



Configuring Ethernet Interfaces

This module describes the configuration of Ethernet interfaces on the Cisco NCS 6000 Series Routers.

The distributed Gigabit Ethernet, 10-Gigabit Ethernet, and Fast Ethernet architecture and features deliver network scalability and performance, while enabling service providers to offer high-density, high-bandwidth networking solutions designed to interconnect the router with other systems in POPs, including core and edge routers and Layer 2 switches.

Feature History for Configuring Ethernet Interfaces

Release	Modification
Release 5.0.0	This feature was introduced.
Release 5.0.1	Support for Source MAC accounting was included.
Release 5.2.1	Support for Link Layer Discovery Protocol (LLDP) was included.

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Prerequisites for Configuring Ethernet Interfaces

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Before configuring Ethernet interfaces, ensure that these tasks and conditions are met:

- Know the interface IP address.
- You know how to apply the specify the generalized interface name with the generalized notation *rack/slot/module/port* .

Information About Configuring Ethernet

Ethernet is defined by the IEEE 802.3 international standard. It enables the connection of up to 1024 nodes over coaxial, twisted-pair, or fiber-optic cable.

The Cisco NCS 6000 Series Router supports 10-Gigabit Ethernet (10 Gbps), and 100-Gigabit Ethernet (100 Gbps) interfaces.

Default Configuration Values for Gigabit Ethernet and 10-Gigabit Ethernet

This table describes the default interface configuration parameters that are present when an interface is enabled on a 10-Gigabit Ethernet modular services card and its associated PLIM.



Note You must use the **shutdown** command to bring an interface administratively down. The interface default is **no shutdown**. When a modular services card is first inserted into the router, if there is no established preconfiguration for it, the configuration manager adds a shutdown item to its configuration. This shutdown can be removed only by entering the **no shutdown** command.

Table 1: Gigabit Ethernet and 10-Gigabit Ethernet Modular Services Card Default Configuration Values

Parameter	Configuration File Entry	Default Value
MAC accounting	mac-accounting	off
Flow control	flow-control	egress off ingress off
MTU	mtu	<ul style="list-style-type: none"> • 1514 bytes for normal frames • 1518 bytes for 802.1Q tagged frames. • 1522 bytes for Q-in-Q frames.
MAC address	mac address	Hardware burned-in address (BIA)

Default Configuration Values for Fast Ethernet

This table describes the default interface configuration parameters that are present when an interface is enabled on the Fast Ethernet SPA card and its associated PLIM.



Note You must specifically configure the **shutdown** command to bring an interface administratively down. The interface default is **no shutdown**. When a modular services card is first inserted into the router, if there is no established preconfiguration for it, the configuration manager adds a shutdown item to its configuration. This shutdown can be removed only by entering the **no shutdown** command.

Table 2: Fast Ethernet Default Configuration Values

Parameter	Configuration File Entry	Default Value
MAC accounting	mac-accounting	off
Duplex operation	duplex full duplex half	Auto-negotiates duplex operation
MTU	mtu	1500 bytes
Interface speed	speed	100 Mbps
Auto-negotiation	negotiation auto	disable

Layer 2 VPN on Ethernet Interfaces

Layer 2 Virtual Private Network (L2VPN) connections emulate the behavior of a LAN across an L2 switched, IP or MPLS-enabled IP network, allowing Ethernet devices to communicate with each other as if they were connected to a common LAN segment.

Traffic from the customer travels over this link to the edge of the SP core network. The traffic then tunnels through an L2VPN over the SP core network to another edge router. The edge router sends the traffic down another attachment circuit (AC) to the customer's remote site.

The L2VPN feature enables users to implement different types of end-to-end services.

Cisco IOS XR software supports a point-to-point end-to-end service, where two Ethernet circuits are connected together. An L2VPN Ethernet port can operate in one of two modes:

- **Port Mode**—In this mode, all packets reaching the port are sent over the PW (pseudowire), regardless of any VLAN tags that are present on the packets. In VLAN mode, the configuration is performed under the `l2transport` configuration mode.
- **VLAN Mode**—Each VLAN on a CE (customer edge) or access network to PE (provider edge) link can be configured as a separate L2VPN connection (using either VC type 4 or VC type 5). In VLAN mode, the configuration is performed under the individual subinterface.

Switching can take place in three ways:

- **AC-to-PW**—Traffic reaching the PE is tunneled over a PW (and conversely, traffic arriving over the PW is sent out over the AC). This is the most common scenario.
- **Local switching**—Traffic arriving on one AC is immediately sent out of another AC without passing through a pseudowire.
- **PW stitching**—Traffic arriving on a PW is not sent to an AC, but is sent back into the core over another PW.

Keep the following in mind when configuring L2VPN on an Ethernet interface:

- L2VPN links support QoS (Quality of Service) and MTU (maximum transmission unit) configuration.
- If your network requires that packets are transported transparently, you may need to modify the packet's destination MAC (Media Access Control) address at the edge of the Service Provider (SP) network. This prevents the packet from being consumed by the devices in the network.

Use the **show interfaces** command to display AC and PW information.

To attach Layer 2 service policies, such as QoS, to the Ethernet interface, refer to the appropriate Cisco IOS XR software configuration guide.

Gigabit Ethernet Protocol Standards Overview

The Gigabit Ethernet interfaces support the following protocol standards:

These standards are further described in the sections that follow.

IEEE 802.3 Physical Ethernet Infrastructure

The IEEE 802.3 protocol standards define the physical layer and MAC sublayer of the data link layer of wired Ethernet. IEEE 802.3 uses Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access at a variety of speeds over a variety of physical media. The IEEE 802.3 standard covers 10 Mbps Ethernet. Extensions to the IEEE 802.3 standard specify implementations for 10-Gigabit Ethernet, and Fast Ethernet.

IEEE 802.3ab 1000BASE-T Gigabit Ethernet

The IEEE 802.3ab protocol standards, or Gigabit Ethernet over copper (also known as 1000BaseT) is an extension of the existing Fast Ethernet standard. It specifies Gigabit Ethernet operation over the Category 5e/6 cabling systems already installed, making it a highly cost-effective solution. As a result, most copper-based environments that run Fast Ethernet can also run Gigabit Ethernet over the existing network infrastructure to dramatically boost network performance for demanding applications.

IEEE 802.3z 1000 Mbps Gigabit Ethernet

Gigabit Ethernet builds on top of the Ethernet protocol, but increases speed tenfold over Fast Ethernet to 1000 Mbps, or 1 Gbps. Gigabit Ethernet allows Ethernet to scale from 10 or 100 Mbps at the desktop to 100 Mbps up to 1000 Mbps in the data center. Gigabit Ethernet conforms to the IEEE 802.3z protocol standard.

By leveraging the current Ethernet standard and the installed base of Ethernet and Fast Ethernet switches and routers, network managers do not need to retrain and relearn a new technology in order to provide support for Gigabit Ethernet.

IEEE 802.3ae 10 Gbps Ethernet

Under the International Standards Organization's Open Systems Interconnection (OSI) model, Ethernet is fundamentally a Layer 2 protocol. 10-Gigabit Ethernet uses the IEEE 802.3 Ethernet MAC protocol, the IEEE 802.3 Ethernet frame format, and the minimum and maximum IEEE 802.3 frame size. 10 Gbps Ethernet conforms to the IEEE 802.3ae protocol standards.

Just as 1000BASE-X and 1000BASE-T (Gigabit Ethernet) remained true to the Ethernet model, 10-Gigabit Ethernet continues the natural evolution of Ethernet in speed and distance. Because it is a full-duplex only and fiber-only technology, it does not need the carrier-sensing multiple-access with the CSMA/CD protocol that defines slower, half-duplex Ethernet technologies. In every other respect, 10-Gigabit Ethernet remains true to the original Ethernet model.

IEEE 802.3ba 100 Gbps Ethernet

IEEE 802.3ba is supported on the Cisco 1-Port 100-Gigabit Ethernet PLIM.

MAC Address

A MAC address is a unique 6-byte address that identifies the interface at Layer 2.

MAC Accounting

The MAC address accounting feature provides accounting information for IP traffic based on the source and destination MAC addresses on LAN interfaces. This feature calculates the total packet and byte counts for a LAN interface that receives or sends IP packets to or from a unique MAC address. It also records a time stamp for the last packet received or sent.

These statistics are used for traffic monitoring, debugging and billing. For example, with this feature you can determine the volume of traffic that is being sent to and/or received from various peers at NAPS/peering points. This feature is currently supported on Ethernet, FastEthernet, and bundle interfaces and supports Cisco Express Forwarding (CEF), distributed CEF (dCEF), flow, and optimum switching.



Note A maximum of 512 MAC addresses per trunk interface are supported for MAC address accounting.

Ethernet MTU

The Ethernet maximum transmission unit (MTU) is the size of the largest frame, minus the 4-byte frame check sequence (FCS), that can be transmitted on the Ethernet network. Every physical network along the destination of a packet can have a different MTU.

Cisco IOS XR software supports two types of frame forwarding processes:

- Fragmentation for IPV4 packets—In this process, IPV4 packets are fragmented as necessary to fit within the MTU of the next-hop physical network.



Note IPv6 does not support fragmentation.

- MTU discovery process determines largest packet size—This process is available for all IPV6 devices, and for originating IPV4 devices. In this process, the originating IP device determines the size of the largest IPV6 or IPV4 packet that can be sent without being fragmented. The largest packet is equal to the smallest MTU of any network between the IP source and the IP destination devices. If a packet is larger than the smallest MTU of all the networks in its path, that packet will be fragmented as necessary. This process ensures that the originating device does not send an IP packet that is too large.

Jumbo frame support is automatically enable for frames that exceed the standard frame size. The default value is 1514 for standard frames and 1518 for 802.1Q tagged frames. These numbers exclude the 4-byte frame check sequence (FCS).

Flow Control on Ethernet Interfaces

The flow control used on 10-Gigabit Ethernet interfaces consists of periodically sending flow control pause frames. It is fundamentally different from the usual full- and half-duplex flow control used on standard

management interfaces. Flow control can be activated or deactivated for ingress traffic only. It is automatically implemented for egress traffic.

802.1Q VLAN

A VLAN is a group of devices on one or more LANs that are configured so that they can communicate as if they were attached to the same wire, when in fact they are located on a number of different LAN segments. Because VLANs are based on logical instead of physical connections, it is very flexible for user and host management, bandwidth allocation, and resource optimization.

The IEEE's 802.1Q protocol standard addresses the problem of breaking large networks into smaller parts so broadcast and multicast traffic does not consume more bandwidth than necessary. The standard also helps provide a higher level of security between segments of internal networks.

The 802.1Q specification establishes a standard method for inserting VLAN membership information into Ethernet frames.

VRRP

The Virtual Router Redundancy Protocol (VRRP) eliminates the single point of failure inherent in the static default routed environment. VRRP specifies an election protocol that dynamically assigns responsibility for a virtual router to one of the VPN concentrators on a LAN. The VRRP VPN concentrator controlling the IP addresses associated with a virtual router is termed as the primary concentrator, and forwards packets sent to those IP addresses. When the primary concentrator becomes unavailable, a backup VPN concentrator takes over.

For more information on VRRP, see the *Implementing VRRP* module of *IP Addresses and Services Configuration Guide*.

HSRP

Hot Standby Routing Protocol (HSRP) is a proprietary protocol from Cisco. HSRP is a routing protocol that provides backup to a router in the event of failure. Several routers are connected to the same segment of an Ethernet, FDDI, or token-ring network and work together to present the appearance of a single virtual router on the LAN. The routers share the same IP and MAC addresses and therefore, in the event of failure of one router, the hosts on the LAN are able to continue forwarding packets to a consistent IP and MAC address. The transfer of routing responsibilities from one device to another is transparent to the user.

HSRP is designed to support non disruptive switchover of IP traffic in certain circumstances and to allow hosts to appear to use a single router and to maintain connectivity even if the actual first hop router they are using fails. In other words, HSRP protects against the failure of the first hop router when the source host cannot learn the IP address of the first hop router dynamically. Multiple routers participate in HSRP and in concert create the illusion of a single virtual router. HSRP ensures that one and only one of the routers is forwarding packets on behalf of the virtual router. End hosts forward their packets to the virtual router.

The router forwarding packets is known as the *active router*. A standby router is selected to replace the active router should it fail. HSRP provides a mechanism for determining active and standby routers, using the IP addresses on the participating routers. If an active router fails a standby router can take over without a major interruption in the host's connectivity.

HSRP runs on top of User Datagram Protocol (UDP), and uses port number 1985. Routers use their actual IP address as the source address for protocol packets, not the virtual IP address, so that the HSRP routers can identify each other.

For more information on HSRP, see the *Implementing HSRP* module of *IP Addresses and Services Configuration Guide*.

Duplex Mode on Fast Ethernet Interfaces

Fast Ethernet ports support the duplex transmission type. Full-duplex mode enables the simultaneous data transmission between a sending station and a receiving station, while half-duplex mode enables data transmission in only one direction at a time.

When configuring duplex mode on a Fast Ethernet interface, keep the following in mind:

- If auto-negotiation is enabled on the interface, the default is duplex negotiated.
- If auto-negotiation is disabled on the interface, the default is full-duplex.



Note You can configure duplex mode on Fast Ethernet interfaces only. Gigabit Ethernet and 10-Gigabit Ethernet interfaces always run in full-duplex mode.

Fast Ethernet Interface Speed

You can configure the interface speed on Fast Ethernet interfaces. Keep the following in mind when configuring the speed for a Fast Ethernet interface:

- If auto-negotiation is enabled on an interface, the default is speed negotiated.
- If auto-negotiation is disabled on an interface, the default speed is the maximum speed allowed on the interface.



Note Both ends of a link must have the same interface speed. A manually configured interface speed overrides any auto-negotiated speed, which can prevent a link from coming up if the configured interface speed at one end of a link is different from the interface speed on the other end.

Link Autonegotiation on Ethernet Interfaces

Link autonegotiation ensures that devices that share a link segment are automatically configured with the highest performance mode of interoperation. Use the **negotiation auto** command in interface configuration mode to enable link autonegotiation on an Ethernet interface. On line card Ethernet interfaces, link autonegotiation is disabled by default.



Note The **negotiation auto** command is available on Gigabit Ethernet and Fast Ethernet interfaces only.

This table describes the performance of the system for different combinations of the duplex and speed modes. The specified **duplex** command configured with the specified **speed** command produces the resulting system action, provided that you have configured autonegotiation on the interface.

Table 3: Relationship Between duplex and speed Commands

duplex Command	speed Command	Resulting System Action
no duplex	no speed	Auto-negotiates both speed and duplex modes.
no duplex	speed 1000	Auto-negotiates for duplex mode and forces 1000 Mbps.
no duplex	speed 100	Auto-negotiates for duplex mode and forces 100 Mbps.
no duplex	speed 10	Auto-negotiates for duplex mode and forces 10 Mbps.
full-duplex	no speed	Forces full duplex and auto-negotiates for speed.
full-duplex	speed 1000	Forces full duplex and 1000 Mbps.
full-duplex	speed 100	Forces full duplex and 100 Mbps.
full-duplex	speed 10	Forces full duplex and 10 Mbps.
half-duplex	no speed	Forces half duplex and auto-negotiates for speed.
half-duplex	speed 1000	Forces half duplex and 1000 Mbps.
half-duplex	speed 100	Forces half duplex and 100 Mbps.
half-duplex	speed 10	Forces half duplex and 10 Mbps.

Link Layer Discovery Protocol (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, and switches). CDP allows network management applications to automatically discover, and acquire knowledge about, other Cisco devices connected to the network.

To support non-Cisco devices, and to allow for interoperability between other devices, the Cisco NCS 6000 Series Router also supports the IEEE 802.1AB Link Layer Discovery Protocol (LLDP).

LLDP is a neighbor discovery protocol that is used by network devices to advertise information about themselves, to other devices on the network. This protocol runs over the Data Link Layer, which permits two systems, running different network layer protocols, to learn about each other.

LLDP supports a set of attributes that it uses to learn information about neighbor devices. These attributes have a defined format that is known as a Type-Length-Value (TLV). LLDP supported devices can use TLVs to receive and send information to their neighbors. Details such as configuration information, device capabilities, and device identities can be advertised using this protocol.

In addition to mandatory TLVs (Chassis ID, Port ID, and Time-to-Live), the router also supports these basic management TLVs that are optional:

- Port Description

- System Name
- System Description
- System Capabilities
- Management Address

These optional TLVs are automatically sent to the neighboring devices when LLDP is active, but you can choose to disable them, using the **lldp tlv-select disable** command.

LLDP Frame Format

LLDP frames use the IEEE 802.3 format, which consists of these fields:

- Destination address (6 bytes)—Uses a multicast address of 01-80-C2-00-00-0E.
- Source address (6 bytes)—MAC address of the sending device or port.
- LLDP Ethertype (2 bytes)—Uses 88-CC.
- LLDP PDU (1500 bytes)—LLDP payload consisting of TLVs.
- FCS (4 bytes)—Cyclic Redundancy Check (CRC) for error checking.

LLDP TLV Format

LLDP TLVs carry the information about neighboring devices within the LLDP PDU using these basic formats:

- TLV Header (16 bits), which includes these fields:
 - TLV Type (7 bits)
 - TLV Information String Length (9 bits)
- TLV Information String (0 to 511 bytes)

LLDP Operation

LLDP is a one-way protocol. The basic operation of LLDP consists of a sending device, which is enabled for transmitting LLDP information, and which sends periodic advertisements of information in LLDP frames to a receiving device.

Devices are identified using a combination of Chassis ID and Port ID TLVs to create an MSAP (MAC Service Access Point). The receiving device saves the information about a neighbor for a certain amount of time specified in the TTL TLV, before aging and removing the information.

LLDP supports these additional operational characteristics:

- LLDP operates independently in transmit or receive modes.
- LLDP operates as a slow protocol using only untagged frames, with transmission speeds of less than 5 frames per second.
- LLDP packets are sent when these events occur:
 - The packet update frequency, specified by the **lldp timer** command, is reached. The default is 30.
 - A change in the values of the managed objects occurs from the local system's LLDP MIB.
 - LLDP is activated on an interface (3 frames are sent upon activation similar to CDP).
- When an LLDP frame is received, the LLDP remote services and PTOPO MIBs are updated with the information in the TLVs.

LLDP supports these actions on these TLV characteristics:

- Interprets a TTL value of 0 as a request to automatically purge the information about the transmitting device. These shutdown LLDPDUs are typically sent prior to a port becoming inoperable.
- An LLDP frame with a malformed mandatory TLV is dropped.
- A TLV with an invalid value is ignored.
- If the TTL is non-zero, copy of an unknown organizationally-specific TLV is maintained, for later access through network management.

Supported LLDP Functions

The Cisco NCS 6000 Series Router supports these LLDP functions:

- IPv4 and IPv6 management addresses—In general, both IPv4 and IPv6 addresses are advertised if they are available, and preference is given to the address that is configured on the transmitting interface.
 - If the transmitting interface does not have a configured address, then the TLV is populated with an address from another interface. The advertised LLDP IP address is implemented according to this priority order of IP addresses for interfaces on the Cisco NCS 6000 Series Router Locally configured address
 - MgmtEth0/RP0/CPU0/0
 - MgmtEth0/RP0/CPU0/1
 - MgmtEth0/RP1/CPU0/0
 - MgmtEth0/RP1/CPU0/1
 - Loopback address

There are certain differences between IPv4 and IPv6 address management in LLDP:

- For IPv4, as long as the IPv4 address is configured on an interface, it can be used as an LLDP management address.
- For IPv6, after the IPv6 address is configured on an interface, the interface status must be Up and pass the Duplicate Address Detection(DAD) process before it is can be used as an LLDP management address.
- LLDP is supported for the nearest physically attached, non-tunneled neighbors.
- Port ID TLVs are supported for Ethernet interfaces, subinterfaces, bundle interfaces, and bundle subinterfaces.

Unsupported LLDP Functions

- These LLDP functions are not supported: LLDP-MED organizationally unique extension—Interoperability, however, still exists between other devices that do support this extension.
- Tunneled neighbors, or neighbors more than one hop away.
- LLDP TLVs cannot be disabled on a per-interface basis; Certain optional TLVs, however, can be disabled globally.

Carrier Delay on Ethernet Interfaces

When enabled on an Ethernet interface, the Carrier Delay feature slows the response of the system to line-up or line-down events. You can configure both Carrier Delay up and Carrier Delay down on an interface at the same time.

Carrier Delay up suppresses short line flaps where the line is down, then comes up, then goes down again. A line that was previously down must be up longer than the duration specified for the **carrier-delay up** command

before the system is informed that the interface has come up. All flaps that are shorter than the duration specified for the **carrier-delay up** command are suppressed.

Configuring Carrier Delay up helps to ensure that a line is reasonably stable before the system is informed that the interface is up and ready to forward traffic.

Carrier Delay down suppresses short line flaps where the line is up, then goes down, then comes up again. A line that was previously up must be down longer than the duration specified for the **carrier-delay down** command before the system is informed that the interface has gone down. All flaps that are shorter than the value specified for the **carrier-delay down** command are suppressed.

Configuring Carrier Delay down can be beneficial in suppressing very short link flaps, thereby preventing interface flaps. Alternatively, configuring this feature can be beneficial in allowing other line protection equipment to have enough time to intervene.

How to Configure Ethernet

This section provides the following configuration procedures:

Configuring Ethernet Interfaces

This section provides the following configuration procedures:

Configuring Gigabit Ethernet Interfaces

Use the following procedure to create a basic Gigabit Ethernet, 10-Gigabit Ethernet, or 100-Gigabit Ethernet interface configuration.

SUMMARY STEPS

1. **show version**
2. **show interfaces** [**TenGigE**] *interface-path-id*
3. **configure**
4. **interface** [**GigabitEthernet** | **TenGigE**] *interface-path-id*
5. **ipv4 address** *ip-address mask*
6. **flow-control** { **bidirectional** | **egress** | **ingress** }
7. **mtu** *bytes*
8. **mac-address** *value1.value2.value3*
9. **negotiation auto**
10. **no shutdown**
11. Do one of the following:
 - **end**
 -
 - **commit**
12. **show interfaces** [**TenGigE**] *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	show version Example: RP/0/RP0/CPU0:router# show version	(Optional) Displays the current software version, and can also be used to confirm that the router recognizes the modular services card.
Step 2	show interfaces [TenGigE] interface-path-id Example: RP/0/RP0/CPU0:router# show TenGigE 0/1/0/0	(Optional) Displays the configured interface and checks the status of each interface port. Possible interface types for this procedure are: <ul style="list-style-type: none"> • HundredGigE • TenGigE
Step 3	configure Example: RP/0/RP0/CPU0:router# configure terminal	Enters XR configuration mode.
Step 4	interface [GigabitEthernet TenGigE] interface-path-id Example: RP/0/RP0/CPU0:router(config)# interfaceTenGigE 0/1/0/0	Enters interface configuration mode and specifies the Ethernet interface name and notation <i>rack/slot/module/port</i> . Possible interface types for this procedure are: <ul style="list-style-type: none"> • HundredGigE • TenGigE <p>Note The example indicates an 8-port 10-Gigabit Ethernet interface in modular services card slot 1.</p>
Step 5	ipv4 address ip-address mask Example: RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.189.38 255.255.255.224	Assigns an IP address and subnet mask to the interface. <ul style="list-style-type: none"> • Replace <i>ip-address</i> with the primary IPv4 address for the interface. • Replace <i>mask</i> with the mask for the associated IP subnet. The network mask can be specified in either of two ways: <ul style="list-style-type: none"> • The network mask can be a four-part dotted decimal address. For example, 255.0.0.0 indicates that each bit equal to 1 means that the corresponding address bit belongs to the network address. • The network mask can be indicated as a slash (/) and number. For example, /8 indicates that the first 8 bits of the mask are ones, and the corresponding bits of the address are network address.

	Command or Action	Purpose
Step 6	<p>flow-control {bidirectional egress ingress}</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# flow control ingress</pre>	<p>(Optional) Enables the sending and processing of flow control pause frames.</p> <ul style="list-style-type: none"> • egress—Enables the sending of flow control pause frames in egress. • ingress—Enables the processing of received pause frames on ingress. • bidirectional—Enables the sending of flow control pause frames in egress and the processing of received pause frames on ingress.
Step 7	<p>mtu bytes</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# mtu 1448</pre>	<p>(Optional) Sets the MTU value for the interface.</p> <ul style="list-style-type: none"> • The default is 1514 bytes for normal frames and 1518 bytes for 802.1Q tagged frames. • The range for Gigabit Ethernet and 10-Gigabit Ethernet mtu values is 64 bytes to 65535 bytes.
Step 8	<p>mac-address value1.value2.value3</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# mac address 0001.2468.ABCD</pre>	<p>(Optional) Sets the MAC layer address of the Management Ethernet interface.</p> <ul style="list-style-type: none"> • The values are the high, middle, and low 2 bytes, respectively, of the MAC address in hexadecimal. The range of each 2-byte value is 0 to ffff.
Step 9	<p>negotiation auto</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# negotiation auto</pre>	<p>(Optional) Enables autonegotiation on a Gigabit Ethernet interface.</p> <ul style="list-style-type: none"> • Autonegotiation must be explicitly enabled on both ends of the connection, or speed and duplex settings must be configured manually on both ends of the connection. • If autonegotiation is enabled, any speed or duplex settings that you configure manually take precedence. <p>Note The negotiation auto command is available on Gigabit Ethernet interfaces only.</p>
Step 10	<p>no shutdown</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# no shutdown</pre>	<p>Removes the shutdown configuration, which forces an interface administratively down.</p>
Step 11	<p>Do one of the following:</p> <ul style="list-style-type: none"> • end • • commit <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# end</pre>	<p>Saves configuration changes.</p> <ul style="list-style-type: none"> • When you issue the end command, the system prompts you to commit changes: <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre>

	Command or Action	Purpose
	<p>Example:</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# commit</pre>	<ul style="list-style-type: none"> • Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to XR EXEC mode. • Entering no exits the configuration session and returns the router to XR EXEC mode without committing the configuration changes. • Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.
Step 12	<p>show interfaces [TenGigE] interface-path-id</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# show interfaces TenGigE 0/3/0/0</pre>	(Optional) Displays statistics for interfaces on the router.

What to Do Next

- To configure MAC Accounting on the Ethernet interface, see the [Configuring MAC Accounting on an Ethernet Interface, on page 14](#) section later in this module.
- To configure an AC on the Ethernet port for Layer 2 VPN implementation, see the [Configuring a L2VPN Ethernet Port, on page 16](#) section later in this module.
- To attach Layer 3 service policies, such as Multiprotocol Label Switching (MPLS) or Quality of Service (QoS), to the Ethernet interface, refer to the appropriate Cisco IOS XR software configuration guide.

What to Do Next

- To attach Layer 3 service policies, such as Multiprotocol Label Switching (MPLS) or Quality of Service (QoS), to the Ethernet interface, refer to the appropriate configuration guide.

Configuring MAC Accounting on an Ethernet Interface

This task explains how to configure MAC accounting on an Ethernet interface. MAC accounting has special show commands, which are illustrated in this procedure. Otherwise, the configuration is the same as configuring a basic Ethernet interface, and the steps can be combined in one configuration session. See “[Configuring Gigabit Ethernet Interfaces, on page 11](#)” in this module for information about configuring the other common parameters for Ethernet interfaces.

SUMMARY STEPS

1. **configure**
2. **interface [TenGigE | fastethernet] interface-path-id**
3. **ipv4 address ip-address mask**

4. **mac-accounting** {egress | ingress}
5. Do one of the following:
 - end
 -
 - commit
6. **show mac-accounting type location instance**

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>configure</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# configure</pre>	Enters XR configuration mode.
Step 2	<p>interface [TenGigE fastethernet] <i>interface-path-id</i></p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config)# interface TenGigE 0/1/0/0</pre>	<p>Physical interface or virtual interface.</p> <p>Note Use the show interfaces command to see a list of all interfaces currently configured on the router.</p> <p>For more information about the syntax for the router, use the question mark (?) online help function.</p>
Step 3	<p>ipv4 address <i>ip-address mask</i></p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.189.38 255.255.255.224</pre>	<p>Assigns an IP address and subnet mask to the interface.</p> <ul style="list-style-type: none"> • Replace <i>ip-address</i> with the primary IPv4 address for the interface. • Replace <i>mask</i> with the mask for the associated IP subnet. The network mask can be specified in either of two ways: <ul style="list-style-type: none"> • The network mask can be a four-part dotted decimal address. For example, 255.0.0.0 indicates that each bit equal to 1 means that the corresponding address bit belongs to the network address. • The network mask can be indicated as a slash (/) and number. For example, /8 indicates that the first 8 bits of the mask are ones, and the corresponding bits of the address are network address.
Step 4	<p>mac-accounting {egress ingress}</p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# mac-accounting egress</pre>	<p>Generates accounting information for IP traffic based on the source and destination MAC addresses on LAN interfaces.</p> <ul style="list-style-type: none"> • To disable MAC accounting, use the no form of this command.
Step 5	Do one of the following:	Saves configuration changes.

	Command or Action	Purpose
	<ul style="list-style-type: none"> • end • • commit <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# end</pre> <p>Example:</p> <pre>RP/0/RP0/CPU0:router(config-if)# commit</pre>	<ul style="list-style-type: none"> • When you issue the end command, the system prompts you to commit changes: <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> • Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to XR EXEC mode. • Entering no exits the configuration session and returns the router to XR EXEC mode without committing the configuration changes. • Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. <ul style="list-style-type: none"> • Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.
Step 6	<p>show mac-accounting <i>type location instance</i></p> <p>Example:</p> <pre>RP/0/RP0/CPU0:router# show mac-accounting TenGigE location 0/2/0/4</pre>	Displays MAC accounting statistics for an interface.

Configuring a L2VPN Ethernet Port

Use the following procedure to configure an L2VPN Ethernet port.



Note The steps in this procedure configure the L2VPN Ethernet port to operate in port mode.

SUMMARY STEPS

1. **configure**
2. **interface** [**TenGigE**] *interface-path-id*
3. **l2transport**
4. **l2protocol** {**cdp** | **pvst** | **stp** | **vtp**} {[**forward** | **tunnel**][**experimental bits**]|**drop**}
5. Do one of the following:
 - **end**
 - **or**
 - **commit**
 - **or**
6. **show interfaces** [**TenGigE**] *interface-path-id*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: <pre>RP/0/RP0/CPU0:router# configure</pre>	Enters XR configuration mode.
Step 2	interface [TenGigE] interface-path-id Example: <pre>RP/0/RP0/CPU0:router(config)# interfaceTenGigE 0/1/0/0</pre>	Enters interface configuration mode and specifies the Ethernet interface name and notation <i>rack/slot/module/port</i> . Possible interface types for this procedure are: <ul style="list-style-type: none"> • TenGigE
Step 3	l2transport Example: <pre>RP/0/RP0/CPU0:router(config-if)# l2transport</pre>	Enables Layer 2 transport mode on a port and enter Layer 2 transport configuration mode.
Step 4	l2protocol {cdp pvst stp vtp} {[forward tunnel][experimental bits][drop]} Example: <pre>RP/0/RP0/CPU0:router(config-if-12)# l2protocol stp tunnel</pre> Example:	Configures Layer 2 protocol tunneling and protocol data unit (PDU) filtering on an interface. Possible protocols and options are: <ul style="list-style-type: none"> • cdp—Cisco Discovery Protocol (CDP) tunneling and data unit parameters. • pvst—Configures VLAN spanning tree protocol tunneling and data unit parameters. • stp—spanning tree protocol tunneling and data unit parameters. • vtp—VLAN trunk protocol tunneling and data unit parameters. • tunnel—(Optional) Tunnels the packets associated with the specified protocol. • experimental bits—(Optional) Modifies the MPLS experimental bits for the specified protocol. • drop—(Optional) Drop packets associated with the specified protocol.
Step 5	Do one of the following: <ul style="list-style-type: none"> • end • or • commit • or Example: <pre>RP/0/RP0/CPU0:router(config-if-12)# end</pre> Example:	Saves configuration changes. <ul style="list-style-type: none"> • When you issue the end command, the system prompts you to commit changes: <pre>Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> • Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to XR EXEC mode.

	Command or Action	Purpose
	RP/0/RP0/CPU0:router(config-if-12) # commit	<ul style="list-style-type: none"> • Entering no exits the configuration session and returns the router to XR EXEC mode without committing the configuration changes. • Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.
Step 6	show interfaces [TenGigE] interface-path-id Example: RP/0/RP0/CPU0:router# show interfaces TenGigE 0/3/0/0	(Optional) Displays statistics for interfaces on the router.

What to Do Next

To attach Layer 2 service policies, such as quality of service (QoS), to the Ethernet interface, refer to the appropriate Cisco IOS XR software configuration guide.

Configuring LLDP

This section includes these configuration topics for LLDP:

LLDP Default Configuration

This table shows values of the LLDP default configuration. To change the default settings, use the LLDP global configuration and LLDP interface configuration commands.

Table 4: LLDP Default Configuration

LLDP Function	Default
LLDP global state	Disabled
LLDP holdtime (before discarding), in seconds	120
LLDP timer (packet update frequency), in seconds	30
LLDP reinitialization delay, in seconds	2
LLDP TLV selection	All TLVs are enabled for sending and receiving.
LLDP interface state	Enabled for both transmit and receive operations when LLDP is globally enabled.

Enabling LLDP Globally

To run LLDP on the router, you must enable it globally. When you enable LLDP globally, all interfaces that support LLDP are automatically enabled for both transmit and receive operations.

You can override this default operation at the interface to disable receive or transmit operations. For more information about how to selectively disable LLDP receive or transmit operations for an interface, see the [Disabling LLDP Receive and Transmit Operations for an Interface, on page 19](#).

To enable LLDP globally, complete these steps:

Configuring Global LLDP Operational Characteristics

The [LLDP Default Configuration, on page 18](#) section describes the default operational characteristics for LLDP. When you enable LLDP globally on the router using the **lldp** command, these defaults are used for the protocol.

To modify the global LLDP operational characteristics such as the LLDP neighbor information holdtime, initialization delay, or packet rate, complete these steps:

Disabling Transmission of Optional LLDP TLVs

Certain TLVs are classified as mandatory in LLDP packets, such as the Chassis ID, Port ID, and Time to Live (TTL) TLVs. These TLVs must be present in every LLDP packet. You can suppress transmission of certain other optional TLVs in LLDP packets.

To disable transmission of optional LLDP TLVs, complete these steps:

Disabling LLDP Receive and Transmit Operations for an Interface

When you enable LLDP globally on the router, all supported interfaces are automatically enabled for LLDP receive and transmit operations. You can override this default by disabling these operations for a particular interface.

To disable LLDP receive and transmit operations for an interface, complete these steps:

SUMMARY STEPS

1. **configure**
2. **interface GigabitEthernet 0/2/0/0**
3. **lldp**
4. **receive disable**
5. **transmit disable**
6. Do one of the following:
 - **end**
 - **or**
 - **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RP0/CPU0:router# configure	Enters global configuration mode.
Step 2	interface GigabitEthernet 0/2/0/0 Example: RP/0/RP0/CPU0:router (config)# interface GigabitEthernet 0/2/0/0	Enters interface configuration mode and specifies the Ethernet interface name and notation <i>rack/slot/module/port</i> . Possible interface types for this procedure are: <ul style="list-style-type: none"> • GigabitEthernet • TenGigE
Step 3	lldp Example: RP/0/RP0/CPU0:router (config-if)# lldp	(Optional) Enters LLDP configuration mode for the specified interface.
Step 4	receive disable Example: RP/0/RP0/CPU0:router (config-lldp)# receive disable	(Optional) Disables LLDP receive operations on the interface.
Step 5	transmit disable Example: RP/0/RP0/CPU0:router (config-lldp)# transmit disable	(Optional) Disables LLDP transmit operations on the interface.
Step 6	Do one of the following: <ul style="list-style-type: none"> • end • or • commit Example: RP/0/RP0/CPU0:router (config)# end Example: RP/0/RP0/CPU0:router (config)# commit	Saves configuration changes. <ul style="list-style-type: none"> • When you issue the end command, the system prompts you to commit changes: <pre>Uncommitted changes found, commit them before exiting (yes/no/cancel)? [cancel]:</pre> <ul style="list-style-type: none"> • Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. • Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes. • Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes.

	Command or Action	Purpose
		<ul style="list-style-type: none"> Use the commit command to save the configuration changes to the running configuration file, and remain within the configuration session.

Verifying the LLDP Configuration

This section describes how to verify the LLDP configuration both globally, and for a particular interface.

Verifying the LLDP Global Configuration

To verify the LLDP global configuration status and operational characteristics, use the **show lldp** command as shown in this example:

```
RP/0/RP0/CPU0:router# show lldp
Wed Apr 13 06:16:45.510 DST
Global LLDP information:
  Status: ACTIVE
  LLDP advertisements are sent every 30 seconds
  LLDP hold time advertised is 120 seconds
  LLDP interface reinitialisation delay is 2 seconds
```

If LLDP is not enabled globally, this output appears when you run the **show lldp** command:

```
RP/0/RP0/CPU0:router# show lldp
Wed Apr 13 06:42:48.221 DST
% LLDP is not enabled
```

Verifying the LLDP Interface Configuration

To verify the LLDP interface status and configuration, use the **show lldp interface** command as shown in this example:

```
RP/0/RP0/CPU0:router# show lldp interface GigabitEthernet 0/1/0/7
Wed Apr 13 13:22:30.501 DST
GigabitEthernet0/1/0/7:
  Tx: enabled
  Rx: enabled
  Tx state: IDLE
  Rx state: WAIT FOR FRAME
```

What To Do Next

To monitor and maintain LLDP on the system or get information about LLDP neighbors, use one of these commands:

Command	Description
clear lldp	Resets LLDP traffic counters or LLDP neighbor information
show lldp entry	Displays detailed information about LLDP neighbors
show lldp errors	Displays LLDP error and overflow statistics
show lldp neighbors	Displays information about LLDP neighbors

Command	Description
<code>show lldp traffic</code>	Displays statistics for LLDP traffic

Configuration Examples for Ethernet

This section provides the following configuration examples:

Configuring an Ethernet Interface: Example

This example shows how to configure an interface for a 10-Gigabit Ethernet modular services card:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface TenGigE 0/0/0/1
RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.189.38 255.255.255.224
RP/0/RP0/CPU0:router(config-if)# flow-control ingress
RP/0/RP0/CPU0:router(config-if)# mtu 1448
RP/0/RP0/CPU0:router(config-if)# mac-address 0001.2468.ABCD
RP/0/RP0/CPU0:router(config-if)# no shutdown
RP/0/RP0/CPU0:router(config-if)# end
Uncommitted changes found, commit them? [yes]: yes
```

```
RP/0/RP0/CPU0:router# show interfaces TenGigE 0/0/0/1

TenGigE0/0/0/1 is down, line protocol is down
  Hardware is TenGigE, address is 0001.2468.abcd (bia 0001.81a1.6b23)
  Internet address is 172.18.189.38/27
  MTU 1448 bytes, BW 10000000 Kbit
    reliability 0/255, txload Unknown, rxload Unknown
  Encapsulation ARPA,
  Full-duplex, 10000Mb/s, LR
  output flow control is on, input flow control is on
  loopback not set
  ARP type ARPA, ARP timeout 01:00:00
  Last clearing of "show interface" counters never
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 total input drops
    0 drops for unrecognized upper-level protocol
  Received 0 broadcast packets, 0 multicast packets
    0 runts, 0 giants, 0 throttles, 0 parity
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 total output drops
  Output 0 broadcast packets, 0 multicast packets
  0 output errors, 0 underruns, 0 applique, 0 resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
```

Configuring MAC-Accounting: Example

This example indicates how to configure MAC-accounting on an Ethernet interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface TenGigE 0/0/0/2
RP/0/RP0/CPU0:router(config-if)# ipv4 address 172.18.189.38 255.255.255.224
RP/0/RP0/CPU0:router(config-if)# mac-accounting egress
RP/0/RP0/CPU0:router(config-if)# commit
RP/0/RP0/CPU0:router(config-if)# exit
RP/0/RP0/CPU0:router(config)# exit
```

Configuring a Layer 2 VPN AC: Example

This example indicates how to configure a Layer 2 VPN AC on an Ethernet interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface TenGigE 0/0/0/2
RP/0/RP0/CPU0:router(config-if)# l2transport
RP/0/RP0/CPU0:router(config-if-l2)# l2protocol tunnel
RP/0/RP0/CPU0:router(config-if-l2)# commit
```

Configuring LLDP: Examples

This example shows how to enable LLDP globally on the router, and modify the default LLDP operational characteristics:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# lldp
RP/0/RP0/CPU0:router(config)# lldp holdtime 60
RP/0/RP0/CPU0:router(config)# lldp reinit 4
RP/0/RP0/CPU0:router(config)# lldp timer 60
RP/0/RP0/CPU0:router(config)# commit
```

This example shows how to disable a specific Gigabit Ethernet interface for LLDP transmission:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface GigabitEthernet 0/2/0/0
RP/0/RP0/CPU0:router(config-if)# lldp
RP/0/RP0/CPU0:router(config-lldp)# transmit disable
```

Where to Go Next

When you have configured an Ethernet interface, you can configure individual VLAN subinterfaces on that Ethernet interface.

For information about modifying Ethernet management interfaces for the shelf controller (SC), route processor (RP), and distributed RP, see the module in this document.

For information about IPv6 see the *Implementing Access Lists and Prefix Lists* module in the *IP Addresses and Services Configuration Guide*.

Additional References

The following sections provide references related to implementing Gigabit, 10-Gigabit, and Fast Ethernet interfaces.

Related Documents

Related Topic	Document Title
Cisco IOS XR master command reference	Cisco IOS XR <i>Master Commands List</i>

Standards

Standards	Title
IEEE 802.1ag ITU-T Y.1731	<i>Ethernet OAM Connectivity Fault Management</i>

MIBs

MIBs	MIBs Link
IEEE CFM MIB	To locate and download MIBs for selected platforms using Cisco IOS XR Software, use the Cisco MIB Locator found at the following URL: http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport