation guide for driver installation instructions.

Use the supplied USB Type A-to-USB mini-Type B cable to connect a PC or other device to the device. The connected device must include a terminal emulation application. When the device detects a valid USB connection to a powered-on device that supports host functionality (such as a PC), input from the RJ-45 console is immediately disabled, and input from the USB console is enabled. Removing the USB connection immediately reenables input from the RJ-45 console connection. An LED on the device shows which console connection is in use.

Console Port Change Logs

At software startup, a log shows whether the USB or the RJ-45 console is active. Every device always first displays the RJ-45 media type.

In the sample output, Device 1 has a connected USB console cable. Because the bootloader did not change to the USB console, the first log from Device 1 shows the RJ-45 console. A short time later, the console changes and the USB console log appears. Device 2 and Device 3 have connected RJ-45 console cables.

```
switch-1

*Mar  1 00:01:00.171: %USB_CONSOLE-6-MEDIA_RJ45: Console media-type is RJ45.
*Mar  1 00:01:00.431: %USB_CONSOLE-6-MEDIA_USB: Console media-type is USB.
```

When the USB cable is removed or the PC de-activates the USB connection, the hardware automatically changes to the RJ-45 console interface:

You can configure the console type to always be RJ-45, and you can configure an inactivity timeout for the USB connector.

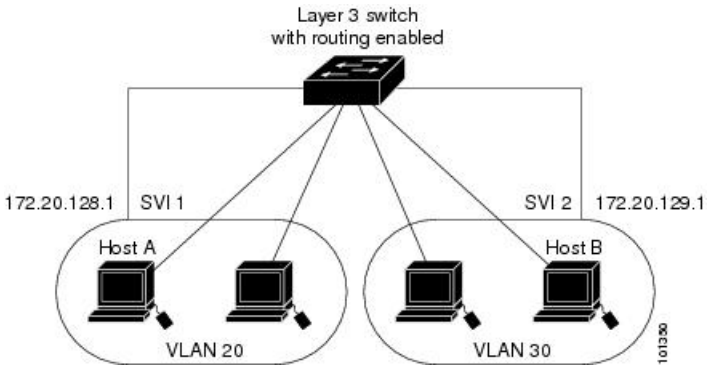
USB 2.0 Host Port

The USB 2.0 host port provides access to external USB flash devices, also known as thumb drives or USB keys. The port supports Cisco USB flash drives with capacities from 128 MB to 16 GB (USB devices with port densities of 128 MB, 256 MB, 1 GB, 4 GB, 8 GB, and 16 GB are supported). You can use standard Cisco IOS command-line interface (CLI) commands to read, write, erase, and copy to or from the flash device. You can also configure the device to boot from the USB flash drive.

Interface Connections

Devices within a single VLAN can communicate directly through any switch. Ports in different VLANs cannot exchange data without going through a routing device. With a standard Layer 2 device, ports in different VLANs have to exchange information through a router. By using the device with routing enabled, when you configure both VLAN 20 and VLAN 30 with an SVI to which an IP address is assigned, packets can be sent from Host A to Host B directly through the device with no need for an external router.

Figure 1: Connecting VLANs with the Switch



When the Network Advantage license is used on the device or the active device, the device uses the routing method to forward traffic between interfaces. If the Network Essentials license is used on the device or the active device, only basic routing (static routing and RIP) is supported. Whenever possible, to maintain high performance, forwarding is done by the device hardware. However, only IPv4 packets with Ethernet II encapsulation are routed in hardware.

The routing function can be enabled on all SVIs and routed ports. The device routes only IP traffic. When IP routing protocol parameters and address configuration are added to an SVI or routed port, any IP traffic received from these ports is routed.

Interface Configuration Mode

The device supports these interface types:

- Physical ports—device ports and routed ports
- VLANs—switch virtual interfaces
- Port channels—EtherChannel interfaces

You can also configure a range of interfaces.

To configure a physical interface (port), specify the interface type, module number, and device port number, and enter interface configuration mode.

- Type—FortyGigabitEthernet (fortygigabitethernet or fo) fiber ports.
- Switch number—The number that identifies the givendevice The number range is assigned the first time the device initializes.
- Module number—The module or slot number on the device: switch (downlink) ports are 0, and uplink ports are 1.

Note C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches have their Module number as 0 always.

- Port number—The interface number on the device. The 10/100/1000 port numbers always begin at 1, starting with the far left port when facing the front of the device, for example, FortyGigabitEthernet1/0/1 or FortyGigabitEthernet1/0/8.

  On a device with SFP uplink ports, the module number is 1 and the port numbers restart. For example, if the device has 24 10/100/1000 ports, the SFP module ports are GigabitEthernet1/1/1 through GigabitEthernet1/1/4 or TenGigabitEthernet1/1/1 through TenGigabitEthernet1/1/4.

You can identify physical interfaces by physically checking the interface location on the device. You can also use the **show** privileged EXEC commands to display information about a specific interface or all the interfaces on the switch. The remainder of this chapter primarily provides physical interface configuration procedures.

These are examples of how to identify interfaces on standalone devices:

- To configure 40-G port 4 on a standalone device, enter this command:

```
Device(config)# interface FortyGigabitEthernet1/0/4
```

Breakout Interfaces

C9500X-28C8D support breakout cables. These cables support 4x10 G by enabling a single 40-G QSFP+ interface to be split into four 10-G SFP+ interfaces. From Cisco IOS XE Gibraltar 16.11.1, support for breakout cables is enabled for Cisco Catalyst 9500 Series Switches - High Performance with Cisco StackWise Virtual. From Cisco IOS XE Cupertino 17.7.1, support for breakout cables is enabled for the C9500X-28C8D model of Cisco Catalyst 9500 Series Switches. The 9500X-60L4D model of Cisco Catalyst 9500 Series Switches supports breakout cables beginning with Cisco IOS XE Dublin 17.10.1b.

Switch Models

Breakout cable support is available only on the following switch models and network modules, with a few limitations.

- C9500-12Q
- C9500-24Q
- C9500-40X-2Q
- C9500-16X-2Q
- C9500-32C
- C9500X-28C8D
- C9500X-60L4D

Limitations for Breakout Interfaces

Catalyst 9500 Series Switches

- To enable breakout for dual mode QSFP breakout cables, the **hw-module breakout module** *slot* **port** *port-range* **switch** *switch-num* command must be configured on all the ports of the switch. The range for the variables in the **hw-module breakout module** *slot* **port** *port-range* **switch** *switch-num* command are given below:
  - *slot*: Slot number of port depending on the chassis model.
  - *port-range*: Single port or range of ports on which breakout is configured. The range varies from 1 to 24.
  - *switch-num*: Switch number in the stack. The range varies from 1 to 8.

  See Breakout Interfaces, on page 7 for the list of configurable interfaces.
- When Cisco StackWise Virtual is configured, breakout ports using 4X10G breakout cables can only be used as data ports; they cannot be used to configure StackWise Virtual links (SVLs) or dual-active detective (DAD) links.

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- Breakout is supported only on 24 ports of the C9500-32C switch model. Every 4th port of C9500-32C does not support breakout due to ASIC limitation. Port numbers 4, 8, 12, 16, 20, 24, 28 and 32 — Hu1/0/4, Hu1/0/8, Hu1/0/12, Hu1/0/16, Hu1/0/20, Hu1/0/24, Hu1/0/28 and Hu1/0/32 — do not support breakout.
- Parent port is disabled after breakout is enabled on it but configuration on the parent port is saved.
- Breakout ports appear in the output of **show run**, **show interface status**, **show ip interface brief** and other show and configuration commands once breakout is enabled and they are automatically removed from all the show and configuration CLIs when breakout is disabled.
- When Cisco StackWise Virtual is configured, breakout ports using 4X25G and 4X10G breakout cables can only be used as data ports; they cannot be used to configure SVLs or DAD links.
- LED of the physical port on which breakout is enabled turns green if any one of the four breakout link is up but it turns off only when all the four breakout links are down.

See Breakout Interfaces, on page 7 for the list of configurable interfaces.

Catalyst 9500X Series Switches

- To enable breakout for dual mode QSFP breakout cables on a standalone switch, the **hw-module breakout port number**or **hw-module breakout range** *port range* command must be configured on a port.

  For Cisco Catalyst 9500X-28C8D Series switches, the range for the variables in these commands are listed below:
  - **port number** — The port number to be converted into breakout ports. The range is 1- 36
  - *port range* — Single port or range of ports on which breakout is configured. The range varies from 1 to 36.

For Cisco Catalyst 9500X-60L4D Series switches, the range for the variables in these commands are listed below:

- **port number** — The port number to be converted into breakout ports. The range is 31- 34
- *port range* — Single port or range of ports on which breakout is configured. The range varies from 31 to 34.

- On Cisco Catalyst 9500X-208C8D Series switches, breakout is supported only on odd 100-G ports and on both odd and even 400-G ports.

  On Cisco Catalyst 9500X-60L4D Series switches, breakout is supported only on 400-G ports.

  When you enable breakout on an odd 100-G port, the next even port becomes inactive. You should disable the even port if it is in a connected state. For example, if breakout has to enabled on port Hu1/0/5, you should ensure that Hu1/0/6 is in not connected state and is in disabled state.

- Parent port and the adjacent port (in case of 100-G ports) is disabled after breakout is enabled and the configuration on the parent port is deleted and not saved. The port returns to a default port status.

- Breakout ports appear in the output of **show run**, **show interface status**, **show ip interface brief** and other show and configuration commands once breakout is enabled and they are automatically removed from all the show and configuration CLIs when breakout is disabled.

See Breakout Interfaces, on page 7 for the list of configurable interfaces.

Default Ethernet Interface Configuration

To configure Layer 2 parameters, if the interface is in Layer 3 mode, you must enter the **switchport** interface configuration command without any parameters to put the interface into Layer 2 mode. This shuts down the interface and then re-enables it, which might generate messages on the device to which the interface is connected. When you put an interface that is in Layer 3 mode into Layer 2 mode, the previous configuration information related to the affected interface might be lost, and the interface is returned to its default configuration.

Note The default switchport mode for all Ethernet interfaces is **dynamic desirable** for C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches

This table shows the Ethernet interface default configuration, including some features that apply only to Layer 2 interfaces.

Table 1: Default Layer 2 Ethernet Interface Configuration

Feature	Default Setting
Operating mode	Layer 2 or switching mode (**switchport** command) for C9500-12Q-E, C9500-12Q-A, C9500-24Q-E, C9500-24Q-A, C9500-40X-E, and C9500-40X-A models of the Cisco Catalyst 9500 Series Switches. Layer 3 or routed port for C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches

Feature	Default Setting
Allowed VLAN range	VLANs 1 to 4094.
Default VLAN (for access ports)	VLAN 1 (Layer 2 interfaces only).
Native VLAN (for IEEE 802.1Q trunks)	VLAN 1 (Layer 2 interfaces only).
VLAN trunking	Switchport mode dynamic auto (supports DTP) (Layer 2 interfaces only) for C9500-12Q-E, C9500-12Q-A, C9500-24Q-E, C9500-24Q-A, C9500-40X-E, and C9500-40X-A models of the Cisco Catalyst 9500 Series Switches. Switchport mode dynamic desirable (supports DTP) (Layer 3 interfaces only) for C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches
Port enable state	All ports are enabled.
Port description	None defined.
Speed	Autonegotiate. (Not supported on the 40-Gigabit interfaces.) The C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches do not support autonegotiate. Their speed is determined by the type of transceiver module plugged in.
Duplex mode	Autonegotiate. (Not supported on the 40-Gigabit interfaces.) The C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches support full duplex mode.
Flow control	Flow control is set to **receive: on**. It is always off for sent packets.
EtherChannel (PAgP)	Disabled on all Ethernet ports.
Port blocking (unknown multicast and unknown unicast traffic)	Disabled (not blocked) (Layer 2 interfaces only).
Broadcast, multicast, and unicast storm control	Disabled.
Protected port	Disabled (Layer 2 interfaces only).
Port security	Disabled (Layer 2 interfaces only).
Port Fast	Disabled.
Auto-MDIX	Enabled.

Interface Speed and Duplex Mode

The ethernet interfaces operate at full duplex mode. In full-duplex mode, two stations can send and receive traffic at the same time.

The following table lists the modules and the speed at which they operate.

Module	Speed with Transceiver Module Plugged in
C9500-32QC	40G, or 100G with a QSFP transceiver module, or 10G with CVR-QSFP-SFP10G transceiver module.
C9500-32C	40G,or 100G with a QSFP transceiver module, or 10G with CVR-QSFP-SFP10G transceiver module.
C9500-48Y4C	1G with SFP module,10G with SFP+ module, 25G with QSFP28 module, 40G and 100G with QSFP module
C9500-24Y4C	1G with SFP module, 10G with SFP+ module, 25G with QSFP28 module, 40G and 100G with QSFP module.

Note SFP, SFP+ and SFP28 ports support speed (auto/10/100/100) and duplex (auto/full/half) options only if the 1000Base-T SFP or the GLC-GE-100FX modules are used.

IEEE 802.3x Flow Control

Flow control enables connected Ethernet ports to control traffic rates during congestion by allowing congested nodes to pause link operation at the other end. If one port experiences congestion and cannot receive any more traffic, it notifies the other port by sending a pause frame to stop sending until the condition clears. Upon receipt of a pause frame, the sending device stops sending any data packets, which prevents any loss of data packets during the congestion period.

Note The switch ports can receive, but not send, pause frames.

You use the **flowcontrol** interface configuration command to set the interface's ability to **receive** pause frames to **on**, **off**, or **desired**. The default state is **on**.

When set to **desired**, an interface can operate with an attached device that is required to send flow-control packets or with an attached device that is not required to but can send flow-control packets.

These rules apply to flow control settings on the device:

- **receive on** (or **desired**): The port cannot send pause frames but can operate with an attached device that is required to or can send pause frames; the port can receive pause frames.
- **receive off**: Flow control does not operate in either direction. In case of congestion, no indication is given to the link partner, and no pause frames are sent or received by either device.

Note For details on the command settings and the resulting flow control resolution on local and remote ports, see the **flowcontrol** interface configuration command in the command reference for this release.

Layer 3 Interfaces

The device supports these types of Layer 3 interfaces:

- SVIs: You should configure SVIs for any VLANs for which you want to route traffic. SVIs are created when you enter a VLAN ID following the **interface vlan** global configuration command. To delete an SVI, use the **no interface vlan** global configuration command. You cannot delete interface VLAN 1.

  Note When you create an SVI, it does not become active until it is associated with a physical port.

  When configuring SVIs, you can use the **switchport autostate exclude** command on a port to exclude that port from being included in determining SVI line-state. To disable autostate on the SVI, use the **no autostate** command on the SVI.

- Routed ports: Routed ports are physical ports configured to be in Layer 3 mode by using the **no switchport** interface configuration command.

- Layer 3 EtherChannel ports: EtherChannel interfaces made up of routed ports.

A Layer 3 device can have an IP address assigned to each routed port and SVI.

There is no defined limit to the number of SVIs and routed ports that can be configured in a device or in a device stack. However, the interrelationship between the number of SVIs and routed ports and the number of other features being configured might have an impact on CPU usage because of hardware limitations. If the device is using its maximum hardware resources, attempts to create a routed port or SVI have these results:

- If you try to create a new routed port, the device generates a message that there are not enough resources to convert the interface to a routed port, and the interface remains as a switchport.

- If you try to create an extended-range VLAN, an error message is generated, and the extended-range VLAN is rejected.

- If the device is notified by VLAN Trunking Protocol (VTP) of a new VLAN, it sends a message that there are not enough hardware resources available and shuts down the VLAN. The output of the **show vlan** user EXEC command shows the VLAN in a suspended state.

- If the device attempts to boot up with a configuration that has more VLANs and routed ports than hardware can support, the VLANs are created, but the routed ports are shut down, and the device sends a message that this was due to insufficient hardware resources.

Note All Layer 3 interfaces require an IP address to route traffic. This procedure shows how to configure an interface as a Layer 3 interface and how to assign an IP address to an interface:

If the physical port is in Layer 2 mode (the default), you must enter the **no switchport** interface configuration command to put the interface into Layer 3 mode. Entering a **no switchport** command disables and then re-enables the interface, which might generate messages on the device to which the interface is connected. Furthermore, when you put an interface that is in Layer 2 mode into Layer 3 mode, the previous configuration information related to the affected interface might be lost, and the interface is returned to its default configuration

How to Configure Interface Characteristics

Configuring Interfaces

These general instructions apply to all interface configuration processes.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

Step 3	**interface**
	Example:
	`Device(config)# interface fortygigabitethernet1/0/1`
	`Device(config-if)#`
		Identifies the interface type, and the number of the connector.
		Note You do not need to add a space between the interface type and the interface number. For example, in the preceding line, you can specify either **fortygigabitethernet 1/0/1**, or **fortygigabitethernet1/0/1**.

Step 4	Follow each **interface** command with the interface configuration commands that the interface requires.	Defines the protocols and applications that will run on the interface. The commands are collected and applied to the interface when you

	Command or Action	Purpose
		enter another interface command or enter **end** to return to privileged EXEC mode.
Step 5	**interface range** or **interface range macro**	(Optional) Configures a range of interfaces. **Note** Interfaces configured in a range must be the same type and must be configured with the same feature options.
Step 6	**show interfaces**	Displays a list of all interfaces on or configured for the switch. A report is provided for each interface that the device supports or for the specified interface.

Adding a Description for an Interface

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-id* **Example:** `Device(config)# interface fortygigabitethernet1/0/2`	Specifies the interface for which you are adding a description, and enter interface configuration mode.
Step 4	**description** *string* **Example:** `Device(config-if)# description Connects to Marketing`	Adds a description for an interface.
Step 5	**end** **Example:**	Returns to privileged EXEC mode.

	Command or Action	Purpose
	`Device(config-if)# end`	
Step 6	**show interfaces** *interface-id* **description**	Verifies your entry.
Step 7	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring a Range of Interfaces

To configure multiple interfaces with the same configuration parameters, use the **interface range** global configuration command. When you enter the interface-range configuration mode, all command parameters that you enter are attributed to all interfaces within that range until you exit this mode.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface range** {*port-range* | **macro** *macro_name*} **Example:** `Device(config)# interface range macro`	Specifies the range of interfaces (VLANs or physical ports) to be configured, and enter interface-range configuration mode. • You can use the **interface range** command to configure up to five port ranges or a previously defined macro. • The **macro** variable is explained in the section on *Configuring and Using Interface Range Macros.* • In a comma-separated *port-range*, you must enter the interface type for each entry

	Command or Action	Purpose
		and enter spaces before and after the comma. • In a hyphen-separated *port-range*, you do not need to re-enter the interface type, but you must enter a space before the hyphen. **Note** Use the normal configuration commands to apply the configuration parameters to all interfaces in the range. Each command is executed as it is entered.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.
Step 5	**show interfaces** [*interface-id*] **Example:** `Device# show interfaces`	Verifies the configuration of the interfaces in the range.
Step 6	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring and Using Interface Range Macros

You can create an interface range macro to automatically select a range of interfaces for configuration. Before you can use the **macro** keyword in the **interface range macro** global configuration command string, you must use the **define interface-range** global configuration command to define the macro.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**define interface-range** *macro_name interface-range* **Example:** `Device(config)# define interface-range enet_list fortygigabitethernet1/0/1 - 5`	Defines the interface-range macro, and save it in NVRAM. • The *macro_name* is a 32-character maximum character string. • A macro can contain up to five comma-separated interface ranges. • Each *interface-range* must consist of the same port type. **Note** Before you can use the **macro** keyword in the **interface range macro** global configuration command string, you must use the **define interface-range** global configuration command to define the macro.
Step 4	**interface range macro** *macro_name* **Example:** `Device(config)# interface range macro enet_list`	Selects the interface range to be configured using the values saved in the interface-range macro called *macro_name*. You can now use the normal configuration commands to apply the configuration to all interfaces in the defined macro.
Step 5	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.
Step 6	**show running-config | include define** **Example:** `Device# show running-config | include define`	Shows the defined interface range macro configuration.
Step 7	**copy running-config startup-config** **Example:** `Device# copy running-config`	(Optional) Saves your entries in the configuration file.

	Command or Action	Purpose
	`startup-config`	

Configuring Breakout Interfaces

For information about device compatibility, see the Transceiver Module Group (TMG) Compatibility Matrix.

C9500-NM-2Q Network Module

The default port connections for the C9500-NM-2Q module depend on whether you use a 40G QSFP module or a 4x10G breakout cable.

- If you use a 40G QSFP module, the ports default to 40G interfaces.
- If you use a 4x10G breakout cable, one 40G port is split into four 10G ports.
- You can use a combination of 40G QSFP modules and 4x10G breakout cables.
- For a 40G port —**FortyGigabitEthernet 1/1/***port-num*, the corresponding starting port in every set of the four 10G breakout ports is **TenGigabitEthernet 1/1/***4***x***port-num-3*, where *port-num* is the port number. For example, the starting port in the first set of 10G breakout ports is TenGigabitEthernet1/1/1, the starting port in the second set of 10G starting breakout ports is TenGigabitEthernet1/1/5 and so on.

The following tables list all the interfaces which are configurable depending on the type of module and cable used. Note that the **show interface status** command displays all the interfaces in the active state.

- In Table 2: C9500-NM-2Q Module with two 40G QSFP Modules, the 10G interfaces are displayed but are not active.
- In Table 3: C9500-NM-2Q Module with two 4x10G Breakout Cables, the 40G interfaces are displayed but are not active.

Table 2: C9500-NM-2Q Module with two 40G QSFP Modules

Interface	Action
FortyGigabitEthernet1/1/1	Configure this interface
FortyGigabitEthernet1/1/2	Configure this interface
TenGigabitEthernet1/1/1	Disregard
TenGigabitEthernet1/1/2	Disregard
TenGigabitEthernet1/1/3	Disregard
TenGigabitEthernet1/1/4	Disregard
TenGigabitEthernet1/1/5	Disregard
TenGigabitEthernet1/1/6	Disregard
TenGigabitEthernet1/1/7	Disregard

Interface	Action
TenGigabitEthernet1/1/8	Disregard

Table 3: C9500-NM-2Q Module with two 4x10G Breakout Cables

Interface	Action
FortyGigabitEthernet1/1/1	Disregard
FortyGigabitEthernet1/1/2	Disregard
TenGigabitEthernet1/1/1	Configure this interface
TenGigabitEthernet1/1/2	Configure this interface
TenGigabitEthernet1/1/3	Configure this interface
TenGigabitEthernet1/1/4	Configure this interface
TenGigabitEthernet1/1/5	Configure this interface
TenGigabitEthernet1/1/6	Configure this interface
TenGigabitEthernet1/1/7	Configure this interface
TenGigabitEthernet1/1/8	Configure this interface

C9500-12Q

The default port connections on the C9500-12Q switch model depends on whether you use a 40G QSFP module or a dual mode breakout cable.

- If you use a 40G QSFP module, the ports default to 40G interfaces.
- If you use a dual mode breakout cable, you can either configure a 40G port or four 10G ports by using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command to switch between the 40G straight mode and 4x10G breakout mode, where *module-num* is 1, *port-num* varies from 1 to 12 and *switch-num* is the switch number in the stack which varies from 1 to 8.
- You can use a combination of 40G QSFP modules and 4x10G breakout cables.
- For a 40G port —**FortyGigabitEthernet 1/0/***port-num*, the corresponding starting port in every set of the four 10G breakout ports is **TenGigabitEthernet 1/0/***4x**port-num-3*, where *port-num* is the port number. For example, the starting port in the first set of 10G breakout ports is TenGigabitEthernet1/0/1, the starting port in the second set of 10G starting breakout ports is TenGigabitEthernet1/0/5 and so on.

The following tables list all the interfaces which are configurable depending on the type of module and cable used. Note that the **show interface status** command displays all the interfaces in the active state.

- In Table 4: C9500-12Q with only 40G QSFP Modules in all the 12 ports, the 10G interfaces are displayed but are not active.
- In Table 5: C9500-12Q with Breakout Cables in all the ports, both the 10G and 40G interfaces are displayed. All the 10G interfaces from TenGigabitEthernet1/0/1 through TenGigabitEthernet1/0/48 are

active and all the 40G interfaces from FortyGigabitEthernet1/0/1 through FortyGigabitEthernet1/0/12 are not active.

Table 4: C9500-12Q with only 40G QSFP Modules

Interface	Action
FortyGigabitEthernet1/0/1	Configure this interface
FortyGigabitEthernet1/0/2	Configure this interface
FortyGigabitEthernet1/0/3	Configure this interface
FortyGigabitEthernet1/0/4	Configure this interface
FortyGigabitEthernet1/0/5	Configure this interface
FortyGigabitEthernet1/0/6	Configure this interface
FortyGigabitEthernet1/0/7	Configure this interface
FortyGigabitEthernet1/0/8	Configure this interface
FortyGigabitEthernet1/0/9	Configure this interface
FortyGigabitEthernet1/0/10	Configure this interface
FortyGigabitEthernet1/0/11	Configure this interface
FortyGigabitEthernet1/0/12	Configure this interface
TenGigabitEthernet1/0/1	Disregard
TenGigabitEthernet1/0/2	Disregard
TenGigabitEthernet1/0/3	Disregard
TenGigabitEthernet1/0/4	Disregard
TenGigabitEthernet1/0/5	Disregard
TenGigabitEthernet1/0/6	Disregard
TenGigabitEthernet1/0/7	Disregard
TenGigabitEthernet1/0/8	Disregard
TenGigabitEthernet1/0/9	Disregard
TenGigabitEthernet1/0/10	Disregard
TenGigabitEthernet1/0/11	Disregard
TenGigabitEthernet1/0/12	Disregard
TenGigabitEthernet1/0/13	Disregard

Interface	Action
TenGigabitEthernet1/0/14	Disregard
TenGigabitEthernet1/0/15	Disregard
TenGigabitEthernet1/0/16	Disregard
TenGigabitEthernet1/0/17	Disregard
TenGigabitEthernet1/0/18	Disregard
TenGigabitEthernet1/0/19	Disregard
TenGigabitEthernet1/0/20	Disregard
TenGigabitEthernet1/0/21	Disregard
TenGigabitEthernet1/0/22	Disregard
TenGigabitEthernet1/0/23	Disregard
TenGigabitEthernet1/0/24	Disregard
TenGigabitEthernet1/0/25	Disregard
TenGigabitEthernet1/0/26	Disregard
TenGigabitEthernet1/0/27	Disregard
TenGigabitEthernet1/0/28	Disregard
TenGigabitEthernet1/0/29	Disregard
TenGigabitEthernet1/0/30	Disregard
TenGigabitEthernet1/0/31	Disregard
TenGigabitEthernet1/0/32	Disregard
TenGigabitEthernet1/0/33	Disregard
TenGigabitEthernet1/0/34	Disregard
TenGigabitEthernet1/0/35	Disregard
TenGigabitEthernet1/0/36	Disregard
TenGigabitEthernet1/0/37	Disregard
TenGigabitEthernet1/0/38	Disregard
TenGigabitEthernet1/0/39	Disregard
TenGigabitEthernet1/0/40	Disregard
TenGigabitEthernet1/0/41	Disregard

Interface	Action
TenGigabitEthernet1/0/42	Disregard
TenGigabitEthernet1/0/43	Disregard
TenGigabitEthernet1/0/44	Disregard
TenGigabitEthernet1/0/45	Disregard
TenGigabitEthernet1/0/46	Disregard
TenGigabitEthernet1/0/47	Disregard
TenGigabitEthernet1/0/48	Disregard

Table 5: C9500-12Q with Breakout Cables

Interface	Action
FortyGigabitEthernet1/0/1	Disregard
FortyGigabitEthernet1/0/2	Disregard
FortyGigabitEthernet1/0/3	Disregard
FortyGigabitEthernet1/0/4	Disregard
FortyGigabitEthernet1/0/5	Disregard
FortyGigabitEthernet1/0/6	Disregard
FortyGigabitEthernet1/0/7	Disregard
FortyGigabitEthernet1/0/8	Disregard
FortyGigabitEthernet1/0/9	Disregard
FortyGigabitEthernet1/0/10	Disregard
FortyGigabitEthernet1/0/11	Disregard
FortyGigabitEthernet1/0/12	Disregard
TenGigabitEthernet1/0/1	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/2	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/3	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/4	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/5	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/6	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/7	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/8	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/9	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/10	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/11	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/12	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/13	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/14	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/15	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/16	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/17	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/18	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/19	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/20	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/21	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/22	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/23	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/24	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/25	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/26	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/27	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/28	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/29	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/30	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/31	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/32	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/33	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/34	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/35	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/36	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/37	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/38	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/39	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/40	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/41	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/42	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/43	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/44	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/45	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/46	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/47	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/48	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

C9500-24Q

The default port connections on the C9500-24Q switch model depends on whether you use a 40G QSFP module or a dual mode breakout cable.

- If you use a 40G QSFP module, the ports default to 40G interfaces.
- If you use a dual mode breakout cable, you can either configure a 40G port or four 10G ports by using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command to switch between the 40G straight mode and 4x10G breakout mode, where *module-num* is 1, *port-num* varies from 1 to 24 and *switch-num* is the switch number in the stack which varies from 1 to 8.
- You can use a combination of 40G QSFP modules and 4x10G breakout cables.
- For a 40G port —**FortyGigabitEthernet 1/0/***port-num*, the corresponding starting port in every set of the four 10G breakout ports is **TenGigabitEthernet 1/0/***4***x***port-num-3*, where *port-num* is the port number. For example, the starting port in the first set of 10G breakout ports is TenGigabitEthernet1/0/1, the starting port in the second set of 10G starting breakout ports is TenGigabitEthernet1/0/5 and so on.

The following tables list all the interfaces which are configurable depending on the type of module and cable used. Note that the **show interface status** command displays all the interfaces in the active state.

- In Table 6: C9500-24Q with only 40G QSFP Modules in all the 24 ports, the 10G interfaces are displayed but are not active.
- In Table 7: C9500-24Q with Breakout Cables, both the 10G and 40G interfaces are displayed but only 10G interfaces from TenGigabitEthernet1/0/1 through TenGigabitEthernet1/0/96 are active and only 40G interfaces from FortyGigabitEthernet1/0/1 through FortyGigabitEthernet1/0/24 are not active.

Table 6: C9500-24Q with only 40G QSFP Modules

Interface	Action
FortyGigabitEthernet1/0/1	Configure this interface
FortyGigabitEthernet1/0/2	Configure this interface
FortyGigabitEthernet1/0/3	Configure this interface
FortyGigabitEthernet1/0/4	Configure this interface
FortyGigabitEthernet1/0/5	Configure this interface
FortyGigabitEthernet1/0/6	Configure this interface
FortyGigabitEthernet1/0/7	Configure this interface
FortyGigabitEthernet1/0/8	Configure this interface
FortyGigabitEthernet1/0/9	Configure this interface
FortyGigabitEthernet1/0/10	Configure this interface
FortyGigabitEthernet1/0/11	Configure this interface
FortyGigabitEthernet1/0/12	Configure this interface
FortyGigabitEthernet1/0/13	Configure this interface
FortyGigabitEthernet1/0/14	Configure this interface
FortyGigabitEthernet1/0/15	Configure this interface
FortyGigabitEthernet1/0/16	Configure this interface
FortyGigabitEthernet1/0/17	Configure this interface
FortyGigabitEthernet1/0/18	Configure this interface
FortyGigabitEthernet1/0/19	Configure this interface
FortyGigabitEthernet1/0/20	Configure this interface
FortyGigabitEthernet1/0/21	Configure this interface
FortyGigabitEthernet1/0/22	Configure this interface
FortyGigabitEthernet1/0/23	Configure this interface

Interface	Action
FortyGigabitEthernet1/0/24	Configure this interface
TenGigabitEthernet1/0/1	Disregard
TenGigabitEthernet1/0/2	Disregard
TenGigabitEthernet1/0/3	Disregard
TenGigabitEthernet1/0/4	Disregard
TenGigabitEthernet1/0/5	Disregard
TenGigabitEthernet1/0/6	Disregard
TenGigabitEthernet1/0/7	Disregard
TenGigabitEthernet1/0/8	Disregard
TenGigabitEthernet1/0/9	Disregard
TenGigabitEthernet1/0/10	Disregard
TenGigabitEthernet1/0/11	Disregard
TenGigabitEthernet1/0/12	Disregard
TenGigabitEthernet1/0/13	Disregard
TenGigabitEthernet1/0/14	Disregard
TenGigabitEthernet1/0/15	Disregard
TenGigabitEthernet1/0/16	Disregard
TenGigabitEthernet1/0/17	Disregard
TenGigabitEthernet1/0/18	Disregard
TenGigabitEthernet1/0/19	Disregard
TenGigabitEthernet1/0/20	Disregard
TenGigabitEthernet1/0/21	Disregard
TenGigabitEthernet1/0/22	Disregard
TenGigabitEthernet1/0/23	Disregard
TenGigabitEthernet1/0/24	Disregard
TenGigabitEthernet1/0/25	Disregard
TenGigabitEthernet1/0/26	Disregard
TenGigabitEthernet1/0/27	Disregard

Interface	Action
TenGigabitEthernet1/0/28	Disregard
TenGigabitEthernet1/0/29	Disregard
TenGigabitEthernet1/0/30	Disregard
TenGigabitEthernet1//31	Disregard
TenGigabitEthernet1/0/32	Disregard
TenGigabitEthernet1/0/33	Disregard
TenGigabitEthernet1/0/34	Disregard
TenGigabitEthernet1/0/35	Disregard
TenGigabitEthernet1/0/36	Disregard
TenGigabitEthernet1/0/37	Disregard
TenGigabitEthernet1/0/38	Disregard
TenGigabitEthernet1/0/39	Disregard
TenGigabitEthernet1/0/40	Disregard
TenGigabitEthernet1/0/41	Disregard
TenGigabitEthernet1/0/42	Disregard
TenGigabitEthernet1/0/43	Disregard
TenGigabitEthernet1/0/44	Disregard
TenGigabitEthernet1/0/45	Disregard
TenGigabitEthernet1/0/46	Disregard
TenGigabitEthernet1/0/47	Disregard
TenGigabitEthernet1/0/48	Disregard
TenGigabitEthernet1/0/49	Disregard
TenGigabitEthernet1/0/50	Disregard
TenGigabitEthernet1/0/51	Disregard
TenGigabitEthernet1/0/52	Disregard
TenGigabitEthernet1/0/53	Disregard
TenGigabitEthernet1/0/54	Disregard
TenGigabitEthernet1/0/55	Disregard

Interface	Action
TenGigabitEthernet1/0/56	Disregard
TenGigabitEthernet1/0/57	Disregard
TenGigabitEthernet1/0/58	Disregard
TenGigabitEthernet1/0/59	Disregard
TenGigabitEthernet1/0/60	Disregard
TenGigabitEthernet1/0/61	Disregard
TenGigabitEthernet1/0/62	Disregard
TenGigabitEthernet1/0/63	Disregard
TenGigabitEthernet1/0/64	Disregard
TenGigabitEthernet1/0/65	Disregard
TenGigabitEthernet1/0/66	Disregard
TenGigabitEthernet1/0/67	Disregard
TenGigabitEthernet1/0/68	Disregard
TenGigabitEthernet1/0/69	Disregard
TenGigabitEthernet1/0/70	Disregard
TenGigabitEthernet1/0/71	Disregard
TenGigabitEthernet1/0/72	Disregard
TenGigabitEthernet1/0/73	Disregard
TenGigabitEthernet1/0/74	Disregard
TenGigabitEthernet1/0/75	Disregard
TenGigabitEthernet1/0/76	Disregard
TenGigabitEthernet1/0/77	Disregard
TenGigabitEthernet1/0/78	Disregard
TenGigabitEthernet1/0/79	Disregard
TenGigabitEthernet1/0/80	Disregard
TenGigabitEthernet1/0/81	Disregard
TenGigabitEthernet1/0/82	Disregard
TenGigabitEthernet1/0/83	Disregard

Interface	Action
TenGigabitEthernet1/0/84	Disregard
TenGigabitEthernet1/0/85	Disregard
TenGigabitEthernet1/0/86	Disregard
TenGigabitEthernet1/0/87	Disregard
TenGigabitEthernet1/0/88	Disregard
TenGigabitEthernet1/0/89	Disregard
TenGigabitEthernet1/0/90	Disregard
TenGigabitEthernet1/0/91	Disregard
TenGigabitEthernet1/0/92	Disregard
TenGigabitEthernet1/0/93	Disregard
TenGigabitEthernet1/0/94	Disregard
TenGigabitEthernet1/0/95	Disregard
TenGigabitEthernet1/0/96	Disregard

Table 7: C9500-24Q with Breakout Cables

Interface	Action
FortyGigabitEthernet1/0/1	Disregard
FortyGigabitEthernet1/0/2	Disregard
FortyGigabitEthernet1/0/3	Disregard
FortyGigabitEthernet1/0/4	Disregard
FortyGigabitEthernet1/0/5	Disregard
FortyGigabitEthernet1/0/6	Disregard
FortyGigabitEthernet1/0/7	Disregard
FortyGigabitEthernet1/0/8	Disregard
FortyGigabitEthernet1/0/9	Disregard
FortyGigabitEthernet1/0/10	Disregard
FortyGigabitEthernet1/0/11	Disregard
FortyGigabitEthernet1/0/12	Disregard

Interface	Action
FortyGigabitEthernet1/0/13	Disregard
FortyGigabitEthernet1/0/14	Disregard
FortyGigabitEthernet1/0/15	Disregard
FortyGigabitEthernet1/0/16	Disregard
FortyGigabitEthernet1/0/17	Disregard
FortyGigabitEthernet1/0/18	Disregard
FortyGigabitEthernet1/0/19	Disregard
FortyGigabitEthernet1/0/20	Disregard
FortyGigabitEthernet1/0/21	Disregard
FortyGigabitEthernet1/0/22	Disregard
FortyGigabitEthernet1/0/23	Disregard
FortyGigabitEthernet1/0/24	Disregard
TenGigabitEthernet1/0/1	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/2	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/3	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/4	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/5	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/6	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/7	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/8	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/9	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/10	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/11	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/12	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/13	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/14	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/15	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/16	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/17	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/18	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/19	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/20	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/21	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/22	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/23	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/24	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/25	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/26	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/27	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/28	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/29	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/30	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/31	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/32	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/33	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/34	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/35	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/36	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/37	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/38	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/39	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/40	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/41	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/42	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/43	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/44	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/45	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/46	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/47	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/48	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/49	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/50	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/51	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/52	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/53	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/54	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/55	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/56	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/57	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/58	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/59	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/60	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/61	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/62	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/63	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/64	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/65	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/66	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/67	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/68	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/69	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/70	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/71	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/72	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/73	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/74	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/75	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/76	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/77	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/78	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/79	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/80	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/81	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/82	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/83	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/84	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/85	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/86	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

Interface	Action
TenGigabitEthernet1/0/87	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/88	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/89	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/90	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/91	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/92	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/93	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/94	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/95	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.
TenGigabitEthernet1/0/96	Configure this interface, if 4x10G breakout is configured using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command.

C9500-32C

The default port connections on the C9500-32C switch model depends on whether you use a 40G QSFP module, a 100G QSFP28 module, a breakout cable or a dual mode breakout cable. You can use a combination of 40G QSFP modules, 100G QSFP28 modules and the 4x10G and 4x25G breakout cables. All the interfaces on C9500-32C switch model are named as HundredGigabitEthernet1/0/*port-num* irrespective of the module inserted into the ports — 40G QSFP module or 100G QSFP28 module.

If you use a dual mode breakout cable, you can either configure a 40G port or four 10G ports by using the **hw-module breakout module** *module-num* **port** *port-num* **switch** *switch-num* command to switch between the 40G straight mode and 4x10G breakout mode.

Enabling breakout on C9500-32C with Cisco StackWise Virtual

To enable breakout on a port, use the **hw-module switch** *switch-num* **breakout port** *port-number* command where *switch-num* varies between 1 and 2 and *port-number* varies from 1 and 32. Use the no form of this command to disable breakout on a port.

To enable breakout on all the supported breakout ports, use the **hw-module switch** *switch-num* **breakout port** *port-range* command where *switch-num* varies between 1 and 2 and *port-range* varies from 1 to 32. Use the no form of this command to disable breakout on all the supported ports.

Enabling breakout on C9500-32C without Cisco StackWise Virtual (Standalone Mode)

To enable breakout on a port, use the **hw-module breakout port** *port-number* command. Use the no form of this command to disable breakout on a port.

To enable breakout on all the supported breakout ports, use the **hw-module breakout port** *port-range* command where *port-range* is 1-32. Use the no form of this command to disable breakout on all the supported ports.

The following table lists all the interfaces which are configurable depending on the type of module or breakout cable used. Breakout of port 2 (40G) and port 7 (100G) is shown in the table below.

- A 4x10G breakout cable is inserted into port number 2. Breakout is enabled using the command **`hw-module breakout 2`**. Port number 2 — Hu1/0/2 — is split into four 10G ports — Hu1/0/2/1, Hu1/0/2/2, Hu1/0/2/3 and Hu1/0/2/4.
- A 4x25G breakout cable is inserted into port number 7. Breakout is enabled using the command **`hw-module breakout 7`**. Port number 7 — Hu1/0/7 — is split into four 25G ports — Hu1/0/7/1, Hu1/0/7/2, Hu1/0/7/3 and Hu1/0/7/4.

Table 8: C9500-32C with 40G QSFP modules, 100G QSFP28 modules and Breakout Cables

Interface	Action
HundredGigabitEthernet1/0/1	Configure this interface
HundredGigabitEthernet1/0/2	Disregard **Note** Although visible in the CLI, this port is inactive as 4x10G breakout is enabled on this port.
HundredGigabitEthernet1/0/3	Configure this interface
HundredGigabitEthernet1/0/4	Configure this interface

Interface	Action
HundredGigabitEthernet1/0/5	Configure this interface
HundredGigabitEthernet1/0/6	Configure this interface
HundredGigabitEthernet1/0/7	Disregard **Note** Although visible in the CLI, this port is inactive as 4x25G breakout is enabled on this port.
HundredGigabitEthernet1/0/8	Configure this interface
HundredGigabitEthernet1/0/9	Configure this interface
HundredGigabitEthernet1/0/10	Configure this interface
HundredGigabitEthernet1/0/11	Configure this interface
HundredGigabitEthernet1/0/12	Configure this interface
HundredGigabitEthernet1/0/13	Configure this interface
HundredGigabitEthernet1/0/14	Configure this interface
HundredGigabitEthernet1/0/15	Configure this interface
HundredGigabitEthernet1/0/16	Configure this interface
HundredGigabitEthernet1/0/17	Configure this interface
HundredGigabitEthernet1/0/18	Configure this interface
HundredGigabitEthernet1/0/19	Configure this interface
HundredGigabitEthernet1/0/20	Configure this interface
HundredGigabitEthernet1/0/21	Configure this interface
HundredGigabitEthernet1/0/22	Configure this interface
HundredGigabitEthernet1/0/23	Configure this interface
HundredGigabitEthernet1/0/24	Configure this interface
HundredGigabitEthernet1/0/23	Configure this interface
HundredGigabitEthernet1/0/24	Configure this interface
HundredGigabitEthernet1/0/25	Configure this interface
HundredGigabitEthernet1/0/26	Configure this interface
HundredGigabitEthernet1/0/27	Configure this interface

Interface	Action
HundredGigabitEthernet1/0/28	Configure this interface
HundredGigabitEthernet1/0/29	Configure this interface
HundredGigabitEthernet1/0/30	Configure this interface
HundredGigabitEthernet1/0/31	Configure this interface
HundredGigabitEthernet1/0/32	Configure this interface
HundredGigabitEthernet1/0/2/1	Configure this interface
HundredGigabitEthernet1/0/2/2	Configure this interface
HundredGigabitEthernet1/0/2/3	Configure this interface
HundredGigabitEthernet1/0/2/4	Configure this interface
HundredGigabitEthernet1/0/7/1	Configure this interface
HundredGigabitEthernet1/0/7/2	Configure this interface
HundredGigabitEthernet1/0/7/3	Configure this interface
HundredGigabitEthernet1/0/7/4	Configure this interface

Configuring Forty Gigabit Ethernet Interface

Follow these steps to configure the forty gigabit ethernet interface. Use the no form of the command to disable the fortygigabit ethernet interface.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-id* **Example:**	Specifies the interface type,that has to be configured.

	Command or Action	Purpose
	`Device(config)# interface fortygigabitethernet1/0/9` `Device(config-if)#`	
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Configuring Hundred Gigabit Ethernet Interface

Follow these steps to configure the hundred gigabit ethernet interface. Use the no form of the command to disable the hundred gigabit ethernet interface.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device# configure terminal`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-type interface-id* **Example:** `Device(config)# interface HundredGigabitEthernet1/0/9`	Specifies the interface type,that has to be configured.
Step 4	**enable** **Example:** `Device(config-if)# enable`	Enables the hundred gigabit ethernet interface. Use **no enable** command to disable the hundred gigabit ethernet interface.

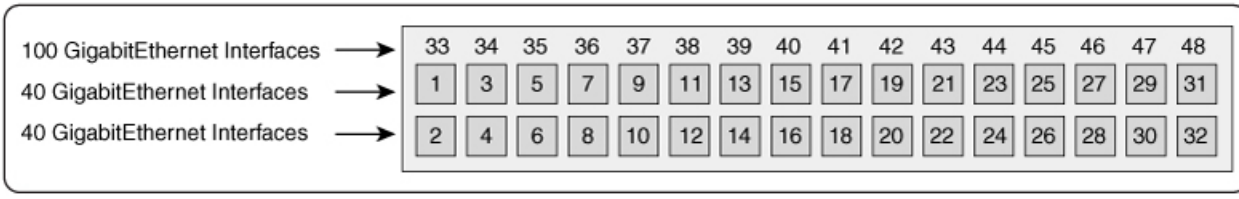
Configuring Hundred GigabitEthernet Interfaces on C9500-32QC

C9500-32QC switch model support port speed of 40G and 100G depending on the QSFP module inserted into the port. The native port numbering and interface configuration on this model is explained below:

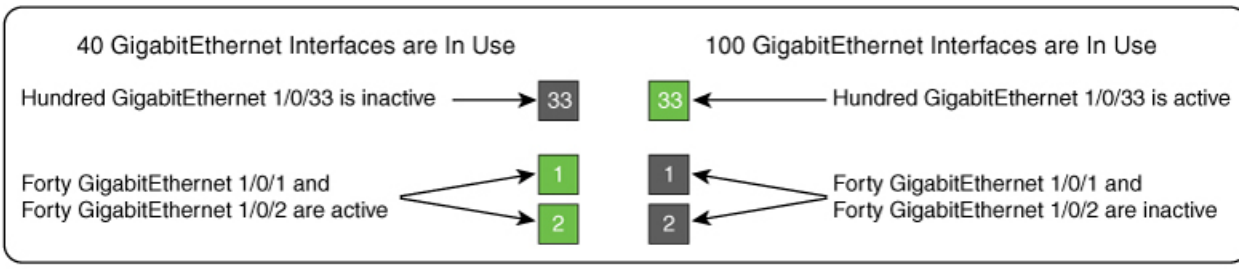
- C9500-32QC — The 40G ports on this switch can be configured to function as 100G ports using the CLI. To enable the 100 GigabitEthernet interfaces, you need to use the CLI.

Interfaces on C9500-32QC

Figure 2: Default Interfaces on C9500-32QC



Insert the 100G QSFP28 module only in the odd-numbered ports (1 to 31) on the upper row. When you insert the 100G QSFP28 module, the corresponding odd-numbered 40G port from the upper row and the even-numbered 40G port from the lower row become inactive when you enter **enable** command on the CLI.



The default status of the 40 GigabitEthernet and 100 GigabitEthernet interfaces is as below:

- Port numbers 1 to 24 are active as 40 GigabitEthernet interfaces, by default. The corresponding 100 GigabitEthernet interfaces for these ports become inactive. To enable the 100 GigabitEthernet interfaces - 33 to 44, use the **enable** command on the 40 GigabitEthernet interface.
- Port numbers 25 to 32 are active as 100 GigabitEthernet interfaces, by default. The corresponding 40 GigabitEthernet interfaces for these ports become inactive. To enable the 40 GigabitEthernet interfaces on these ports - 25 to 32, use the **no enable** command on the 100 GigabitEthernet interface.

The port mapping for 100GigabitEthernet interfaces is shown in the table below:

Table 9: Port mapping for 100 GigabitEthernet interfaces

40 GigabitEthernet Ports/Interfaces	100 GigabitEthernet Interfaces
Port number 1 and 2 (FortyGigabitEthernet 1/0/1 and FortyGigabitEthernet 1/0/2)	HundredGigabitEthernet 1/0/33
Port number 3 and 4 (FortyGigabitEthernet 1/0/3 and FortyGigabitEthernet 1/0/4)	HundredGigabitEthernet 1/0/34
Port number 5 and 6 (FortyGigabitEthernet 1/0/5 and FortyGigabitEthernet 1/0/6)	HundredGigabitEthernet 1/0/35

40 GigabitEthernet Ports/Interfaces	100 GigabitEthernet Interfaces
Port number 7 and 8 (FortyGigabitEthernet 1/0/7 and FortyGigabitEthernet 1/0/8)	HundredGigabitEthernet 1/0/36
Port number 9 and 10 (FortyGigabitEthernet 1/0/9 and FortyGigabitEthernet 1/0/10)	HundredGigabitEthernet 1/0/37
Port number 11 and 12 (FortyGigabitEthernet 1/0/11 and FortyGigabitEthernet 1/0/12)	HundredGigabitEthernet 1/0/38
Port number 13 and 14 (FortyGigabitEthernet 1/0/13 and FortyGigabitEthernet 1/0/14)	HundredGigabitEthernet 1/0/39
Port number 15 and 16 (FortyGigabitEthernet 1/0/15 and FortyGigabitEthernet 1/0/16)	HundredGigabitEthernet 1/0/40
Port number 17 and 18 (FortyGigabitEthernet 1/0/17 and FortyGigabitEthernet 1/0/18)	HundredGigabitEthernet 1/0/41
Port number 19 and 20 (FortyGigabitEthernet 1/0/19 and FortyGigabitEthernet 1/0/20)	HundredGigabitEthernet 1/0/42
Port number 21 and 22 (FortyGigabitEthernet 1/0/21 and FortyGigabitEthernet 1/0/22)	HundredGigabitEthernet 1/0/43
Port number 23 and 24 (FortyGigabitEthernet 1/0/23 and FortyGigabitEthernet 1/0/24)	HundredGigabitEthernet 1/0/44
Port number 25 and 26 (FortyGigabitEthernet 1/0/25 and FortyGigabitEthernet 1/0/26)	HundredGigabitEthernet 1/0/45
Port number 27 and 28 (FortyGigabitEthernet 1/0/27 and FortyGigabitEthernet 1/0/28)	HundredGigabitEthernet 1/0/46

40 GigabitEthernet Ports/Interfaces	100 GigabitEthernet Interfaces
Port number 29 and 30 (FortyGigabitEthernet 1/0/29 and FortyGigabitEthernet 1/0/30)	HundredGigabitEthernet 1/0/47
Port number 31 and 32 (FortyGigabitEthernet 1/0/31 and FortyGigabitEthernet 1/0/32)	HundredGigabitEthernet 1/0/48

Configuring IEEE 802.3x Flow Control

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode
Step 2	**interface** *interface-id* **Example:** `Device(config)# interface fortygigabitethernet1/0/1`	Specifies the physical interface to be configured, and enter interface configuration mode.
Step 3	**flowcontrol** {**receive**} {**on** | **off** | **desired**} **Example:** `Device(config-if)# flowcontrol receive on`	Configures the flow control mode for the port.
Step 4	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 5	**show interfaces** *interface-id* **Example:** `Device# show interfaces fortygigabitethernet1/0/1`	Verifies the interface flow control settings.

	Command or Action	Purpose
Step 6	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring Layer 3 Interfaces

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** {**fortygigabitethernet** *interface-id*} | {**vlan** *vlan-id*} | {**port-channel** *port-channel-number*} **Example:** `Device(config)# interface fortygigabitethernet1/0/2`	Specifies the interface to be configured as a Layer 3 interface, and enter interface configuration mode.
Step 4	**no switchport** **Example:** `Device(config-if)# no switchport`	For physical ports only, enters Layer 3 mode.
Step 5	**ip address** *ip_address subnet_mask* **Example:** `Device(config-if)# ip address 192.20.135.21 255.255.255.0`	Configures the IP address and IP subnet.

	Command or Action	Purpose
Step 6	**no shutdown** **Example:** `Device(config-if)# no shutdown`	Enables the interface.
Step 7	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 8	**show interfaces** [*interface-id*]	Verifies the configuration.
Step 9	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring a Logical Layer 3 GRE Tunnel Interface

Before you begin

Generic Routing Encapsulation (GRE) is a tunneling protocol used to encapsulate network layer protocols inside virtual point-to-point links. A GRE tunnel only provides encapsulation and not encryption.

Note

- GRE tunnels are supported on the hardware on Cisco Catalyst 9000 switches. When GRE is configured without tunnel options, packets are hardware-switched. When GRE is configured with tunnel options (such as key, checksum, and so on), packets are switched in the software. A maximum of 1000 GRE tunnels are supported.
- Other features such as Access Control Lists (ACL) and Quality of Service (QoS) are not supported for the GRE tunnels.
- The **tunnel path-mtu-discovery** command is not supported for GRE tunnels. To avoid fragmentation, you can set the maximum transmission unit (MTU) of both ends of the GRE tunnel to the lowest value by using the **ip mtu 256** command.

To configure a GRE tunnel, perform this task:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface tunnel** *number* **Example:** `Device(config)#interface tunnel 2`	Enables tunneling on the interface.
Step 4	**ip address** *ip_addresssubnet_mask* **Example:** `Device(config)#ip address 100.1.1.1 255.255.255.0`	Configures the IP address and IP subnet.
Step 5	**tunnel source** {*ip_address* | *type_number*} **Example:** `Device(config)#tunnel source 10.10.10.1`	Configures the tunnel source.
Step 6	**tunnel destination** {*host_name* | *ip_address*} **Example:** `Device(config)#tunnel destination 10.10.10.2`	Configures the tunnel destination.
Step 7	**tunnel mode gre ip** **Example:** `Device(config)#tunnel mode gre ip`	Configures the tunnel mode.
Step 8	**end** **Example:** `Device(config)#end`	Exits configuration mode.

Configuring SVI Autostate Exclude

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-id* **Example:** `Device(config)# interface fortygigabitethernet1/0/2`	Specifies a Layer 2 interface (physical port or port channel), and enter interface configuration mode.
Step 4	**switchport autostate exclude** **Example:** `Device(config-if)# switchport autostate exclude`	Excludes the access or trunk port when defining the status of an SVI line state (up or down)
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 6	**show running config interface** *interface-id*	(Optional) Shows the running configuration. Verifies the configuration.
Step 7	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Shutting Down and Restarting the Interface

Shutting down an interface disables all functions on the specified interface and marks the interface as unavailable on all monitoring command displays. This information is communicated to other network servers through all dynamic routing protocols. The interface is not mentioned in any routing updates.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** {**vlan** *vlan-id*} | {**fortygigabitethernet** *interface-id*} | {**port-channel** *port-channel-number*} **Example:** `Device(config)# interface fortygigabitethernet1/0/2`	Selects the interface to be configured.
Step 4	**shutdown** **Example:** `Device(config-if)# shutdown`	Shuts down an interface.
Step 5	**no shutdown** **Example:** `Device(config-if)# no shutdown`	Restarts an interface.
Step 6	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

	Command or Action	Purpose
Step 7	**show running-config** **Example:** `Device# show running-config`	Verifies your entries.

Configuring the Console Media Type

Follow these steps to set the console media type to RJ-45. If you configure the console as RJ-45, USB console operation is disabled, and input comes only through the RJ-45 connector.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**line console 0** **Example:** `Device(config)# line console 0`	Configures the console and enters line configuration mode.
Step 4	**media-type rj45 switch** *switch_number* **Example:** `Device(config-line)# media-type rj45 switch 1`	Configures the console media type to be only RJ-45 port. If you do not enter this command and both types are connected, the USB port is used by default.
Step 5	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

	Command or Action	Purpose
Step 6	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring USB Inactivity Timeout

The configurable inactivity timeout reactivates the RJ-45 console port if the USB console port is activated but no input activity occurs on it for a specified time period. When the USB console port is deactivated due to a timeout, you can restore its operation by disconnecting and reconnecting the USB cable.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**line console 0** **Example:** `Device(config)# line console 0`	Configures the console and enters line configuration mode.
Step 4	**usb-inactivity-timeout switch** *switch_number timeout-minutes* **Example:** `Device(config-line)# usb-inactivity-timeout switch 1 30`	Specifies an inactivity timeout for the console port. The range is 1 to 240 minutes. The default is to have no timeout configured.
Step 5	**copy running-config startup-config** **Example:** `Device# copy running-config`	(Optional) Saves your entries in the configuration file.

	Command or Action	Purpose
	`startup-config`	

Monitoring Interface Characteristics

Monitoring Interface Status

Commands entered at the privileged EXEC prompt display information about the interface, including the versions of the software and the hardware, the configuration, and statistics about the interfaces.

Table 10: Show Commands for Interfaces

Command	Purpose
show interfaces *interface-id* **status** [**err-disabled**]	Displays interface status or a list of interfaces in the error-disabled state.
show interfaces [*interface-id*] **switchport**	Displays administrative and operational status of switching (nonrouting) ports. You can use this command to find out if a port is in routing or in switching mode.
show interfaces [*interface-id*] **description**	Displays the description configured on an interface or all interfaces and the interface status.
show ip interface [*interface-id*]	Displays the usability status of all interfaces configured for IP routing or the specified interface.
show interface [*interface-id*] **stats**	Displays the input and output packets by the switching path for the interface.
show interfaces *interface-id*	(Optional) Displays speed and duplex on the interface.
show interfaces transceiver dom-supported-list **Note** This command is not supported on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.	(Optional) Displays Digital Optical Monitoring (DOM) status on the connect SFP modules.
show interfaces transceiver properties	(Optional) Displays temperature, voltage, or amount of current on the interface.
show interfaces [*interface-id*] [{**transceiver properties** | **detail**}] *module number*]	Displays physical and operational status about an SFP module.
show running-config interface [*interface-id*]	Displays the running configuration in RAM for the interface.

Command	Purpose
show version	Displays the hardware configuration, software version, the names and sources of configuration files, and the boot images.
show controllers ethernet-controller *interface-id* **phy**	Displays the operational state of the auto-MDIX feature on the interface.

Clearing and Resetting Interfaces and Counters

Table 11: Clear Commands for Interfaces

Command	Purpose
clear counters [*interface-id*]	Clears interface counters.
clear interface *interface-id*	Resets the hardware logic on an interface.
clear line [*number* | **console 0** | **vty** *number*]	Resets the hardware logic on an asynchronous serial line.

Note The **clear counters** privileged EXEC command does not clear counters retrieved by using Simple Network Management Protocol (SNMP), but only those seen with the **show interface** privileged EXEC command.

Configuration Examples for Interface Characteristics

Adding a Description to an Interface: Example

```
Device# configure terminal
Enter configuration commands, one per line. End with CNTRL/Z.
Device(config)# interface fortygigabitethernet1/0/2
Device(config-if)# description Connects to Marketing
Device(config-if)# end
Device# show interfaces fortygigabitethernet1/0/2 description
Interface Status    Protocol Description
Fo1/0/1   down      down      Connects to Marketing
```

Configuring a Range of Interfaces: Examples

```
Device# configure terminal
Device(config)# interface range fortyGigabitEthernet 1/0/1-2

Device(config-if-range)# shut
```

If you enter multiple configuration commands while you are in interface-range mode, each command is executed as it is entered. The commands are not batched and executed after you exit interface-range mode. If you exit interface-range configuration mode while the commands are being executed, some commands might

not be executed on all interfaces in the range. Wait until the command prompt reappears before exiting interface-range configuration mode.

Configuring and Using Interface Range Macros: Examples

This example shows how to define an interface-range named *enet_list* to include ports 1 and 2 on switch 1 and to verify the macro configuration:

```
Device# configure terminal
Device(config)# define interface-range enet_list fortyGigabitEthernet 1/0/1 - 2
Device(config)# end
Device# show running-config | include define
define interface-range enet_list FortyGigabitEthernet1/0/1
```

This example shows how to enter interface-range configuration mode for the interface-range macro *enet_list*:

```
Device# configure terminal
Device(config)# interface range macro enet_list
Device(config-if-range)#
```

This example shows how to delete the interface-range macro *enet_list* and to verify that it was deleted.

```
Device# configure terminal
Device(config)# no define interface-range enet_list
Device(config)# end
Device# show run | include define
Device#
```

Configuring Layer 3 Interfaces: Example

```
Device# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Device(config)# interface fortygigabitethernet1/0/2
Device(config-if)# no switchport
Device(config-if)# ip address 192.20.135.21 255.255.255.0
Device(config-if)# no shutdown
```

Configuring Breakout Interfaces : Example

Catalyst 9500 Series Switches

The following is a sample output of **show interface status** command with dual mode 40G QSFP module inserted into port number 2 of the C9500-24Q switch model.

```
Device# show interface status

Port      Name               Status       Vlan       Duplex  Speed Type
Fo2/0/1                    notconnect   1            auto   auto unknown
Fo2/0/2                     notconnect   1            full    40G QSFP
```

```
40G SR4 SFP
Fo2/0/3                     notconnect   1            auto   auto unknown
Fo2/0/4                     notconnect   1            auto   auto unknown
Fo2/0/5                     notconnect   1            auto   auto unknown
Fo2/0/6                     notconnect   1            auto   auto unknown
Fo2/0/7                     notconnect   1            auto   auto unknown
Fo2/0/8                     notconnect   1            auto   auto unknown
Fo2/0/9                     notconnect   1            auto   auto unknown
Fo2/0/10                    notconnect   1            auto   auto unknown
Fo2/0/11                    notconnect   1            auto   auto unknown
Fo2/0/12                    notconnect   1            auto   auto unknown
Fo2/0/13                    notconnect   1            auto   auto unknown
Fo2/0/14                    notconnect   1            auto   auto unknown
Fo2/0/15                    notconnect   1            auto   auto unknown
Fo2/0/16                    notconnect   1            auto   auto unknown
Fo2/0/17                    notconnect   1            auto   auto unknown
Fo2/0/18                    notconnect   1            auto   auto unknown
Fo2/0/19                    notconnect   1            auto   auto unknown
Fo2/0/20                    notconnect   1            auto   auto unknown
Fo2/0/21                    notconnect   1            auto   auto unknown
Fo2/0/22                    notconnect   1            auto   auto unknown
Fo2/0/23                    notconnect   1            auto   auto unknown
Fo2/0/24                    notconnect   1            auto   auto unknown
…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….….
…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….….
…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….…….….
…….…….…….…….…….…….…….…….…..(Output truncated).…….…….…….…….…….…….…….….
```

The following is a sample output of **show interface status** command when 40G QSFP module inserted in port number 2 is removed and 4x10G breakout cable is inserted into port number 2 after using the command **`hw-mod breakout module 1 port 2 switch 2`**. Port number 2 — Fo2/0/2 — is split into four 10G ports — Te2/0/5, Te2/0/6, Te2/0/7 and Te2/0/8.

```
Device# configure terminal
Device (config)# hw-mod breakout module 1 port 2 switch 2
Device (config)#
*May 17 21:35:26.003 UTC: %PLATFORM_PM-6-MODULE_REMOVED: SFP module with
 interface name Fo2/0/2 removed
*May 17 21:35:27.399 UTC: %PLATFORM_PM-6-FRULINK_REMOVED: 1x40G Port2
uplink module removed from switch 2 slot 1
*May 17 21:35:27.899 UTC: %PLATFORM_PM-6-FRULINK_INSERTED: BC:4x10G Port2
 uplink module inserted in the switch 2 slot 1
*May 17 21:35:29.399 UTC: %LINK-3-UPDOWN: Interface
FortyGigabitEthernet2/0/2, changed state to down
*May 17 21:35:31.181 UTC: %PLATFORM_PM-6-MODULE_INSERTED: SFP module
inserted with interface name Te2/0/5
*May 17 21:35:33.414 UTC: %PLATFORM_PM-6-MODULE_INSERTED: SFP module
inserted with interface name Te2/0/6
*May 17 21:35:35.648 UTC: %PLATFORM_PM-6-MODULE_INSERTED: SFP module
inserted with interface name Te2/0/7
*May 17 21:35:37.881 UTC: %PLATFORM_PM-6-MODULE_INSERTED: SFP module
inserted with interface name Te2/0/8
*May 17 21:35:42.234 UTC: %LINK-3-UPDOWN: Interface
```

```
TenGigabitEthernet2/0/5, changed state to up
*May 17 21:35:43.234 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
 TenGigabitEthernet2/0/5, changed state to up
*May 17 21:35:51.460 UTC: %LINK-3-UPDOWN: Interface
TenGigabitEthernet2/0/6, changed state to up
*May 17 21:35:51.506 UTC: %LINK-3-UPDOWN: Interface
TenGigabitEthernet2/0/7, changed state to up
*May 17 21:35:51.551 UTC: %LINK-3-UPDOWN: Interface
TenGigabitEthernet2/0/8, changed state to up
*May 17 21:35:52.286 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
 Vlan1, changed state to up
*May 17 21:35:52.461 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
 TenGigabitEthernet2/0/6, changed state to up
*May 17 21:35:52.505 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
 TenGigabitEthernet2/0/7, changed state to up
*May 17 21:35:52.551 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
 TenGigabitEthernet2/0/8, changed state to up
Device (config)# end
Device # show interface status

Port      Name               Status       Vlan       Duplex  Speed Type
Fo2/0/1                     notconnect   1           auto   auto unknown
Fo2/0/3                     notconnect   1           auto   auto unknown
Fo2/0/4                     notconnect   1           auto   auto unknown
Fo2/0/5                     notconnect   1           auto   auto unknown
Fo2/0/6                     notconnect   1           auto   auto unknown
Fo2/0/7                     notconnect   1           auto   auto unknown
Fo2/0/8                     notconnect   1           auto   auto unknown
Fo2/0/9                     notconnect   1           auto   auto unknown
Fo2/0/10                    notconnect   1           auto   auto unknown
Fo2/0/11                    notconnect   1           auto   auto unknown
Fo2/0/12                    notconnect   1           auto   auto unknown
Fo2/0/13                    notconnect   1           auto   auto unknown
Fo2/0/14                    notconnect   1           auto   auto unknown
Fo2/0/15                    notconnect   1           auto   auto unknown
Fo2/0/16                    notconnect   1           auto   auto unknown
Fo2/0/17                    notconnect   1           auto   auto unknown
Fo2/0/18                    notconnect   1           auto   auto unknown
Fo2/0/19                    notconnect   1           auto   auto unknown
Fo2/0/20                    notconnect   1           auto   auto unknown
Fo2/0/21                    notconnect   1           auto   auto unknown
Fo2/0/22                    notconnect   1           auto   auto unknown
Fo2/0/23                    notconnect   1           auto   auto unknown
Fo2/0/24                    notconnect   1           auto   auto unknown
….….….….….….….….….….….….….….….….….….….….….….….….….….….….….….….….….
….….….….….….….….….….….….….….….….….….….….….….….….….….….….….….….….
….….….….….….….….….….….(Output truncated).….….….….….….….….….….….
Te2/0/5                      connected    1            full    10G
Te2/0/6                      connected    1            full    10G
Te2/0/7                      connected    1            full    10G QSFP
40G SR4 SFP
Te2/0/8                      connected    1            full    10G
```

```
. . . . . .
. . . . . .
. . . . . .(Output truncated). . . . . .
```

Catalyst 9500 Series Switches - High Performance

The following is a sample output of **show interface status** command after enabling breakout on port 1 with 4x10G breakout cable inserted on port 7 with 4x25G breakout cable inserted using the **hw-module breakout** *port-num* command of the C9500-32C switch model.

- Port number 1 — Hu1/0/1 — is split into four 10G ports — Hu1/0/1/1, Hu1/0/1/2, Hu1/0/1/3 and Hu1/0/1/4.
- Port number 7 — Hu1/0/7 — is split into four 25G ports — Hu1/0/7/1, Hu1/0/7/2, Hu1/0/7/3 and Hu1/0/7/4.

```
Device# show interface status

Port         Name               Status         Vlan         Duplex  Speed
  Type
Hu1/0/1                         inactive       1              full    40G
  unknown
Hu1/0/2                         notconnect     1              full    40G
  unknown
Hu1/0/3                         notconnect     1              full    40G
  unknown
Hu1/0/4                         notconnect     1              auto   auto
  unknown
Hu1/0/5                         notconnect     1              full    40G
  unknown
Hu1/0/6                         notconnect     1              full    40G
  unknown
Hu1/0/7                         inactive       1              full   100G
  unknown
Hu1/0/8                         connected      111            full   100G
  QSFP 100G CU1M
Hu1/0/9                         notconnect     1              full    40G
  unknown
Hu1/0/10                        notconnect     1              full    40G
  unknown
Hu1/0/11                        notconnect     1              full    40G
  unknown
Hu1/0/12                        notconnect     1              auto   auto
  unknown
Hu1/0/13                        notconnect     1              full   100G
  unknown
Hu1/0/14                        notconnect     1              full    40G
  unknown
Hu1/0/15                        notconnect     1              full    40G
  unknown
Hu1/0/16                        notconnect     1              auto   auto
  unknown
Hu1/0/17                        notconnect     1              full   100G
```

```
  unknown
Hu1/0/18                  notconnect     1              full    40G
  unknown
Hu1/0/19                  notconnect     1              full    40G
  QSFP 4SFP10G CU5M
Hu1/0/20                  connected      48             full   100G
  QSFP 100G AOC10M
Hu1/0/21                  notconnect     1              full    40G
  unknown
Hu1/0/22                  notconnect     1              full    40G
  unknown
Hu1/0/23                  notconnect     1              full    40G
  unknown
Hu1/0/24                  notconnect     1              auto   auto
  unknown
Hu1/0/25                  notconnect     1              full    40G
  unknown
Hu1/0/26                  notconnect     1              full    40G
  unknown
Hu1/0/27                  notconnect     1              full    40G
  QSFP 4SFP10G CU4M
Hu1/0/28                  connected      112            full   100G
  QSFP 100G CU3M
Hu1/0/29                  notconnect     1              full    40G
  unknown
Hu1/0/30                  notconnect     1              full    40G
  unknown
Hu1/0/31                  notconnect     1              full    40G
  unknown
Hu1/0/32                  notconnect     31             full   100G
  QSFP 100G CU3M
Hu1/0/1/1                 connected      1              full    10G
  QSFP 4X10G AOC2M
Hu1/0/1/2                 connected      1              full    10G
  QSFP 4X10G AOC2M
Hu1/0/1/3                 notconnect     1              full    10G
  QSFP 4X10G AOC2M
Hu1/0/1/4                 notconnect     1              full    10G
  QSFP 4X10G AOC2M
Hu1/0/7/1                 connected      routed         full    25G
  QSFP28 4SFP25G CU3M
Hu1/0/7/2                 connected      routed         full    25G
  QSFP28 4SFP25G CU3M
Hu1/0/7/3                 connected      routed         full    25G
  QSFP28 4SFP25G CU3M
Hu1/0/7/4                 connected      routed         full    25G
  QSFP28 4SFP25G CU3M
```

The following is a sample output of **hw-module breakout** *port-num* command after enabling breakout on port 1.

```
Device(config)# hw-module breakout 1
Breakout: Enabling breakout ports on HundredGig1/0/1 successful.

Device(config)#
*Aug  2 06:10:56.281: %TRANSCEIVER-6-REMOVED: R0/0: iomd: Transceiver
module removed from HundredGigE1/0/1
*Aug  2 06:10:56.317: %TRANSCEIVER-6-INSERTED: R0/0: iomd: transceiver
module inserted in HundredGigE1/0/1/1
*Aug  2 06:10:56.319: %TRANSCEIVER-6-INSERTED: R0/0: iomd: transceiver
module inserted in HundredGigE1/0/1/2
*Aug  2 06:10:56.321: %TRANSCEIVER-6-INSERTED: R0/0: iomd: transceiver
module inserted in HundredGigE1/0/1/3
*Aug  2 06:10:56.323: %TRANSCEIVER-6-INSERTED: R0/0: iomd: transceiver
module inserted in HundredGigE1/0/1/4

*Aug  2 06:11:05.927: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/1, changed
 state to up
*Aug  2 06:11:05.928: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/2, changed
 state to up
*Aug  2 06:11:06.167: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/3, changed
 state to up
*Aug  2 06:11:06.172: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/4, changed
 state to up

*Aug  2 06:11:06.927: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/1, changed state to up
*Aug  2 06:11:06.928: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/2, changed state to up
*Aug  2 06:11:07.167: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/3, changed state to up
*Aug  2 06:11:07.173: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/4, changed state to up
```

The following is a sample output of **no hw-module breakout** *port-num* command after disabling breakout on port 1.

```
Device(config)# no hw-module breakout 1
Breakout: Disabling breakout ports on HundredGig1/0/1 successful.

Device(config)#
*Aug  2 10:25:36.905: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/1, changed state to down
*Aug  2 10:25:36.927: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/2, changed state to down
*Aug  2 10:25:36.952: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/3, changed state to down
*Aug  2 10:25:36.974: %LINEPROTO-5-UPDOWN: Line protocol on Interface
HundredGigE1/0/1/4, changed state to down

*Aug  2 10:25:37.905: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/1, changed
 state to down
*Aug  2 10:25:37.927: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/2, changed
 state to down
```

```
*Aug  2 10:25:37.951: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/3, changed
 state to down
*Aug  2 10:25:37.975: %LINK-3-UPDOWN: Interface HundredGigE1/0/1/4, changed
 state to down

*Aug  2 10:25:38.869: %TRANSCEIVER-6-INSERTED: R0/0: iomd: transceiver
module inserted in HundredGigE1/0/1
*Aug  2 10:25:38.903: %TRANSCEIVER-6-REMOVED: R0/0: iomd: Transceiver
module removed from HundredGigE1/0/1/1
*Aug  2 10:25:38.941: %TRANSCEIVER-6-REMOVED: R0/0: iomd: Transceiver
module removed from HundredGigE1/0/1/2
*Aug  2 10:25:38.978: %TRANSCEIVER-6-REMOVED: R0/0: iomd: Transceiver
module removed from HundredGigE1/0/1/3
*Aug  2 10:25:39.015: %TRANSCEIVER-6-REMOVED: R0/0: iomd: Transceiver
module removed from HundredGigE1/0/1/4
```

Configuring 40G and 100G on C9500-32QC: Example

The following example shows how to enable interface HundredGigabitEthernet 1/0/40. When you enable the interface HundredGigabitEthernet 1/0/40, the corresponding FortyGigabitEthernet 1/0/15 and FortyGigabitEthernet 1/0/16 interfaces, become inactive.

```
Device# configure terminal
Device(config)interface HundredGigabitEthernet 1/0/40
Device(config-if)enable
Device(config-if)end
```

The following example shows how to enable interface FortyGigabitEthernet 1/0/25. When you disable the interface HundredGigabitEthernet 1/0/45, the corresponding FortyGigabitEthernet 1/0/25 and FortyGigabitEthernet 1/0/26 interfaces, become active.

```
Device# configure terminal
Device(config)interface HundredGigabitEthernet 1/0/45
Device(config-if)no enable
Device(config-if)end
```

The following is sample output of all the 40 GigabitEthernet and 100 GigabitEthernet interfaces on C9500-32QC.

```
Device# show interface status
Port      Name               Status       Vlan       Duplex  Speed Type
Fo1/0/1                      notconnect   routed       full    40G QSFP
40G AOC10M
Fo1/0/2                      notconnect   routed       full    40G QSFP
40G CU3M
Fo1/0/3                      notconnect   routed       full   100G QSFP
100G CU3M
Fo1/0/4                      notconnect   routed       full    40G QSFP
40G CU5M
Fo1/0/5                      notconnect   routed       full   100G QSFP
100G CU3M
Fo1/0/6                      notconnect   routed       full    40G QSFP
```

```
40G AOC2M
Fo1/0/7                    notconnect   routed       full   100G QSFP
100G CU3M
Fo1/0/8                    notconnect   routed       full    40G QSFP
40G CR4 SFP
Fo1/0/9                    notconnect   routed       full   100G QSFP
100G CU3M
Fo1/0/10                  notconnect   routed       auto   auto unknown
Fo1/0/11                   notconnect   routed       full   100G QSFP
100G CU3M
Fo1/0/12                  notconnect   routed       auto   auto unknown
Fo1/0/13                   notconnect   routed       full   100G QSFP
100G CU3M

Port      Name             Status       Vlan       Duplex  Speed Type
Fo1/0/14                  notconnect   routed       auto   auto unknown
Fo1/0/15                   notconnect   routed       full   100G QSFP
100G CU3M
Fo1/0/16                  notconnect   routed       auto   auto unknown
Fo1/0/17                   notconnect   routed       full    40G QSFP
40G AOC10M
Fo1/0/18                  notconnect   routed       auto   auto unknown
Fo1/0/19                   notconnect   routed       full    40G QSFP
40G AOC3M
Fo1/0/20                  notconnect   routed       auto   auto unknown
Fo1/0/21                  notconnect   routed       auto   auto unknown
Fo1/0/22                   notconnect   routed       full    40G QSFP
40G CR4 SFP
Fo1/0/23                   notconnect   routed       full    40G QSFP
40G CR4 SFP
Fo1/0/24                   notconnect   routed       full    40G QSFP
40G CR4 SFP
Fo1/0/25                  inactive     routed       auto   auto unknown
Fo1/0/26                  inactive     routed       auto   auto unknown
Fo1/0/27                  inactive     routed       auto   auto unknown
Fo1/0/28                   inactive     routed       full    40G QSFP
40G CR4 SFP
Fo1/0/29                  inactive     routed       auto   auto unknown

Port      Name             Status       Vlan       Duplex  Speed Type
Fo1/0/30                  inactive     routed       auto   auto unknown
Fo1/0/31                  inactive     routed       auto   auto unknown
Fo1/0/32                   inactive     routed       full    40G QSFP
40G CR4 SFP
Hu1/0/33                  inactive     routed       auto   auto unknown
Hu1/0/34                  inactive     routed       auto   auto unknown
Hu1/0/35                  inactive     routed       auto   auto unknown
Hu1/0/36                  inactive     routed       auto   auto unknown
Hu1/0/37                  inactive     routed       auto   auto unknown
Hu1/0/38                  inactive     routed       auto   auto unknown
Hu1/0/39                  inactive     routed       auto   auto unknown
```

```
Hu1/0/40                  inactive     routed       auto   auto unknown
Hu1/0/41                  inactive     routed       auto   auto unknown
Hu1/0/42                  inactive     routed       auto   auto unknown
Hu1/0/43                  inactive     routed       auto   auto unknown
Hu1/0/44                  inactive     routed       auto   auto unknown
Hu1/0/45                   notconnect   routed       full    40G QSFP
40G CU3M
Hu1/0/46                   connected    routed       full   100G QSFP
100G CU3M
Hu1/0/47                   connected    routed       full   100G QSFP
100G CU3M
Hu1/0/48                   connected    routed       full   100G QSFP
100G CU3M
```

Example: Configuring the Console Media Type

The following example shows how to disable the USB console media type and enable the RJ-45 console media type:

```
Device# configure terminal
Device(config)# line console 0
Device(config-line)# media-type rj45 switch 1
```

The following example shows how to reverse the previous configuration and immediately activate any USB console that is connected:

```
Device# configure terminal
Device(config)# line console 0
Device(config-line)# no media-type rj45 switch 1
```

Example: Configuring the USB Inactivity Timeout

The following example shows how to configure the inactivity timeout to 30 minutes:

```
Device# configure terminal
Device(config)# line console 0
Device(config-line)# usb-inactivity-timeout switch 1 30
```

The following example shows how to disable the configuration:

```
Device# configure terminal
Device(config)# line console 0
Device(config-line)# no usb-inactivity-timeout switch 1
```

If there is no (input) activity on a USB console port for the configured number of minutes, the inactivity timeout setting applies to the RJ-45 port, and a log shows this occurrence:

```
*Mar  1 00:47:25.625: %USB_CONSOLE-6-INACTIVITY_DISABLE: Console media-type USB disabled
due to inactivity, media-type reverted to RJ45.
```

At this point, the only way to reactivate the USB console port is to disconnect and reconnect the cable.

When the USB cable on the switch has been disconnected and reconnected, a log similar to this appears:

```
*Mar  1 00:48:28.640: %USB_CONSOLE-6-MEDIA_USB: Console media-type is USB.
```

Additional References for the Interface Characteristics Feature

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	See the *Interface and Hardware Commands* section in the *Command Reference (Catalyst 9500 Series Switches)*

Standards and RFCs

Standard/RFC	Title
None	--

MIBs

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History for Configuring Interface Characteristics

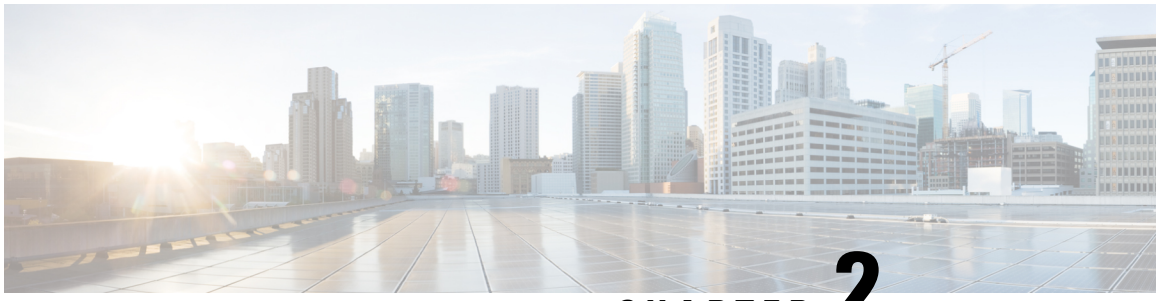
This table provides release and related information for the features explained in this module.

These features are available in all the releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	Interface Characteristics	Interface Characteristics includes interface types, connections, configuration modes, speed, and other aspects of configuring a physical interface on a device. Support for this feature was introduced only on the C9500-12Q, C9500-24Q, C9500-16X and C9500-40X models of the Cisco Catalyst 9500 Series Switches.
Cisco IOS XE Everest 16.6.4	IEEE 802.3x Flow Control	The default value for **flowcontrol** interface configuration command was modified to **on** on the C9500-12Q, C9500-24Q, C9500-16X and C9500-40X models of the Cisco Catalyst 9500 Series Switches

Release	Feature	Feature Information
Cisco IOS XE Fuji 16.8.1a	Interface Characteristics	Interface Characteristics includes interface types, connections, configuration modes, speed, and other aspects of configuring a physical interface on a device. Support for this feature was introduced only on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.
	Breakout interfaces	Support for breakout interfaces was introduced on the following: • Only the first four ports of C9500-12Q, C9500-24Q, C9500-16X and C9500-40X models. • All the ports of the C9500-NM-2Q network module.
Cisco IOS XE Fuji 16.9.1	Breakout interfaces	On Cisco Catalyst 9500 Series Switches, support for breakout configuration was introduced only on the first twelve ports of C9500-24Q, C9500-16X, C9500-40X models.
Cisco IOS XE Gibraltar 16.10.1	Breakout interfaces	On Cisco Catalyst 9500 Series Switches, support for breakout configuration was introduced on the following: • The first twenty-four ports of C9500-40X, and all ports of C9500-24Q and C9500-16X models. • C9500-32C model
	Password Authentication on USB 3.0 SSD	Support for configuring password on a USB 3.0 SSD was enabled on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models of the Cisco Catalyst 9500 Series Switches.

Use the Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.



CHAPTER 2

Configuring Ethernet Management Port

- Prerequisites for Ethernet Management Ports, on page 73
- Restrictions for Ethernet Management Port, on page 73
- Information About the Ethernet Management Port, on page 73
- How to Configure the Ethernet Management Port, on page 76
- Example for Configuring IP Address on Ethernet Management Interface, on page 77
- Additional References for Ethernet Management Ports, on page 77
- Feature History for Ethernet Management Port, on page 78

Prerequisites for Ethernet Management Ports

When connecting a PC to the Ethernet management port, you must first assign an IP address.

Restrictions for Ethernet Management Port

The ethernet management port relay is not supported on the Cisco Catalyst 9500 Series Switches – High Performance.

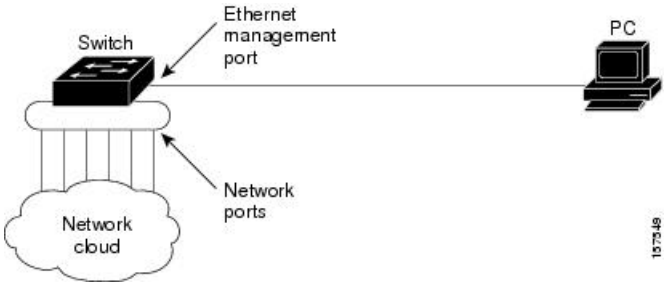
Information About the Ethernet Management Port

The Ethernet management port, also referred to as the *Gi0/0* or *GigabitEthernet0/0* port, is a VRF (VPN routing/forwarding) interface to which you can connect a PC. You can use the Ethernet management port instead of the device console port for network management.

Ethernet Management Port Direct Connection to a Device

Figure 3: Connecting a Switch to a PC

This figure displays how to connect the Ethernet management port to the PC for a device or a standalone device.



Ethernet Management Port with StackWise Virtual

Physically, the Ethernet management port needs to be connected from both active and standby switches to the uplink switch. Since the switches in a Cisco StackWise Virtual solution use a single management plane, the same IP address is applicable to both active and standby switches. After stateful switchover (SSO) between the active and standby switches, the Ethernet Management port on the active (previously standby) switch will link up and continue to support management functionalities.

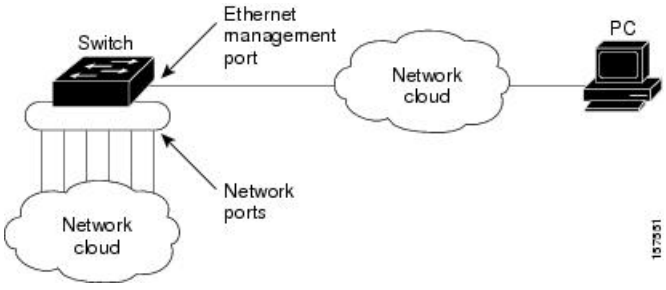
Note Any SSH, SCP, or Telnet sessions established by clients over the Ethernet management port IP address before stateful switchover to a new active switch in StackWise Virtual will be terminated and a new session has to be initiated after switchover.

Ethernet Management Port and Routing

By default, the Ethernet management port is enabled. The device cannot route packets from the Ethernet management port to a network port, and the reverse. Even though the Ethernet management port does not support routing, you may need to enable routing protocols on the port.

Figure 4: Network Example with Routing Protocols Enabled

Enable routing protocols on the Ethernet management port when the PC is multiple hops away from the device and the packets must pass through multiple Layer 3 devices to reach the PC.



In the above figure , if the Ethernet management port and the network ports are associated with the same routing process, the routes are propagated as follows:

- The routes from the Ethernet management port are propagated through the network ports to the network.
- The routes from the network ports are propagated through the Ethernet management port to the network.

Because routing is not supported between the Ethernet management port and the network ports, traffic between these ports cannot be sent or received. If this happens, data packet loops occur between the ports, which disrupt the device and network operation. To prevent the loops, configure route filters to avoid routes between the Ethernet management port and the network ports.

Supported Features on the Ethernet Management Port

The Ethernet management port supports these features:

- Express Setup (only in switch stacks)
- Network Assistant
- Telnet with passwords
- TFTP
- Secure Shell (SSH)
- DHCP-based autoconfiguration
- SMNP (only the ENTITY-MIB and the IF-MIB)
- IP ping
- Interface features
  - Speed—10 Mb/s, 100 Mb/s, 1000 Mb/s, and autonegotiation
  - Duplex mode—Full, half, and autonegotiation
  - Loopback detection
- Cisco Discovery Protocol (CDP)
- DHCP relay agent
- IPv4 and IPv6 access control lists (ACLs)
- Routing protocols

Caution Before enabling a feature on the Ethernet management port, make sure that the feature is supported. If you try to configure an unsupported feature on the Ethernet Management port, the feature might not work properly, and the device might fail.

How to Configure the Ethernet Management Port

Disabling and Enabling the Ethernet Management Port

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**interface gigabitethernet0/0** **Example:** `Device(config)# interface gigabitethernet0/0`	Specifies the Ethernet management port in the CLI.
Step 3	**shutdown** **Example:** `Device(config-if)# shutdown`	Disables the Ethernet management port.
Step 4	**no shutdown** **Example:** `Device(config-if)# no shutdown`	Enables the Ethernet management port.
Step 5	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode.
Step 6	**show interfaces gigabitethernet0/0** **Example:** `Device# show interfaces gigabitethernet0/0`	Displays the link status. To find out the link status to the PC, you can monitor the LED for the Ethernet management port. The LED is green (on) when the link is active, and the LED is off when the link is down. The LED is amber when there is a POST failure.

What to do next

Proceed to manage or configure your switch using the Ethernet management port. See the Network Management section.

Example for Configuring IP Address on Ethernet Management Interface

This example shows how to configure IP address on the management interface.

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# vrf forwarding Mgmt-vrf
Switch(config-if)#ip address 192.168.247.10 255.255.0.0
Switch(config-if)# end
```

```
Switch#show running-config interface Gi0/0
Building configuration...

Current configuration : 118 bytes
!
interface GigabitEthernet0/0
vrf forwarding Mgmt-vrf
ip address 192.168.247.10 255.255.0.0
negotiation auto
end
```

Additional References for Ethernet Management Ports

Related Documents

Related Topic	Document Title
Bootloader configuration	See the *System Management* section of this guide.
Bootloader commands	See the *System Management Commands* section of the *Command Reference (Catalyst 9500 Series Switches)*

MIBs

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

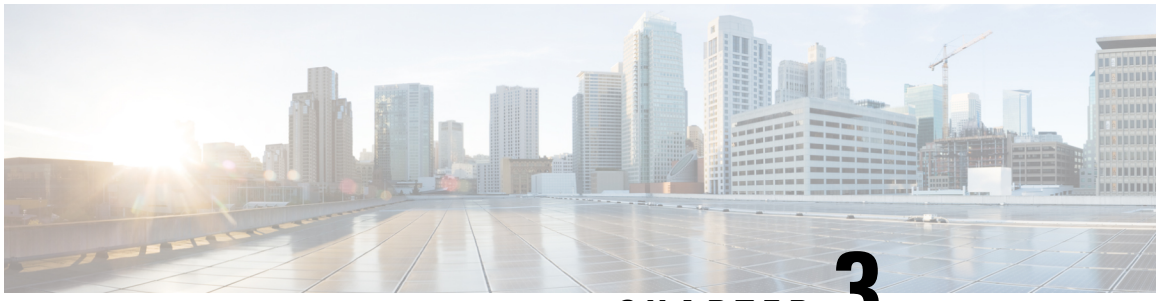
Feature History for Ethernet Management Port

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	Ethernet Management Port	The Ethernet management port is a VRF interface to which you can connect a PC. You can use the Ethernet management port instead of the device console port for network management. Support for this feature was introduced only on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models of the Cisco Catalyst 9500 Series Switches.
Cisco IOS XE Fuji 16.8.1a	Ethernet Management Port	Support for this feature was introduced only on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.



CHAPTER 3

Configuring LLDP, LLDP-MED, and Wired Location Service

- Restrictions for LLDP, on page 79
- Information About LLDP, LLDP-MED, and Wired Location Service, on page 79
- How to Configure LLDP, LLDP-MED, and Wired Location Service, on page 83
- Configuration Examples for LLDP, LLDP-MED, and Wired Location Service, on page 93
- Monitoring and Maintaining LLDP, LLDP-MED, and Wired Location Service, on page 94
- Additional References for LLDP, LLDP-MED, and Wired Location Service, on page 95
- Feature History for LLDP, LLDP-MED, and Wired Location Service, on page 95

Restrictions for LLDP

- If the interface is configured as a tunnel port, LLDP is automatically disabled.
- If you first configure a network-policy profile on an interface, you cannot apply the **switchport voice vlan** command on the interface. If the **switchport voice vlan** *vlan-id* is already configured on an interface, you can apply a network-policy profile on the interface. This way the interface has the voice or voice-signaling VLAN network-policy profile applied on the interface.
- You cannot configure static secure MAC addresses on an interface that has a network-policy profile.
- When Cisco Discovery Protocol and LLDP are both in use within the same switch, it is necessary to disable LLDP on interfaces where Cisco Discovery Protocol is in use for power negotiation. LLDP can be disabled at interface level with the commands **no lldp tlv-select power-management** or **no lldp transmit / no lldp receive**.

Information About LLDP, LLDP-MED, and Wired Location Service

LLDP

The Cisco Discovery Protocol (CDP) is a device discovery protocol that runs over Layer 2 (the data link layer) on all Cisco-manufactured devices (routers, bridges, access servers, switches, and controllers). CDP allows

network management applications to automatically discover and learn about other Cisco devices connected to the network.

To support non-Cisco devices and to allow for interoperability between other devices, the device supports the IEEE 802.1AB Link Layer Discovery Protocol (LLDP). LLDP is a neighbor discovery protocol that is used for network devices to advertise information about themselves to other devices on the network. This protocol runs over the data-link layer, which allows two systems running different network layer protocols to learn about each other.

LLDP Supported TLVs

LLDP supports a set of attributes that it uses to discover neighbor devices. These attributes contain type, length, and value descriptions and are referred to as TLVs. LLDP supported devices can use TLVs to receive and send information to their neighbors. This protocol can advertise details such as configuration information, device capabilities, and device identity.

The switch supports these basic management TLVs. These are mandatory LLDP TLVs.

- Port description TLV
- System name TLV
- System description TLV
- System capabilities TLV
- Management address TLV

These organizationally specific LLDP TLVs are also advertised to support LLDP-MED.

- Port VLAN ID TLV (IEEE 802.1 organizationally specific TLVs)
- MAC/PHY configuration/status TLV (IEEE 802.3 organizationally specific TLVs)

LLDP-MED

LLDP for Media Endpoint Devices (LLDP-MED) is an extension to LLDP that operates between endpoint devices such as IP phones and network devices. It specifically provides support for voice over IP (VoIP) applications and provides additional TLVs for capabilities discovery, network policy, Power over Ethernet, inventory management and location information. By default, all LLDP-MED TLVs are enabled.

LLDP-MED Supported TLVs

LLDP-MED supports these TLVs:

- LLDP-MED capabilities TLV

  Allows LLDP-MED endpoints to determine the capabilities that the connected device supports and has enabled.

- Network policy TLV

  Allows both network connectivity devices and endpoints to advertise VLAN configurations and associated Layer 2 and Layer 3 attributes for the specific application on that port. For example, the switch can notify a phone of the VLAN number that it should use. The phone can connect to any device, obtain its VLAN number, and then start communicating with the call control.

By defining a network-policy profile TLV, you can create a profile for voice and voice-signaling by specifying the values for VLAN, class of service (CoS), differentiated services code point (DSCP), and tagging mode. These profile attributes are then maintained centrally on the switch and propagated to the phone.

- Power management TLV

  Enables advanced power management between LLDP-MED endpoint and network connectivity devices. Allows devices and phones to convey power information, such as how the device is powered, power priority, and how much power the device needs.

  LLDP-MED also supports an extended power TLV to advertise fine-grained power requirements, end-point power priority, and end-point and network connectivity-device power status. LLDP is enabled and power is applied to a port, the power TLV determines the actual power requirement of the endpoint device so that the system power budget can be adjusted accordingly. The device processes the requests and either grants or denies power based on the current power budget. If the request is granted, the switch updates the power budget. If the request is denied, the device turns off power to the port, generates a syslog message, and updates the power budget. If LLDP-MED is disabled or if the endpoint does not support the LLDP-MED power TLV, the initial allocation value is used throughout the duration of the connection.

  You can change power settings by entering the **power inline** {**auto** [**max** *max-wattage*] | **never** | **static** [**max** *max-wattage*] } interface configuration command. By default the PoE interface is in **auto** mode; If no value is specified, the maximum is allowed (30 W).

- Inventory management TLV

  Allows an endpoint to send detailed inventory information about itself to the device, including information hardware revision, firmware version, software version, serial number, manufacturer name, model name, and asset ID TLV.

- Location TLV

  Provides location information from the device to the endpoint device. The location TLV can send this information:

  - Civic location information

    Provides the civic address information and postal information. Examples of civic location information are street address, road name, and postal community name information.

  - ELIN location information

    Provides the location information of a caller. The location is determined by the Emergency location identifier number (ELIN), which is a phone number that routes an emergency call to the local public safety answering point (PSAP) and which the PSAP can use to call back the emergency caller.

  - Geographic location information

    Provides the geographical details of a switch location such as latitude, longitude, and altitude of a switch.

  - custom location

    Provides customized name and value of a switch location.

Wired Location Service

The device uses the location service feature to send location and attachment tracking information for its connected devices to a Cisco Mobility Services Engine (MSE). The tracked device can be a wireless endpoint, a wired endpoint, or a wired device or controller. The device notifies the MSE of device link up and link down events through the Network Mobility Services Protocol (NMSP) location and attachment notifications.

The MSE starts the NMSP connection to the device, which opens a server port. When the MSE connects to the device there are a set of message exchanges to establish version compatibility and service exchange information followed by location information synchronization. After connection, the device periodically sends location and attachment notifications to the MSE. Any link up or link down events detected during an interval are aggregated and sent at the end of the interval.

When the device determines the presence or absence of a device on a link-up or link-down event, it obtains the client-specific information such as the MAC address, IP address, and username. If the client is LLDP-MED- or CDP-capable, the device obtains the serial number and UDI through the LLDP-MED location TLV or CDP.

Depending on the device capabilities, the device obtains this client information at link up:

- Slot and port specified in port connection
- MAC address specified in the client MAC address
- IP address specified in port connection
- 802.1X username if applicable
- Device category is specified as a *wired station*
- State is specified as *new*
- Serial number, UDI
- Model number
- Time in seconds since the device detected the association

Depending on the device capabilities, the device obtains this client information at link down:

- Slot and port that was disconnected
- MAC address
- IP address
- 802.1X username if applicable
- Device category is specified as a *wired station*
- State is specified as *delete*
- Serial number, UDI
- Time in seconds since the device detected the disassociation

When the device shuts down, it sends an attachment notification with the state *delete* and the IP address before closing the NMSP connection to the MSE. The MSE interprets this notification as disassociation for all the wired clients associated with the device.

If you change a location address on the device, the device sends an NMSP location notification message that identifies the affected ports and the changed address information.

Default LLDP Configuration

Table 12: Default LLDP Configuration

Feature	Default Setting
LLDP global state	Disabled
LLDP holdtime (before discarding)	120 seconds
LLDP timer (packet update frequency)	30 seconds
LLDP reinitialization delay	2 seconds
LLDP tlv-select	Disabled to send and receive all TLVs
LLDP interface state	Disabled
LLDP receive	Disabled
LLDP transmit	Disabled
LLDP med-tlv-select	Disabled to send all LLDP-MED TLVs. When LLDP is glob LLDP-MED-TLV is also enabled.

How to Configure LLDP, LLDP-MED, and Wired Location Service

Enabling LLDP

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**lldp run** **Example:** `Device (config)# lldp run`	Enables LLDP globally on the device.
Step 4	**interface** *interface-id* **Example:** `Device (config)# interface fortygigabitethernet2/0/1`	Specifies the interface on which you are enabling LLDP, and enter interface configuration mode.
Step 5	**lldp transmit** **Example:** `Device(config-if)# lldp transmit`	Enables the interface to send LLDP packets.
Step 6	**lldp receive** **Example:** `Device(config-if)# lldp receive`	Enables the interface to receive LLDP packets.
Step 7	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 8	**show lldp** **Example:** `Device# show lldp`	Verifies the configuration.
Step 9	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring LLDP Characteristics

You can configure the frequency of LLDP updates, the amount of time to hold the information before discarding it, and the initialization delay time. You can also select the LLDP and LLDP-MED TLVs to send and receive.

Note Steps 3 through 6 are optional and can be performed in any order.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**lldp holdtime** *seconds* **Example:** `Device(config)# lldp holdtime 120`	(Optional) Specifies the amount of time a receiving device should hold the information from your device before discarding it. The range is 0 to 65535 seconds; the default is 120 seconds.
Step 4	**lldp reinit** *delay* **Example:** `Device(config)# lldp reinit 2`	(Optional) Specifies the delay time in seconds for LLDP to initialize on an interface. The range is 2 to 5 seconds; the default is 2 seconds.
Step 5	**lldp timer** *rate* **Example:** `Device(config)# lldp timer 30`	(Optional) Sets the sending frequency of LLDP updates in seconds. The range is 5 to 65534 seconds; the default is 30 seconds.
Step 6	**lldp tlv-select** **Example:** `Device(config)# tlv-select`	(Optional) Specifies the LLDP TLVs to send or receive.
Step 7	**interface** *interface-id* **Example:** `Device (config)# interface fortygigabitethernet2/0/1`	Specifies the interface on which you are enabling LLDP, and enter interface configuration mode.

	Command or Action	Purpose
Step 8	**lldp med-tlv-select** **Example:** `Device (config-if)# lldp med-tlv-select inventory management`	(Optional) Specifies the LLDP-MED TLVs to send or receive.
Step 9	**end** **Example:** `Device (config-if)# end`	Returns to privileged EXEC mode.
Step 10	**show lldp** **Example:** `Device# show lldp`	Verifies the configuration.
Step 11	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring LLDP-MED TLVs

By default, the device only sends LLDP packets until it receives LLDP-MED packets from the end device. It then sends LLDP packets with MED TLVs, as well. When the LLDP-MED entry has been aged out, it again only sends LLDP packets.

By using the **lldp** interface configuration command, you can configure the interface not to send the TLVs listed in the following table.

Table 13: LLDP-MED TLVs

LLDP-MED TLV	Description
inventory-management	LLDP-MED inventory management TLV
location	LLDP-MED location TLV
network-policy	LLDP-MED network policy TLV
power-management	LLDP-MED power management TLV

Follow these steps to enable a TLV on an interface:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-id* **Example:** `Device (config)# interface fortygigabitethernet2/0/1`	Specifies the interface on which you are enabling LLDP, and enter interface configuration mode.
Step 4	**lldp med-tlv-select** **Example:** `Device(config-if)# lldp med-tlv-select inventory management`	Specifies the TLV to enable.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 6	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring Network-Policy TLV

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**network-policy profile** *profile number* **Example:** `Device(config)# network-policy profile 1`	Specifies the network-policy profile number, and enter network-policy configuration mode. The range is 1 to 4294967295.
Step 4	{**voice** | **voice-signaling**} **vlan** [*vlan-id* {**cos** *cvalue* | **dscp** *dvalue*}] | [[**dot1p** {**cos** *cvalue* | **dscp** *dvalue*}] | **none** | **untagged**] **Example:** `Device(config-network-policy)# voice vlan 100 cos 4`	Configures the policy attributes: • **voice**—Specifies the voice application type. • **voice-signaling**—Specifies the voice-signaling application type. • **vlan**—Specifies the native VLAN for voice traffic. • *vlan-id*—(Optional) Specifies the VLAN for voice traffic. The range is 1 to 4094. • **cos** *cvalue*—(Optional) Specifies the Layer 2 priority class of service (CoS) for the configured VLAN. The range is 0 to 7; the default is 5. • **dscp** *dvalue*—(Optional) Specifies the differentiated services code point (DSCP) value for the configured VLAN. The range is 0 to 63; the default is 46. • **dot1p**—(Optional) Configures the telephone to use IEEE 802.1p priority tagging and use VLAN 0 (the native VLAN).

	Command or Action	Purpose
		• **none**—(Optional) Do not instruct the IP telephone about the voice VLAN. The telephone uses the configuration from the telephone key pad. • **untagged**—(Optional) Configures the telephone to send untagged voice traffic. This is the default for the telephone.
Step 5	**exit** **Example:** `Device(config)# exit`	Returns to global configuration mode.
Step 6	**interface** *interface-id* **Example:** `Device (config)# interface fortygigabitethernet2/0/1`	Specifies the interface on which you are configuring a network-policy profile, and enter interface configuration mode.
Step 7	**network-policy** *profile number* **Example:** `Device(config-if)# network-policy 1`	Specifies the network-policy profile number.
Step 8	**lldp med-tlv-select network-policy** **Example:** `Device(config-if)# lldp med-tlv-select network-policy`	Specifies the network-policy TLV.
Step 9	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.
Step 10	**show network-policy profile** **Example:** `Device# show network-policy profile`	Verifies the configuration.
Step 11	**copy running-config startup-config** **Example:**	(Optional) Saves your entries in the configuration file.

	Command or Action	Purpose
	`Device# copy running-config startup-config`	

Configuring Location TLV and Wired Location Service

Beginning in privileged EXEC mode, follow these steps to configure location information for an endpoint and to apply it to an interface.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

Step 2	**location** {**admin-tag** *string* | **civic-location identifier** {*id* | **host**} | **elin-location** *string* **identifier** *id* | **custom-location identifier** {*id* | **host**} | **geo-location identifier** {*id* | **host**}}
	Example:
	`Device(config)# location civic-location identifier 1`
	`Device(config-civic)# number 3550`
	`Device(config-civic)# primary-road-name "Cisco Way"`
	`Device(config-civic)# city "San Jose"`
	`Device(config-civic)# state CA`
	`Device(config-civic)# building 19`
	`Device(config-civic)# room C6`
	`Device(config-civic)# county "Santa Clara"`
	`Device(config-civic)# country US`
		Specifies the location information for an endpoint.
		• **admin-tag**—Specifies an administrative tag or site information.
		• **civic-location**—Specifies civic location information.
		• **elin-location**—Specifies emergency location information (ELIN).
		• **custom-location**—Specifies custom location information.
		• **geo-location**—Specifies geo-spatial location information.
		• **identifier** *id*—Specifies the ID for the civic, ELIN, custom, or geo location.
		• **host**—Specifies the host civic, custom, or geo location.
		• *string*—Specifies the site or location information in alphanumeric format.

Step 3	**exit** **Example:** `Device(config-civic)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 4	**interface** *interface-id* **Example:** `Device (config)# interface fortygigabitethernet2/0/1`	Specifies the interface on which you are configuring the location information, and enter interface configuration mode.
Step 5	**location** {**additional-location-information** *word* | **civic-location-id** {*id* | **host**} | **elin-location-id** *id* | **custom-location-id** {*id* | **host**} | **geo-location-id** {*id* | **host**} } **Example:** `Device(config-if)# location elin-location-id 1`	Enters location information for an interface: • **additional-location-information**—Specifies additional information for a location or place. • **civic-location-id**—Specifies global civic location information for an interface. • **elin-location-id**—Specifies emergency location information for an interface. • **custom-location-id**—Specifies custom location information for an interface. • **geo-location-id**—Specifies geo-spatial location information for an interface. • **host**—Specifies the host location identifier. • *word*—Specifies a word or phrase with additional location information. • *id*—Specifies the ID for the civic, ELIN, custom, or geo location. The ID range is 1 to 4095.
Step 6	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.
Step 7	Use one of the following: • **show location admin-tag** *string* • **show location civic-location identifier** *id* • **show location elin-location identifier** *id* **Example:** `Device# show location admin-tag` or	Verifies the configuration.

	Command or Action	Purpose

	`Device# show location civic-location identifier`
	
	or
	
	`Device# show location elin-location identifier`	

Step 8	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Enabling Wired Location Service on the Device

Before you begin

For wired location to function, you must first enter the **ip device tracking** global configuration command.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**nmsp notification interval** {**attachment** | **location**} *interval-seconds* **Example:** `Device(config)# nmsp notification interval location 10`	Specifies the NMSP notification interval. **attachment**—Specifies the attachment notification interval. **location**—Specifies the location notification interval. *interval-seconds*—Duration in seconds before the device sends the MSE the location or

	Command or Action	Purpose
		attachment updates. The range is 1 to 30; the default is 30.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.
Step 5	**show network-policy profile** **Example:** `Device# show network-policy profile`	Verifies the configuration.
Step 6	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuration Examples for LLDP, LLDP-MED, and Wired Location Service

Configuring Network-Policy TLV: Examples

This example shows how to configure VLAN 100 for voice application with CoS and to enable the network-policy profile and network-policy TLV on an interface:

```
# configure terminal
(config)# network-policy 1
(config-network-policy)# voice vlan 100 cos 4
(config-network-policy)# exit
(config)# interface gigabitethernet1/0/1
(config-if)# network-policy profile 1
(config-if)# lldp med-tlv-select network-policy
```

This example shows how to configure the voice application type for the native VLAN with priority tagging:

```
config-network-policy)# voice vlan dot1p cos 4
config-network-policy)# voice vlan dot1p dscp 34
```

Monitoring and Maintaining LLDP, LLDP-MED, and Wired Location Service

Commands for monitoring and maintaining LLDP, LLDP-MED, and wired location service.

Command	Description
clear lldp counters	Resets the traffic counters to zero.
clear lldp table	Deletes the LLDP neighbor information table.
clear nmsp statistics	Clears the NMSP statistic counters.
show lldp	Displays global information, such as frequency of transmissions, the holdtime for packets being sent, and the delay time before LLDP initializes on an interface.
show lldp entry *entry-name*	Displays information about a specific neighbor. You can enter an asterisk (*) to display all neighbors, or you can enter the neighbor name.
show lldp interface [*interface-id*]	Displays information about interfaces with LLDP enabled. You can limit the display to a specific interface.
show lldp neighbors [*interface-id*] [**detail**]	Displays information about neighbors, including device type, interface type and number, holdtime settings, capabilities, and port ID. You can limit the display to neighbors of a specific interface or expand the display for more detailed information.
show lldp traffic	Displays LLDP counters, including the number of packets sent and received, number of packets discarded, and number of unrecognized TLVs.
show location admin-tag *string*	Displays the location information for the specified administrative tag or site.
show location civic-location identifier *id*	Displays the location information for a specific global civic location.
show location elin-location identifier *id*	Displays the location information for an emergency location
show network-policy profile	Displays the configured network-policy profiles.
show nmsp	Displays the NMSP information

Additional References for LLDP, LLDP-MED, and Wired Location Service

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	See the *Interface and Hardware Commands* section in the *Command Reference (Catalyst 9500 Series Switches)*

MIBs

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

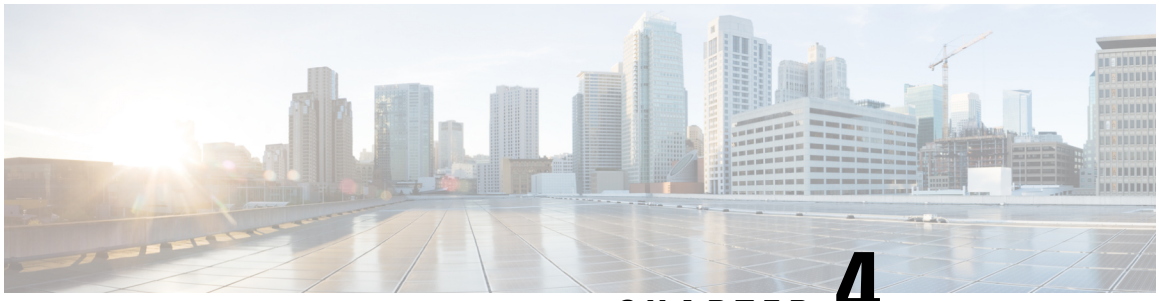
Feature History for LLDP, LLDP-MED, and Wired Location Service

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	Link Layer Discovery Protocol (LLDP), LLDP-MED, Wired Location Service	LLDP is a neighbor discovery protocol that is used for network devices to advertise information about themselves to other devices on the network. This protocol runs over the data-link layer, which allows two systems running different network layer protocols to learn about each other. LLDP-MED operates between endpoints and network devices. Wired Location Service lets you send tracking information of the connected devices to a Cisco Mobility Services Engine (MSE). Support for this feature was introduced only on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models of the Cisco Catalyst 9500 Series Switches.
Cisco IOS XE Fuji 16.8.1a	Link Layer Discovery Protocol (LLDP), LLDP-MED, Wired Location Service	LLDP is a neighbor discovery protocol that is used for network devices to advertise information about themselves to other devices on the network. This protocol runs over the data-link layer, which allows two systems running different network layer protocols to learn about each other. LLDP-MED operates between endpoints and network devices. Wired Location Service lets you send tracking information of the connected devices to a Cisco Mobility Services Engine (MSE). Support for this feature was introduced only on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.



CHAPTER 4

Configuring System MTU

- Restrictions for System MTU, on page 97
- Information About the MTU, on page 97
- How to Configure MTU , on page 98
- Configuration Examples for System MTU, on page 100
- Additional References for System MTU, on page 100
- Feature History for System MTU, on page 101

Restrictions for System MTU

When configuring the system MTU values, follow these guidelines:

- The device does not support the MTU on a per-interface basis.
- If you enter the **system mtu** *bytes* command in global configuration mode, the command affects all the switched and routed ports on the switch.

Information About the MTU

The default maximum transmission unit (MTU) size for payload received in Ethernet frame and sent on all device interfaces is 1500 bytes.

System MTU Value Application

This table shows how the MTU values are applied.

Table 14: MTU Values

Configuration	system mtu command	ip mtu command	ipv6 mtu command
Standalone switch	You can enter the **system mtu** command on a switch . The range is from 1500 to 9198 bytes. The C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches support a range of 1500 to 9216 bytes.	Use the **ip mtu** *bytes* command. The range is from 832 up to 1500 bytes. **Note** The IP MTU value is the applied value, not the configured value.	Use the **ipv6 mtu** *bytes* command. The range is from 1280 to the system jumbo MTU value (in bytes). **Note** The IPv6 MTU value is the applied value, not the configured value.

The upper limit of the IP or IPv6 MTU value is based on the switch configuration and refers to the currently applied system MTU value. For more information about setting the MTU sizes, see the **system mtu** global configuration command in the command reference for this release.

How to Configure MTU

Configuring the System MTU

Follow these steps to change the MTU size for switched packets:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**system mtu** *bytes* **Example:** `Device(config)# system mtu 1900`	(Optional) Changes the MTU size for all interfaces.

	Command or Action	Purpose
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.
Step 5	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	Saves your entries in the configuration file.
Step 6	**show system mtu** **Example:** `Device# show system mtu`	Verifies your settings.

Configuring Protocol-Specific MTU

To override system MTU values on routed interfaces, configure protocol-specific MTU under each routed interface. To change the MTU size for routed ports, perform this procedure

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**interface** *interface* **Example:** `Device(config)# interface gigabitethernet0/0`	Enters interface configuration mode.
Step 3	**ip mtu** *bytes* **Example:** `Device(config-if)# ip mtu 68`	Changes the IPv4 MTU size
Step 4	**ipv6 mtu** *bytes* **Example:** `Device(config-if)# ipv6 mtu 1280`	(Optional) Changes the IPv6 MTU size.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

	Command or Action	Purpose
Step 6	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	Saves your entries in the configuration file.
Step 7	**show system mtu** **Example:** `Device# show system mtu`	Verifies your settings.

Configuration Examples for System MTU

Example: Configuring Protocol-Specific MTU

```
Device# configure terminal
Device(config)# interface fortygigabitethernet 0/0
Device(config-if)# ip mtu 900
Device(config-if)# ipv6 mtu 1286
Device(config-if)# end
```

Example: Configuring the System MTU

```
Device# configure terminal
Device(config)# system mtu 1600
Device(config)# exit
```

Additional References for System MTU

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	See the *Interface and Hardware Commands* section in the *Command Reference (Catalyst 9500 Series Switches)*

MIBs

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

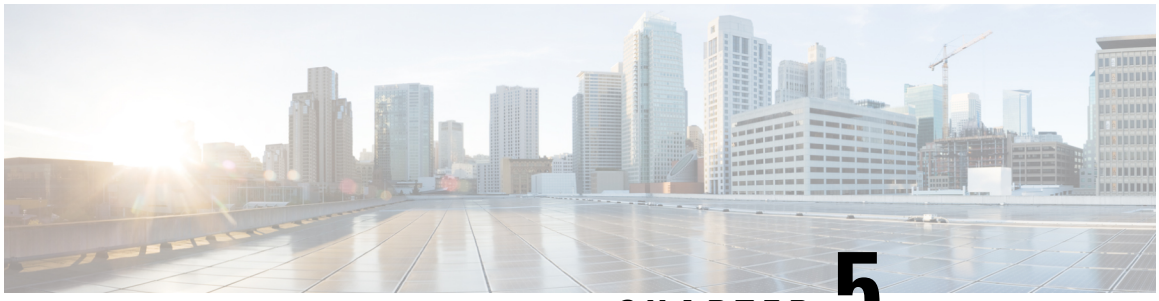
Feature History for System MTU

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	System MTU	System MTU defines the maximum transmission unit size for frames transmitted on all interfaces of a switch. Support for this feature was introduced on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models of the Cisco Catalyst 9500 Series Switches.
Cisco IOS XE Fuji 16.8.1a	System MTU	System MTU defines the maximum transmission unit size for frames transmitted on all interfaces of a switch. Support for this feature was introduced on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.



CHAPTER 5

Configuring Internal Power Supplies

- Restrictions for Internal Power Supplies, on page 103
- Information About Internal Power Supplies , on page 103
- How to Configure Internal Power Supplies, on page 104
- Monitoring Internal Power Supplies, on page 105
- Configuration Examples for Internal Power Supplies, on page 105
- Additional References for Internal Power Supplies, on page 106
- Feature History for Internal Power Supplies, on page 107

Restrictions for Internal Power Supplies

- Power Supply configuration is not supported on C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches. Use the **show environment status** command to check the power supply status.
- For C9500-32C, the power supply with serial number starting with POG has two fans and the power supply with serial number starting with QCS has a single fan. See Configuration Examples for Internal Power Supplies, on page 105.

Information About Internal Power Supplies

See the device installation guide for information about the power supplies.

How to Configure Internal Power Supplies

Configuring Internal Power Supply

Note Power Supply configuration is not supported on C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

Use the **show environment status** command to check the power supply status.

You can use the **power supply** EXEC command to configure and manage the internal power supply on the device. The device does not support the **no power supply** EXEC command.

Follow these steps beginning in user EXEC mode:

Procedure

	Command or Action	Purpose
Step 1	**power supply** *switch_number* **slot**{**A** | **B**} { **off** | **on** } **Example:** `Device# power supply 1 slot A on`	Sets the specified power supply to **off** or **on** by using one of these keywords: • **A** —Selects the power supply in slot A. • **B** —Selects power supply in slot B. **Note** Power supply slot B is the closest to the outer edge of the device. • **off** —Set the power supply off. • **on** —Set the power supply on. By default, the device power supply is **on**.
Step 2	**show environment power** **Example:** `Device# show environment power`	Verifies your settings.

Monitoring Internal Power Supplies

Table 15: Show Commands for Power Supplies

Command	Purpose
show environment power [**all** | **switch** *switch_number*]	(Optional) Displays the status of the internal power supplies for the specified device. . The device keywords are available only on stacking-capable devices. **Note** This command is not applicable to the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

Configuration Examples for Internal Power Supplies

This example shows the sample output of **show environment status** command when a power supply with serial number starting with QCS is installed into C9500-32C switch. In this example, the second fan displays the state as `N/A` because the power supply with serial number starting with QCS has a single fan.

```
Device# show inventory

NAME: "Chassis", DESCR: "Cisco Catalyst 9500 Series Chassis"
PID: C9500-32C         , VID: V00  , SN: CAT2202L2M5

NAME: "Power Supply Module 1", DESCR: "Cisco Catalyst 9500 Series 1600W
AC  Power Supply"
PID: C9K-PWR-1600WAC-R , VID: V01  , SN: QCS2230500J

Device# show environment status

Power                                    Fan States
Supply  Model No              Type  Capacity  Status     0     1
------  --------------------  ----  --------  ---------  ----------
PS1     C9K-PWR-1600WAC-R     AC    1600 W    ok         good  N/A
```

This example shows the sample output of **show environment status** command when a power supply with serial number starting with POG is installed into C9500-32C switch. In this example, the second fan displays the state as `good` because the power supply with serial number starting with POG has a two fans.

```
Device# show inventory

NAME: "Chassis", DESCR: "Cisco Catalyst 9500 Series Chassis"
PID: C9500-32C         , VID: V01  , SN: CAT2344L1N8

NAME: "Power Supply Module 0", DESCR: "Cisco Catalyst 9500 Series 1600W
AC  Power Supply"
PID: C9K-PWR-1600WAC-R , VID: V01  , SN: POG2319D04K
```

```
Device# show environment status

Power                                      Fan States
Supply  Model No              Type  Capacity  Status     0     1
------  --------------------  ----  --------  ---------  ----------
PS0     C9K-PWR-1600WAC-R     AC    1600 W    ok         good  good
```

This example shows how to set the power supply in slot A to off:

```
Device# power supply 1 slot A off
Disabling Power supply A may result in a power loss to PoE devices and/or switches ...
Continue? (yes/[no]): yes
Device#
Jun 10 04:52:54.389: %PLATFORM_ENV-6-FRU_PS_OIR: FRU Power Supply 1 powered off
Jun 10 04:52:56.717: %PLATFORM_ENV-1-FAN_NOT_PRESENT: Fan is not present
Device#
```

This example shows how to set the power supply in slot A to on:

```
Device# power supply 1 slot A on
Jun 10 04:54:39.600: %PLATFORM_ENV-6-FRU_PS_OIR: FRU Power Supply 1 powered on
```

This example shows the output of the **show env power** command:

Table 16: show env power Status Descriptions

Field	Description
OK	The power supply is present and power is good.
Not Present	No power supply is installed.
No Input Power	The power supply is present but there is no input power.
Disabled	The power supply and input power are present, but power supply is switched off by CLI.
Not Responding	The power supply is not recognizable or is faulty.
Failure-Fan	The power supply fan is faulty.

Additional References for Internal Power Supplies

Related Documentation

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Command Reference (Catalyst 9500 Series Switches)*
For information about the power supplies.	*Cisco Catalyst 9500 Series Switches Hardware Installation Guide*

MIBs

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

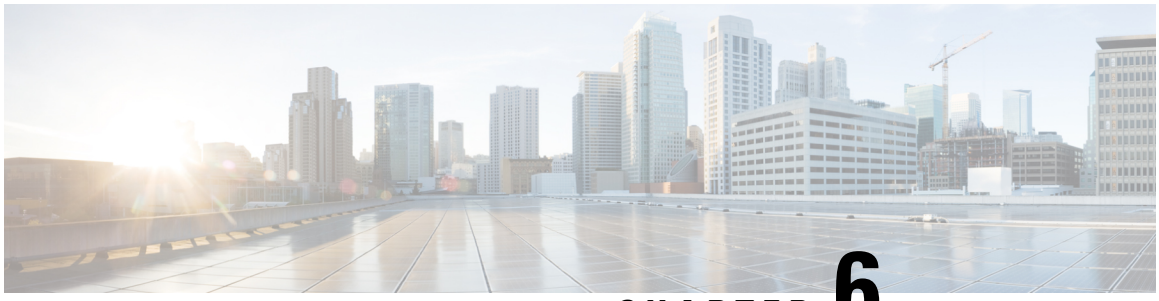
Feature History for Internal Power Supplies

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	Internal Power Supplies	The switch operates with power supply modules which could be AC, DC or both. Refer the *Hardware Installation Guide* for more details on power supply units. Support for power supply configuration was introduced only on the C9500-12Q, C9500-24Q, C9500-16X and C9500-40X models of the Cisco Catalyst 9500 Series Switches.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.



CHAPTER 6

Configuring USB 3.0 SSD

- Information About USB 3.0 SSD, on page 109
- How to Configure USB 3.0 SSD, on page 110
- Monitoring USB 3.0 SSD, on page 114
- Troubleshooting USB 3.0 SSD, on page 115
- Configuration Examples for Configuring USB 3.0 SSD, on page 117
- Feature History for USB 3.0 SSD, on page 119

Information About USB 3.0 SSD

USB 3.0 SSD

From Cisco IOS XE Fuji 16.9.1, support for USB 3.0 SSD is enabled on Cisco Catalyst 9500 Series Switches. USB 3.0 SSD provides extra 120 GB storage for application hosting. Applications can be hosted in Kernel Virtual Machines (KVM), Linux Containers (LXC), or Docker containers. The storage drive can also be used to save packet captures, trace logs generated by the operating system and third-party applications. USB 3.0 SSD can be used simultaneously as a general-purpose storage device and as an application-hosting device. You must use only Cisco USB drives; non-Cisco USB drives are not supported.

Note Support for USB 3.0 SSD is not available on Cisco Catalyst 9500 Series High Performance Switches.

Note USB 3.0 SSD cannot be used to boot images, emergency install the images, or upgrade internal flash using (software maintenance update (SMU or **install** commands. Bootloader support for USB 3.0 SSD is not available.

USB 3.0 SSD is enabled with Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T) functionality for health monitoring of the drive. The purpose of S.M.A.R.T is to monitor the reliability of the drive and predict drive failures, and to carry out different types of drive self tests. SMART Disk Monitoring Daemon (smartd) is enabled immediately after the insertion of a USB 3.0 SSD and starts logging warnings and errors in the /crashinfo/tracelogs/smart_errors.log. These warnings and errors are also displayed on the console. On removing the USB 3.0 SSD, smartd stops running.

USB 3.0 SSD is supported as a field-replaceable unit (FRU) that offers flexible storage configurations. If SSD is used initially on a PC, the default partition on USB 3.0 SSD is created by the PC supporting all the file systems. If SSD is used initially on the switch, one partition of 120 GB is created to support EXT4 file system.

File System on USB 3.0 SSD

USB 3.0 SSD is shipped as a raw device. When the device boots up, Cisco IOS software creates a partition with EXT4 as the default file system. However, the device supports all EXT-based file systems such as EXT2, EXT3, and EXT4. Non-EXT based file systems such as VFAT, NTFS, LVM, and so on are not supported.

The following file system operations are supported on the drive:

- Read
- Write
- Delete
- Copy
- Format

Password Authentication on USB 3.0 SSD

To protect the drive from unauthorized access, you must enable security on USB 3.0 SSD by setting a user password. A USB 3.0 SSD supports the following security states:

- Security disabled — User password has not been configured on the drive. This is the out-of-box state which is the default for any new drive.
- Security enabled — User password has been configured on the drive.
- Locked — Security is enabled and the drive is inaccessible.
- Unlocked — Security is enabled or disabled, but the drive is accessible.

You can configure password authentication using the CLI as well as programmable NETCONF/YANG method.

How to Configure USB 3.0 SSD

Formatting USB 3.0 SSD

Use the **format usbflash1:** {**ext2** | **ext3** | **ext4** | **secure**} command to format the EXT file systems or the entire drive.

To format the USB 3.0 SSD drive in a device stack, use **format usbflash1**-*switch_num*: {**ext2** | **ext3** | **ext4** | **secure**} command.

Unmounting USB 3.0 SSD from a Switch or a Switch Stack

To safely remove the USB 3.0 SSD from a switch or a switch stack, use the **hw-module switch** <*switch_num*> **usbflash1 unmount** command in privileged EXEC mode. This command unmounts the filesystem created upon insertion, and notifies the system to complete pending read or write operations, if any, to safely remove the drive from the switch.

```
Device#hw-module switch 1 usbflash1 unmount

      *Jan  5 22:21:32.723: %IOSXE-0-PLATFORM: Switch 1 R0/0: SSD_UNMOUNT_LOG: usbflash1:
has been unmounted. All the usbflash1 entries in    IOS will now be cleared until the SSD
is plugged back into the switch.
      *Jan  5 22:21:32.729: %IOSD_INFRA-6-IFS_DEVICE_OIR: Device usbflash1 removed
```

After you run this command, you will not be able to access the USB anymore. To use the USB again reinsert it into the switch.

If you run the **hw-module switch** <*switch_num*> **usbflash1 unmount** command on a switch or switch stack without inserting the USB, the following error message is displayed.

```
Device#hw-module switch 1 usbflash1 unmount

*Jun 20 22:50:40.321:
ERROR: USB Not Present in this Slot 1
```

Enabling Password Security on USB 3.0 SSD

The password authentication feature enables you to configure security on a USB 3.0 SSD in order to protect the drive from unauthorized access and associated risks.To enable security on a USB 3.0 SSD, follow these steps to set a password on the drive.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device>enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**hw-module switch** *switch-number* **usbflash1 security enable password** *usb-password* **Example:** `Device#hw-module switch 1 usbflash1 security enable password 1234`	Configures a user-defined password on the USB 3.0 SSD. **Note** Password security will take effect only after after Online Insertion and Removal (OIR) of the USB or a switch reload.

After Online Insertion and Removal (OIR) of the USB or a switch reload, the USB will be in *Enabled and Locked* state. To unlock and access the USB, you must configure the switch to use the USB 3.0 SSD password that you create in this task.

What to do next

To configure the USB 3.0 SSD password on the switch, see Configuring USB 3.0 SSD Password on a Switch, on page 112.

Configuring USB 3.0 SSD Password on a Switch

To access a password protected USB 3.0 SSD using a switch, you must configure the same USB 3.0 SSD password on the switch. USB 3.0 SSD will be in locked state after a switch reset or OIR of the drive. To unlock and access the drive, the switch prompts you to enter the USB 3.0 SSD password saved on the switch. This procedure saves the password to the running configuration on the switch in type-6 encryption format.

Using the Encrypted Preshared Key feature, you can securely store plain text passwords in type-6 format in NVRAM using the command-line interface (CLI). Type-6 passwords are encrypted. Although the encrypted passwords can be seen or retrieved, it is difficult to decrypt them to find out the actual password.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device>enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device#configure terminal`	Enters global configuration mode.
Step 3	(Optional) **key config-key password-encrypt** *password* **Example:** `Device(config)#key config-key password-encrypt 123456789`	Configures the master key on the switch. The password configured using this command is the master encryption key that is used to encrypt all the other keys in the switch. **Note** Skip this step if you have already configured the master key on the switch.
Step 4	[**no**] **hw-module switch** *switch-number* **usbflash1-password** *usb-password* **Example:** `Device(config)#hw-module switch 1 usbflash1-password 1234`	**Note** Ensure the password matches the one that you have configured on the USB 3.0 SSD to enable security. Encrypts the password internally using type-6 encryption. Use the **no** form of the command to remove the USB 3.0 SSD password from the running configuration of the switch.

	Command or Action	Purpose
Step 5	**end** **Example:** `Device(config)#end`	Returns to privileged EXEC mode.

Unlocking USB 3.0 SSD

Follow these steps to unlock a USB 3.0 SSD:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**hw-module switch** *switch-number* **usbflash1 security unlock password** *usb-password* **Example:** `Device#hw-module switch 1 usbflash1 security unlock password 1234`	Unlocks the drive and makes the drive available for temporary access. Note that password security is still enabled on the drive and if you insert the drive on any other switch, the drive will be in locked state.

Disabling Password Security on USB 3.0 SSD

Follow these steps to disable security or to change the password configured on a USB 3.0 SSD.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**hw-module switch** *switch-number* **usbflash1 security disable password** *usb-password* **Example:** `Device#hw-module switch 1 usbflash1 security disable password 1234`	Disables security on USB 3.0 SSD and makes the drive accessible. You do not have to reload the switch or perform OIR of the drive for the changes to take effect.

	Command or Action	Purpose
		Note On a switch stack, enter the switch number of the switch on which you have inserted the USB 3.0 SSD.

Monitoring USB 3.0 SSD

You can view the contents of the USB 3.0 SSD before working on its contents. For example, before copying a new configuration file, you might want to verify that the filesystem does not already contain a configuration file with the same name. To display information about files on a filesystem, use one of the privileged EXEC commands listed in the following table:

Table 17: Commands to Display Files on a Filesystem

Command Name	Description
dir usbflash1:	Displays the list of files on the USB flash filesystem on an active switch. To access flash partitions of a standby switch or the device members in a stack, use **usbflash1**–*n* where *n*, is the standby switch number or the stack member number.
dir usbflash1-*switch_num***:**	Displays the list of files on the filesystem in a stack setup.
dir stby-usbflash1:	Displays the list of files on the filesystem on the standby switch in a stack setup.
show usbflash1: filesystem	Displays more information about the filesystem.
show inventory	Displays the physical inventory information for the USB hardware. After multiple switchovers, the **show inventory** command output might display the USB flash filesystem (usbflash1) for the active switch with the switch number. **Note** The **show inventory** command displays ”usbflash1” in the output only when the device is in “Disabled and Unlocked” state or “Enabled and Unlocked” state.
more `file-url`	Displays the logs with SMART errors and overall health of the drive.
show hw-module usbflash1 security status	Displays USB 3.0 SSD authentication status.

Troubleshooting USB 3.0 SSD

Troubleshooting USB 3.0 SSD Insertion and Removal

Table 18: Errors and Troubleshooting

Error That You May Encounter	Troubleshooting
USB3.0 SSD not detected after insertion	• Check if you are using a Cisco USB 3.0 SSD. If not, remove the drive from the device, and replace it with a Cisco USB 3.0 SSD. • If you are using a Cisco USB 3.0 SSD and the system is unable to detect the drive, remove and reinsert the USB 3.0 SSD. If it continues to fail, the USB might be defective.

Error messages displayed on the console after removing USB 3.0 SSD:
`*Mar 20 00:48:16.353: %IOSXE-4-PLATFORM: Switch 1 R0/0: kernel: xhci_hcd 0000:00:14.0: Cannot set link state.`
`*Mar 20 00:48:16.353: %IOSXE-3-PLATFORM: Switch 1 R0/0: kernel: usb usb4-port1: cannot disable (err = -32)`
`*May 10 01:12:49.603: %IOSXE-3-PLATFORM: Switch 3 R0/0: kernel: JBD2: Error -5 detected when updating journal superblock for sda1-8.`
	Remove the USB 3.0 SSD from the device after running the **unmount** command. For more information, see Unmounting USB 3.0 SSD from a Switch or a Switch Stack, on page 111.

Error message displayed on the console on inserting a non-Cisco USB 3.0 SSD: `%IOSXEBOOT-4-SSD_MOUNT_LOG: (local/local): ***INFO: Not a CISCO SSD - Cannot be used***`	Remove the USB from the device, and replace it with a Cisco USB 3.0 SSD.

Troubleshooting Password Authentication

Table 19: Errors and Troubleshooting

Error That You May Encounter	Troubleshooting
USB3.0 SSD not detected after insertion	Run the **show hw-module usbflash1 security status** command and check for `USB Authentication Status` fields in the output. If the `USB Authentication Status` field in the output displays `Enabled and Locked`, perform one of the following: • Unlock the drive temporarily using the **hw-module switch 1** *switch-number* **usbflash1 security unlock password** *usb-password* command. • Configure USB 3.0 SSD password on the switch. See Configuring USB 3.0 SSD Password on a Switch, on page 112.

USB 3.0 SSD password does not match the password saved in the running configuration of the switch. The switch displays the following error messages:
`*Oct 19 19:32:04.094: %IOSD_INFRA-6-IFS_DEVICE_OIR: Device usbflash1 added`
`*Oct 19 19:32:04.138: Warning: Configured password on SWITCH does not match with that on DRIVE.`
`Please remove password from SWITCH first and then from DRIVE to re-configure.`
	Perform the following:
	• Remove the password from the switch and reconfigure the switch to use the correct password. See Configuring USB 3.0 SSD Password on a Switch, on page 112.

USB 3.0 SSD without a password inserted on a switch that has the drive password configured. An attempt to unlock the disk using the password configured on the switch fails and the switch displays the following messages:
`*Dec 14 00:01:00.374: %IOSD_INFRA-6-IFS_DEVICE_OIR: Device usbflash1 added`
`*Dec 14 00:01:00.430: ERROR: No password configured on DRIVE. Remove password from SWITCH to re-configure.`
	Perform the following steps:
	1. Enable security on the drive USB 3.0 SSD. See Enabling Password Security on USB 3.0 SSD, on page 111.
	2. Reconfigure the password on the switch. See Configuring USB 3.0 SSD Password on a Switch, on page 112.

Error That You May Encounter	Troubleshooting

USB 3.0 SSD configured with a password inserted on a switch that does not have the drive password configured. An attempt to unlock the disk fails and the switch displays the following messages:
`*Oct 19 19:36:18.003: %IOSD_INFRA-6-IFS_DEVICE_OIR: Device usbflash1 added`
`*Oct 19 19:36:18.028: Warning: No password configured on SWITCH. Remove password from DRIVE to re-configure`
	Do one of the following:
	• Disable the password configured on the drive. See Disabling Password Security on USB 3.0 SSD, on page 113.
	• Configure password on the switch. See Configuring USB 3.0 SSD Password on a Switch, on page 112.

A USB 3.0 SSD in `Disabled and locked` state indicates that the USB drive has become unusable because of corrupted hardware.	To unlock and enable the drive, contact TAC.

Configuration Examples for Configuring USB 3.0 SSD

Example: Displaying USB 3.0 SSD Authentication Status

This example shows the USB 3.0 SSD authentication status on a switch stack with 4 switches.

Device# **show hw-module usbflash1 security status**

```
Switch#   USB Authentication        Status
-----------------------------------------------------
1         USB Not Present          USB 3.0 is not present
2         Disabled and Unlocked    Security is disabled & the drive in unlocked state
(Default state if USB is  present)
3         Enabled and Locked       Security Enabled and the drive in locked state
4         Enabled and Unlocked     Security Enabled and the drive in unlocked state
```

When the drive is in *Enabled and Unlocked* or *Disabled and Unlocked* state, you can format a drive and perform normal file system operations like read, write, delete, and copy.

Examples: Verifying the Filesystem

The following example displays the output of the **dir usbflash1:/** command in privileged EXEC mode:

```
Switch#dir usbflash1:

Directory of usbflash1:/
11  drwx           16384   Oct 9 2015 01:49:18 +00:00  lost+found
3145729  drwx             4096   Oct 9 2015 04:10:41 +00:00  test
118014062592 bytes total (111933120512 bytes free)
```

The following example displays the output of the **dir usbflash1:***switch_num***:** command in a device stack:

```
Switch#dir  usbflash1-2:
Directory of usbflash1-2:/
```

```
11 drwx 16384 Jun 8 2018 21:35:39 +00:00 lost+found

118014083072 bytes total (111933390848 bytes free)
```

Alternately, you can use the **dir stby-usbflash1:** command to access the file system on a standby switch:

```
Switch#dir  stby-usbflash1:
Directory of usbflash1-3:/
11  drwx           16384  May 16 2018 23:32:43 +00:00  lost+found
118014083072 bytes total (110358429696 bytes free)
```

To display the file system information for usbflash1, use the **show usbflash1: filesystem** command in privileged EXEC mode:

```
Switch#show usbflash1: filesystem
Filesystem: usbflash1
Filesystem Path: /vol/usb1
Filesystem Type: ext4
```

Examples: Verifying Physical Inventory Information

To display the physical inventory information for USB 3.0 SSD hardware, use the **show inventory** command:

```
Switch#show inventory

NAME: "usbflash1", DESCR: "usbflash1"
PID: SSD-120G          , VID: STP21460FN9, SN: V01
```

The following is a sample output of the **show inventory** command in a device stack:

```
Switch#show inventory

NAME: "usbflash1", DESCR: "usbflash1"
PID: SSD-120G          , VID: STP21460FN9, SN: V01

NAME: "usbflash1-3", DESCR: "usbflash1-3"
PID: SSD-120G          , VID: STP21310001, SN: V01
```

Examples: Verifying the Health of the Drive

To check the overall health of the drive, use the **more flash:smart_overall_health.log** command in privileged EXEC mode:

```
Switch#more flash:smart_overall_health.log

=== START OF READ SMART DATA SECTION ===
SMART overall-health self-assessment test result: PASSED
```

To check the health error logs, use the **more crashinfo:tracelogs/smart_errors.log** command in privileged EXEC mode:

```
Switch#more crashinfo:tracelogs/smart_errors.log
%IOSXEBOOT-4-SMART_LOG: (local/local): Mon Jan 4 00:13:10 Universal 2016 INFO: Starting
SMART daemon
```

Note The system might display warnings in the smart_errors.log. You can ignore these if the overall health self assessment in the flash/smart_overall_health.log displays `PASSED`.

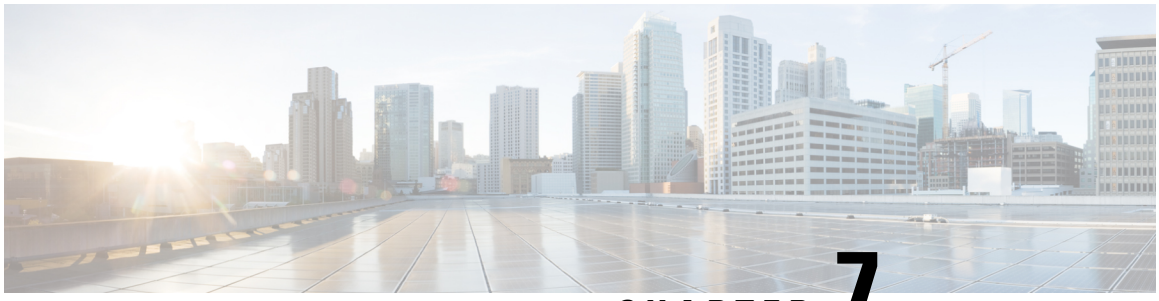
Feature History for USB 3.0 SSD

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Fuji 16.9.1	USB 3.0 SSD	USB 3.0 SSD provides extra 120 GB storage to be used as a general-purpose storage device and as an application-hosting device. Support for this feature was introduced only on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models of the Cisco Catalyst 9500 Series Switches.
Cisco IOS XE Gibraltar 16.10.1	Password authentication	Password authentication feature enables you set a password on the USB 3.0 SSD device in order to protect the drive from unauthorized access and associated risks.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.



CHAPTER 7

M2 SATA Module

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- File System and Storage on M2 SATA, on page 122
- Limitations of M2 SATA, on page 122
- Self-Monitoring, Analysis and Reporting Technology System (S.M.A.R.T.) Health Monitoring, on page 123
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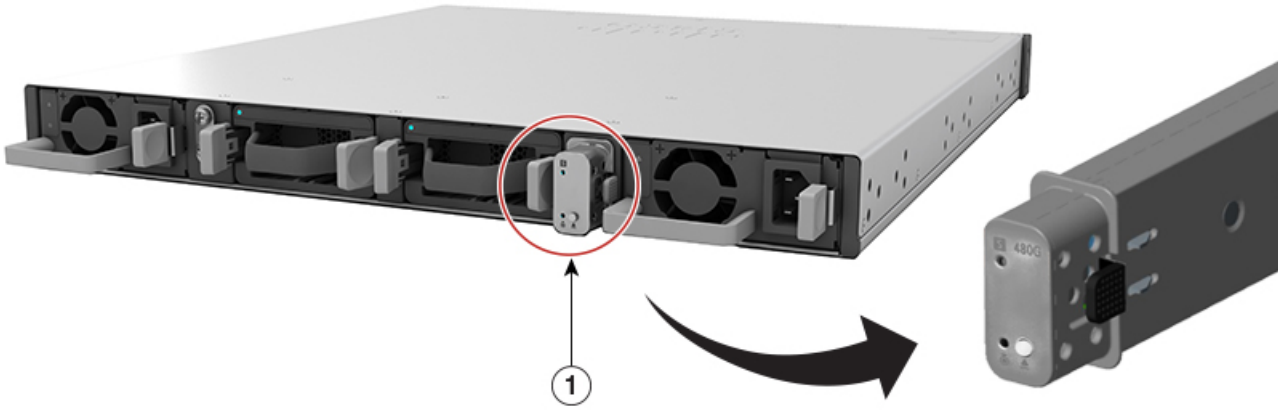
M2 SATA Module on Cisco Catalyst 9500 Series High Performance Switches

To support the storage needs on the switch, the Cisco Catalyst 9500 Series High Performance Switches support pluggable Serial Advanced Technology Attachment (SATA) Solid State Drive (SSD) module. The SATA SSD module slot is located on the rear panel of the switch.

The SATA module is a Field Replaceable Unit (FRU). A hot-swap button on the rear panel of the switch initiates the removal of the SATA module. For more information on inserting and removing the SSD SATA module, refer the *Cisco Catalyst 9500 Series Switch Installation Guide*.

The SSD module storage capacity ranges are 240GB, 480GB and 960GB. SATA SSD mainly provides storage for application hosting. Applications can be hosted on Kernel Virtual Machines (KVM), Linux containers or Docket Containers. SATA SSD module can also be used to store software generated packet captures and trace logs.

Figure 5: SATA Module on the Rear Panel



File System and Storage on M2 SATA

The default file system format of SATA is EXT4. However, SATA supports all extended file systems-EXT2, EXT3 and EXT4.

The SATA device has the following characteristics:

- Files stored on the M2 SATA partition are compatible with files stored on other devices.
- You can copy, or, store files between M2 SATA and other types of devices such as USB, eUSB, flash, and other IOS-XE file-system or storage.
- You can also read, write, delete, and format the SATA device.

.

You can check the type of current file system using the **show disk0: filesys** command:

```
Switch#show disk0: filesys
Filesystem: disk0
Filesystem Path: /vol/disk0
Filesystem Type: ext3
Mounted: Read/Write
```

Limitations of M2 SATA

- Non-EXT based file systems are not supported on M2 SATA.
- You cannot use M2 SATA to boot images from rommon.
- You cannot upgrade the firmware on the M2 SATA drive.
- M2 SATA is supported only on C9500-24Y-4C, C9500-48Y-4C, C9500-32QC, and C9500-32C models of the Cisco Catalyst 9500 Series Switches.

Self-Monitoring, Analysis and Reporting Technology System (S.M.A.R.T.) Health Monitoring

Cisco Catalyst IOS XE Release 16.9.1 gives you the ability to monitor the health of the device through CLIs. You can monitor internal hot-spots, flash wear-outs, and hardware failure of the SATA device and alert your users about a SATA failure. These users can then backup data and obtain a new SATA device.

A linux deamon smartd starts when the SATA is inserted into the Switch. By default, the polling interval is set to 2 days for offline test, 6 days for short test and 14 days for long test. The warnings and error messages are saved in /crashinfo/tracelogs/smart_errors.log and are also sent to the IOSd console.

The S.M.A.R.T. feature and smartd daemon are enabled by default when the SATA device is detected by the switch.

Note If the SATA is not detected after insertion, check the existing file system on the device. If it is not EXT based, SATA will not be detected. In that case, change the filesystem to EXT and reinsert the SATA.

The following CLI shows the logs from the smartd daemon:

```
Switch# more crashinfo:tracelogs/smart_errors.log
%IOSXEBOOT-4-SMART_LOG: (local/local): Mon Jan 4 00:13:10 Universal 2016
INFO: Starting SMART deamon
```

You can monitor the overall health of the device through the following CLI:

```
Switch# more flash:smart_overall_health.log
smartctl 6.4 2015-06-04 r4109 [x86_64-linux-4.4.131] (local build)
Copyright (C) 2002-15, Bruce Allen, Christian Franke, www.smartmontools.org

=== START OF READ SMART DATA SECTION ===
SMART overall-health self-assessment test result: PASSED
```

Accessing File System on M2 SATA

The mounted file system from the SATA flash card is accessed at disk0:. Use the **show file systems** command to view the details of each type of available filesystem.

Copying files to and from bootflash: or usbflash0: is supported.

Formatting the M2 SATA Flash Disk

To format a new Flash Disk, use the **format disk0:** command.

The format command recursively deletes all files on the device. This command fails if any file is open during its execution.

```
Switch#format disk0: ? <cr> <cr>
       ext2    ext2 filesystem type
       ext3    ext3 filesystem type
       ext4    ext4 filesystem type
```

```
      secure  Securely format the file system
<cr> <cr>

Switch# format disk0:
Format operation may take a while. Continue? [confirm]
Format operation will destroy all data in "disk0:". Continue? [confirm] Format of disk0:
complete
```

Operations on the SATA Module

The following are some of the operations that you can perform on the SATA:

Command	Description
dir *filesystem*	Displays the directories on the specified file system.
copy *source-file destination-url*	Copies files from specified source to a specified destination.
delete	Deletes a specified file
format	Formats the filesystem on the disk.
show disk0:	Displays the content and details of disk0:
show file information *file-url*	Displays information about a specific file.
show file systems	Displays the available file system on your device.
show inventory	Displays the details of the existing modules on the switch.

Following are sample outputs of the operations:

```
Switch# dir disk0:
Directory of disk0:/
        11  drwx            16384  May 11 2018 16:06:14 +00:00  lost+found
        10747905  drwx             4096  May 25 2018 13:03:43 +00:00  test
        236154740736 bytes total (224072925184 bytes free)
```

Copy a file from the disk0: to USB

```
Switch# copy disk0:test.txt usbflash0:
Destination filename [test.txt]?
Copy in progress...C
17866 bytes copied in 0.096 secs (186104 bytes/sec)
```

```
Switch# dir usbflash0:
Directory of usbflash0:/
   12  -rw-         33554432  Jul 28 2017 10:12:58 +00:00  nvram_config
   11  drwx            16384  Jul 28 2017 10:09:46 +00:00  lost+found
   13  -rw-            17866  Aug 11 2017 09:52:16 +00:00  test.txt
189628416 bytes total (145387520 bytes free)
```

Delete the file test.txt from disk0:

```
Switch# delete disk0:test.txt
Delete filename [test.txt]?
Delete disk0:/test.txt? [confirm]
```

```
Switch# dir disk0:
Directory of disk0:/
No files in directory
118148280320 bytes total (112084135936 bytes free)
```

Copy file test.txt from USB to disk0:

```
Switch# copy usbflash0:test.txt disk0:
Destination filename [test.txt]?
Copy in progress...C
17866 bytes copied in 0.058 secs (308034 bytes/sec)

Switch# dir disk0:
Directory of disk0:/
   11  -rw-           17866  Aug 11 2017 09:53:03 +00:00  test.txt
118148280320 bytes total (112084115456 bytes free)
```

Format the disk

To format the ext4 filesystem, use the following command:

```
Switch#format disk0:ext4
```

Show commands

```
Switch# show disk0:
-#- --length-- ---------date/time---------- path
  2      17866 Aug 11 2017 09:54:06.0000000000 +00:00 test.txt
112084115456 bytes available (62513152 bytes used)

Switch# show file information disk0:test.txt
disk0:test.txt:
  type is image (elf64) []
  file size is 448 bytes, run size is 448 bytes
Foreign image, entry point 0x400610

Switch# show file systems
File Systems:

              Size(b)       Free(b)      Type  Flags  Prefixes
-
             -
*  11250098176    9694093312      disk     rw   bootflash: flash:
    1651314688    1232220160      disk     rw   crashinfo:
  118148280320  112084115456      disk     rw   disk0:
     189628416     145387520      disk     rw   usbflash0:
    7763918848    7696850944      disk     ro   webui:
             -             -    opaque     rw   null:
             -             -    opaque     ro   tar:
             -             -   network     rw   tftp:
      33554432      33532852     nvram     rw   nvram:
             -             -    opaque     wo   syslog:
             -             -   network     rw   rcp:
             -             -   network     rw   http:
             -             -   network     rw   ftp:
             -             -   network     rw   scp:
             -             -   network     rw   https:
             -             -    opaque     ro   cns:

Switch#show disk0: filesys
    Filesystem: disk0
    Filesystem Path: /vol/disk0
    Filesystem Type: ext4
    Mounted: Read/Write

Switch#show inventory
NAME: "Power Supply Module 1", DESCR: "Cisco Catalyst 9500 Series 650W AC Power Supply"
```

```
PID: C9K-PWR-650WAC-R , VID: V00 , SN: DCI2136201N
NAME: "Fan Tray 0", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY , VID: , SN:
NAME: "Fan Tray 1", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY , VID: , SN:
NAME: "Slot 1 Supervisor", DESCR: "Cisco Catalyst 9500 Series Router"
PID: C9500-32QC , VID: V00 , SN: CAT2148L16K
NAME: "SATA disk", DESCR: "disk0 Drive"
PID: C9K-F1-SSD-960G , VID: V00 , SN: CAT2148L0D2
```

Feature History and Information for M2 SATA Module

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Feature Name	Release	Feature Information
M2 SATA Module	Cisco IOS XE Fuji 16.9.1	The M2 SATA card addresses the storage needs of a device. It a a small form factor card and connector. For more information refer the *Hardware Installion Guide* for the device. Support for this feature was introduced on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.