Carrier Ethernet Configuration Guide, Cisco IOS Release 15SY

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CHAPTER 1

Using Ethernet Operations Administration and Maintenance

Ethernet Operations, Administration, and Maintenance (OAM) is a protocol for installing, monitoring, and troubleshooting Ethernet metropolitan-area networks (MANs) and Ethernet WANs. It relies on a new, optional sublayer in the data link layer of the Open Systems Interconnection (OSI) model. The OAM features covered by this protocol are Discovery, Link Monitoring, Remote Fault Detection, Remote Loopback, and Cisco Proprietary Extensions.

The advent of Ethernet as a MAN and WAN technology has emphasized the necessity for integrated management for larger deployments. For Ethernet to extend into public MANs and WANs, it must be equipped with a new set of requirements on Ethernet's traditional operations, which had been centered on enterprise networks only. The expansion of Ethernet technology into the domain of service providers, where networks are substantially larger and more complex than enterprise networks and the user-base is wider, makes operational management of link uptime crucial.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Using Ethernet Operations Administration and Maintenance

Ethernet OAM

Ethernet OAM is a protocol for installing, monitoring, and troubleshooting metro Ethernet networks and Ethernet WANs. It relies on a new, optional sublayer in the data link layer of the OSI model. Ethernet OAM can be implemented on any full-duplex point-to-point or emulated point-to-point Ethernet link. A system-wide implementation is not required; OAM can be deployed for part of a system; that is, on particular interfaces.

Normal link operation does not require Ethernet OAM. OAM frames, called OAM protocol data units (PDUs), use the slow protocol destination MAC address 0180.c200.0002. They are intercepted by the MAC sublayer and cannot propagate beyond a single hop within an Ethernet network.

Ethernet OAM is a relatively slow protocol with modest bandwidth requirements. The frame transmission rate is limited to a maximum of 10 frames per second; therefore, the impact of OAM on normal operations is negligible. However, when link monitoring is enabled, the CPU must poll error counters frequently. In this case, the required CPU cycles will be proportional to the number of interfaces that have to be polled.

Two major components, the OAM client and the OAM sublayer, make up Ethernet OAM. The following two sections describe these components.

OAM Client

The OAM client is responsible for establishing and managing Ethernet OAM on a link. The OAM client also enables and configures the OAM sublayer. During the OAM discovery phase, the OAM client monitors OAM PDUs received from the remote peer and enables OAM functionality on the link based on local and remote state as well as configuration settings. Beyond the discovery phase (at steady state), the OAM client is responsible for managing the rules of response to OAM PDUs and managing the OAM remote loopback mode.

OAM Sublayer

The OAM sublayer presents two standard IEEE 802.3 MAC service interfaces: one facing toward the superior sublayers, which include the MAC client (or link aggregation), and the other interface facing toward the subordinate MAC control sublayer. The OAM sublayer provides a dedicated interface for passing OAM control information and OAM PDUs to and from a client.

The OAM sublayer is made up of three components: control block, multiplexer, and packet parser (p-parser). Each component is described in the following sections.

Control Block

The control block provides the interface between the OAM client and other blocks internal to the OAM sublayer. The control block incorporates the discovery process, which detects the existence and capabilities of remote OAM peers. It also includes the transmit process that governs the transmission of OAM PDUs to the multiplexer and a set of rules that govern the receipt of OAM PDUs from the p-parser.

Multiplexer

The multiplexer manages frames generated (or relayed) from the MAC client, control block, and p-parser. The multiplexer passes through frames generated by the MAC client untouched. It passes OAM PDUs generated by the control block to the subordinate sublayer; for example, the MAC sublayer. Similarly, the multiplexer passes loopback frames from the p-parser to the same subordinate sublayer when the interface is in OAM remote loopback mode.

P-Parser

The p-parser classifies frames as OAM PDUs, MAC client frames, or loopback frames and then dispatches each class to the appropriate entity. OAM PDUs are sent to the control block. MAC client frames are passed to the superior sublayer. Loopback frames are dispatched to the multiplexer.

Benefits of Ethernet OAM

Ethernet OAM provides the following benefits:

- Competitive advantage for service providers
- Standardized mechanism to monitor the health of a link and perform diagnostics

Cisco Implementation of Ethernet OAM

The Cisco implementation of Ethernet OAM consists of the Ethernet OAM shim and the Ethernet OAM module.

The Ethernet OAM shim is a thin layer that connects the Ethernet OAM module and the platform code. It is implemented in the platform code (driver). The shim also communicates port state and error conditions to the Ethernet OAM module via control signals.

The Ethernet OAM module, implemented within the control plane, handles the OAM client as well as control block functionality of the OAM sublayer. This module interacts with the CLI and Simple Network Management Protocol (SNMP)/programmatic interface via control signals. In addition, this module interacts with the Ethernet OAM shim through OAM PDU flows.

OAM Features

The OAM features as defined by IEEE 802.3ah, *Ethernet in the First Mile* , are discovery, Link Monitoring, Remote Fault Detection, Remote Loopback, and Cisco Proprietary Extensions.

Discovery

Discovery is the first phase of Ethernet OAM and it identifies the devices in the network and their OAM capabilities. Discovery uses information OAM PDUs. During the discovery phase, the following information is advertised within periodic information OAM PDUs:

- OAM mode--Conveyed to the remote OAM entity. The mode can be either active or passive and can be used to determine device functionality.

- OAM configuration (capabilities)--Advertises the capabilities of the local OAM entity. With this information a peer can determine what functions are supported and accessible; for example, loopback capability.
- OAM PDU configuration--Includes the maximum OAM PDU size for receipt and delivery. This information along with the rate limiting of 10 frames per second can be used to limit the bandwidth allocated to OAM traffic.
- Platform identity--A combination of an organization unique identifier (OUI) and 32-bits of vendor-specific information. OUI allocation, controlled by the IEEE, is typically the first three bytes of a MAC address.

Discovery includes an optional phase in which the local station can accept or reject the configuration of the peer OAM entity. For example, a node may require that its partner support loopback capability to be accepted into the management network. These policy decisions may be implemented as vendor-specific extensions.

Link Monitoring

Link monitoring in Ethernet OAM detects and indicates link faults under a variety of conditions. Link monitoring uses the event notification OAM PDU and sends events to the remote OAM entity when there are problems detected on the link. The error events include the following:

- Error Symbol Period (error symbols per second)--The number of symbol errors that occurred during a specified period exceeded a threshold. These errors are coding symbol errors.
- Error Frame (error frames per second)--The number of frame errors detected during a specified period exceeded a threshold.
- Error Frame Period (error frames per *n* frames)--The number of frame errors within the last n frames has exceeded a threshold.
- Error Frame Seconds Summary (error seconds per *m* seconds)--The number of error seconds (1-second intervals with at least one frame error) within the last m seconds has exceeded a threshold.

Since IEEE 802.3ah OAM does not provide a guaranteed delivery of any OAM PDU, the event notification OAM PDU may be sent multiple times to reduce the probability of a lost notification. A sequence number is used to recognize duplicate events.

Remote Failure Indication

Faults in Ethernet connectivity that are caused by slowly deteriorating quality are difficult to detect. Ethernet OAM provides a mechanism for an OAM entity to convey these failure conditions to its peer via specific flags in the OAM PDU. The following failure conditions can be communicated:

- Link Fault--Loss of signal is detected by the receiver; for instance, the peer's laser is malfunctioning. A link fault is sent once per second in the information OAM PDU. Link fault applies only when the physical sublayer is capable of independently transmitting and receiving signals.
- Dying Gasp--An unrecoverable condition has occurred; for example, when an interface is shut down. This type of condition is vendor specific. A notification about the condition may be sent immediately and continuously.
- Critical Event--An unspecified critical event has occurred. This type of event is vendor specific. A critical event may be sent immediately and continuously.

Remote Loopback

An OAM entity can put its remote peer into loopback mode using the loopback control OAM PDU. Loopback mode helps an administrator ensure the quality of links during installation or when troubleshooting. In loopback mode, every frame received is transmitted back on the same port except for OAM PDUs and pause frames. The periodic exchange of OAM PDUs must continue during the loopback state to maintain the OAM session.

The loopback command is acknowledged by responding with an information OAM PDU with the loopback state indicated in the state field. This acknowledgement allows an administrator, for example, to estimate if a network segment can satisfy a service-level agreement. Acknowledgement makes it possible to test delay, jitter, and throughput.

When an interface is set to the remote loopback mode the interface no longer participates in any other Layer 2 or Layer 3 protocols; for example Spanning Tree Protocol (STP) or Open Shortest Path First (OSPF). The reason is that when two connected ports are in a loopback session, no frames other than the OAM PDUs are sent to the CPU for software processing. The non-OAM PDU frames are either looped back at the MAC level or discarded at the MAC level.

From a user's perspective, an interface in loopback mode is in a link-up state.

Cisco Vendor-Specific Extensions

Ethernet OAM allows vendors to extend the protocol by allowing them to create their own type-length-value (TLV) fields.

OAM Messages

Ethernet OAM messages or OAM PDUs are standard length, untagged Ethernet frames within the normal frame length bounds of 64 to 1518 bytes. The maximum OAM PDU frame size exchanged between two peers is negotiated during the discovery phase.

OAM PDUs always have the destination address of slow protocols (0180.c200.0002) and an Ethertype of 8809. OAM PDUs do not go beyond a single hop and have a hard-set maximum transmission rate of 10 OAM PDUs per second. Some OAM PDU types may be transmitted multiple times to increase the likelihood that they will be successfully received on a deteriorating link.

Four types of OAM messages are supported:

- Information OAM PDU--A variable-length OAM PDU that is used for discovery. This OAM PDU includes local, remote, and organization-specific information.
- Event notification OAM PDU--A variable-length OAM PDU that is used for link monitoring. This type of OAM PDU may be transmitted multiple times to increase the chance of a successful receipt; for example, in the case of high-bit errors. Event notification OAM PDUs also may include a time stamp when generated.
- Loopback control OAM PDU--An OAM PDU fixed at 64 bytes in length that is used to enable or disable the remote loopback command.
- Vendor-specific OAM PDU--A variable-length OAM PDU that allows the addition of vendor-specific extensions to OAM.

IEEE 802.3ah Link Fault RFI Support

The IEEE 802.3ah Link Fault RFI Support feature provides a per-port configurable option that moves a port into a blocking state when an OAM PDU control request packet is received with the Link Fault Status flag set. In the blocking state, the port can continue to receive OAM PDUs, detect remote link status, and automatically recover when the remote link becomes operational. When an OAM PDU is received with the Link Fault Status flag set to zero or FALSE, the port is enabled and all VLANs configured on the port are set to "forwarding."

Note If you configure the Ethernet OAM timeout period to be the minimum allowable value of 2 seconds, the Ethernet OAM session may be dropped briefly when the port transitions from blocked to unblocked. This action will not occur by default; the default timeout value is 5 seconds.

Before the release of the IEEE 802.3ah Link Fault RFI Support feature, when an OAM PDU control request packet was received with the Link Fault Status flag set, one of three actions was taken:

- The port was put in the error-disable state, meaning that the port did not send or receive packets, including Bridge Protocol Data Units (BPDU) packets. In the error-disable state, a link can automatically recover after the error-disable timeout period but cannot recover automatically when the remote link becomes operational.
- A warning message was displayed or logged, and the port remained operational.
- The Link Fault Status flag was ignored.

Ethernet Connectivity Fault Management

Ethernet connectivity fault management (CFM) is an end-to-end per-service-instance Ethernet layer OAM protocol that includes proactive connectivity monitoring, fault verification, and fault isolation. End to end can be provider edge (PE) to PE or customer edge (CE) to CE. Per service instance means per VLAN.

For more information about Ethernet CFM, see Ethernet Connectivity Fault Management .

High Availability Features Supported by 802.3ah

In access and service provider networks using Ethernet technology, High Availability (HA) is a requirement, especially on Ethernet OAM components that manage Ethernet virtual circuit (EVC) connectivity. End-to-end connectivity status information is critical and must be maintained on a hot standby Route Switch Processor (RSP) (a standby RSP that has the same software image as the active RSP and supports synchronization of line card, protocol, and application state information between RSPs for supported features and protocols). End-to-end connectivity status is maintained on the CE, PE, and access aggregation PE (uPE) network nodes based on information received by protocols such as CFM and 802.3ah. This status information is used to either stop traffic or switch to backup paths when an EVC is down. Metro Ethernet clients (for example, CFM and 802.3ah) maintain configuration data and dynamic data, which is learned through protocols. Every transaction involves either accessing or updating data among the various databases. If the databases are synchronized across active and standby modules, the RSPs are transparent to clients.

Cisco infrastructure provides various component application program interfaces (APIs) for clients that are helpful in maintaining a hot standby RSP. Metro Ethernet HA clients (such as, HA/ISSU, CFM HA/ISSU, 802.3ah HA/ISSU) interact with these components, update the databases, and trigger necessary events to other components.

Benefits of 802.3ah HA

- Elimination of network downtime for Cisco software image upgrades, resulting in higher availability
- Elimination of resource scheduling challenges associated with planned outages and late night maintenance windows
- Accelerated deployment of new services and applications and faster implementation of new features, hardware, and fixes due to the elimination of network downtime during upgrades
- Reduced operating costs due to outages while delivering higher service levels due to the elimination of network downtime during upgrades

NSF SSO Support in 802.3ah OAM

The redundancy configurations Stateful Switchover (SSO) and Nonstop Forwarding (NSF) are both supported in Ethernet OAM and are automatically enabled. A switchover from an active to a standby Route Switch Processor (RSP) occurs when the active RSP fails, is removed from the networking device, or is manually taken down for maintenance. NSF interoperates with the SSO feature to minimize network downtime following a switchover. The primary function of Cisco NSF is to continue forwarding IP packets following an RSP switchover.

For detailed information about the SSO feature, see the "Configuring Stateful Switchover" module of the *High Availability Configuration Guide*. For detailed information about the NSF feature, see the "Configuring Cisco Nonstop Forwarding" module of the *High Availability Configuration Guide.*

ISSU Support in 802.3ah OAM

Cisco In-Service Software Upgrades (ISSUs) allow you to perform a Cisco software upgrade or downgrade without disrupting packet flow. ISSU is automatically enabled in 802.3ah. OAM performs a bulk update and a runtime update of the continuity check database to the standby Route Switch Processor (RSP), including adding, deleting, or updating a row. This checkpoint data requires ISSU capability to transform messages from one release to another. All the components that perform active RSP to standby RSP updates using messages require ISSU support.

ISSU lowers the impact that planned maintenance activities have on network availability by allowing software changes while the system is in service. For detailed information about ISSU, see the "Performing an In Service Software Upgrade" module of the *High Availability Configuration Guide*.

How to Set Up and Configure Ethernet Operations Administration and Maintenance

Enabling Ethernet OAM on an Interface

Ethernet OAM is by default disabled on an interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*]
5. **exit**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface gigabitethernet 3/8`	Specifies an interface and enters interface configuration mode.
Step 4	**ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*] **Example:** `Device(config-if)# ethernet oam`	Enables Ethernet OAM.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

Disabling and Enabling a Link Monitoring Session

Link monitoring is enabled by default when you enable Ethernet OAM. Perform these tasks to disable and enable link monitoring sessions:

Disabling a Link Monitoring Session

Perform this task to disable a link monitoring session.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*]
5. **no ethernet oam link-monitor supported**
6. **exit**

DETAILED STEPS

	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	**interface** *type number* **Example:** `Device(config)# interface gigabitEthernet 3/8`	Specifies an interface and enters interface configuration mode.
Step 4	**ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*] **Example:** `Device(config-if)# ethernet oam`	Enables Ethernet OAM.
Step 5	**no ethernet oam link-monitor supported** **Example:** `Device(config-if)# no ethernet oam link-monitor supported`	Disables link monitoring on the interface.
Step 6	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

Enabling a Link Monitoring Session

Perform this task to reenable a link monitoring session after it was previously disabled.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam link-monitor supported**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Device> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface gigabitEthernet 3/8`	Specifies an interface and enters interface configuration mode.
Step 4	**ethernet oam link-monitor supported** **Example:** `Device(config-if)# ethernet oam link-monitor supported`	Enables link monitoring on the interface.
Step 5	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

Stopping and Starting Link Monitoring Operations

Link monitoring operations start automatically when Ethernet OAM is enabled on an interface. When link monitoring operations are stopped, the interface does not actively send or receive event notification OAM PDUs. The tasks in this section describe how to stop and start link monitoring operations.

Stopping Link Monitoring Operations

Perform this task to stop link monitoring operations.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*]
5. **no ethernet oam link-monitor on**
6. **exit**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface gigabitethernet 3/8`	Specifies an interface and enters interface configuration mode.
Step 4	**ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*] **Example:** `Device(config-if)# ethernet oam`	Enables Ethernet OAM.
Step 5	**no ethernet oam link-monitor on** **Example:** `Device(config-if)# no ethernet oam link-monitor on`	Stops link monitoring operations.
Step 6	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

Starting Link Monitoring Operations

Perform this task to start link monitoring operations.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam link-monitor on**
5. **exit**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface gigabitethernet 3/8`	Specifies an interface and enters interface configuration mode.
Step 4	**ethernet oam link-monitor on** **Example:** `Device(config-if)# ethernet oam link-monitor on`	Starts link monitoring operations.
Step 5	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

Configuring Link Monitoring Options

Perform this optional task to specify link monitoring options. Steps 4 through 10 can be performed in any sequence.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*]
5. **ethernet oam link-monitor high-threshold action error-disable-interface**
6. **ethernet oam link-monitor frame** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*}
7. **ethernet oam link-monitor frame-period** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *frames*}
8. **ethernet oam link-monitor frame-seconds** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*}
9. **ethernet oam link-monitor receive-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*}
10. **ethernet oam link-monitor transmit-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*}
11. **ethernet oam link-monitor symbol-period** {**threshold** {**high** {**none** | *high-symbols*} | **low** *low-symbols*} | **window** *symbols*}
12. **exit**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface gigabitEthernet 3/8`	Identifies the interface and enters interface configuration mode.

	Command or Action	Purpose
Step 4	**ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*] **Example:** `Device(config-if)# ethernet oam`	Enables Ethernet OAM.
Step 5	**ethernet oam link-monitor high-threshold action error-disable-interface** **Example:** `Device(config-if)# ethernet oam link-monitor high-threshold action error-disable-interface`	Configures an error-disable function on an Ethernet OAM interface when a high threshold for an error is exceeded.
Step 6	**ethernet oam link-monitor frame** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-if)# ethernet oam link-monitor frame window 399`	Configures a number for error frames that when reached triggers an action.
Step 7	**ethernet oam link-monitor frame-period** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *frames*} **Example:** `Device(config-if)# ethernet oam link-monitor frame-period threshold high 599`	Configures a number of frames to be polled. Frame period is a user-defined parameter.
Step 8	**ethernet oam link-monitor frame-seconds** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-if)# ethernet oam link-monitor frame-seconds window 699`	Configures a period of time in which error frames are counted.
Step 9	**ethernet oam link-monitor receive-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-if)# ethernet oam link-monitor receive-crc window 99`	Configures an Ethernet OAM interface to monitor ingress frames with cyclic redundancy check (CRC) errors for a period of time.

	Command or Action	Purpose
Step 10	**ethernet oam link-monitor transmit-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-if)# ethernet oam link-monitor transmit-crc threshold low 199`	Configures an Ethernet OAM interface to monitor egress frames with CRC errors for a period of time.
Step 11	**ethernet oam link-monitor symbol-period** {**threshold** {**high** {**none** | *high-symbols*} | **low** *low-symbols*} | **window** *symbols*} **Example:** `Device(config-if)# ethernet oam link-monitor symbol-period threshold high 299`	Configures a threshold or window for error symbols, in number of symbols.
Step 12	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

Example

```
Device# configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Device(config)# interface gigabitEthernet 3/8
Device(config-if)#
Device(config-if)# ethernet oam

Device(config-if)# ethernet oam link-monitor high-threshold action error-disable-interface
Device(config-if)# ethernet oam link-monitor frame window 399
Device(config-if)# ethernet oam link-monitor frame-period threshold high 599
Device(config-if)# ethernet oam link-monitor frame-seconds window 699
Device(config-if)# ethernet oam link-monitor receive-crc window 99
Device(config-if)# ethernet oam link-monitor transmit-crc threshold low 199
Device(config-if)# ethernet oam link-monitor symbol-period threshold high 299
Device(config-if)# exit
Device# show running-config

Building configuration...
Current configuration : 5613 bytes
!
!
version 12.2
!
!
.
.
.
!
!
interface GigabitEthernet3/8
 no ip address
 ethernet oam link-monitor high-threshold action error-disable-interface
```

```
ethernet oam link-monitor frame window 399
ethernet oam link-monitor frame-period threshold high 599
ethernet oam link-monitor frame-seconds window 699
ethernet oam link-monitor receive-crc window 99
ethernet oam link-monitor transmit-crc threshold low 199
ethernet oam link-monitor symbol-period threshold high 299
ethernet oam
```

Configuring Global Ethernet OAM Options Using a Template

Perform this task to create a template to use for configuring a common set of options on multiple Ethernet OAM interfaces. Steps 4 through 10 are optional and can be performed in any sequence. These steps may also be repeated to configure different options.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **template** *template-name*
4. **ethernet oam link-monitor receive-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*}
5. **ethernet oam link-monitor transmit-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*}
6. **ethernet oam link-monitor symbol-period** {**threshold** {**high** {**none** | *high-symbols*} | **low** *low-symbols*} | **window** *symbols*}
7. **ethernet oam link-monitor high-threshold action error-disable-interface**
8. **ethernet oam link-monitor frame** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*}
9. **ethernet oam link-monitor frame-period** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *frames*}
10. **ethernet oam link-monitor frame-seconds** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*}
11. **exit**
12. **interface** *type number*
13. **source template** *template-name*
14. **exit**
15. **exit**
16. **show running-config**

DETAILED STEPS

	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	**template** *template-name* **Example:** `Device(config)# template oam-temp`	Configures a template and enters template configuration mode.
Step 4	**ethernet oam link-monitor receive-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-template)# ethernet oam link-monitor receive-crc window 99`	Configures an Ethernet OAM interface to monitor ingress frames with CRC errors for a period of time.
Step 5	**ethernet oam link-monitor transmit-crc** {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-template)# ethernet oam link-monitor transmit-crc threshold low 199`	Configures an Ethernet OAM interface to monitor egress frames with CRC errors for a period of time.
Step 6	**ethernet oam link-monitor symbol-period** {**threshold** {**high** {**none** | *high-symbols*} | **low** *low-symbols*} | **window** *symbols*} **Example:** `Device(config-template)# ethernet oam link-monitor symbol-period threshold high 299`	Configures a threshold or window for error symbols, in number of symbols.
Step 7	**ethernet oam link-monitor high-threshold action error-disable-interface** **Example:** `Device(config-template)# ethernet oam link-monitor high-threshold action error-disable-interface`	Configures an error-disable function on an Ethernet OAM interface when a high threshold for an error is exceeded.
Step 8	**ethernet oam link-monitor frame** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-template)# ethernet oam link-monitor frame window 399`	Configures a number for error frames that when reached triggers an action.

	Command or Action	Purpose
Step 9	**ethernet oam link-monitor frame-period** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *frames*} **Example:** `Device(config-template)# ethernet oam link-monitor frame-period threshold high 599`	Configures a number of frames to be polled. Frame period is a user-defined parameter.
Step 10	**ethernet oam link-monitor frame-seconds** {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*} **Example:** `Device(config-template)# ethernet oam link-monitor frame-seconds window 699`	Configures a period of time in which error frames are counted.
Step 11	**exit** **Example:** `Device(config-template)# exit`	Returns to global configuration mode.
Step 12	**interface** *type number* **Example:** `Device(config)# interface gigabitEthernet 3/8`	Identifies the interface on which to use the template and enters interface configuration mode.
Step 13	**source template** *template-name* **Example:** `Device(config-if)# source template oam-temp`	Applies to the interface the options configured in the template.
Step 14	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 15	**exit** **Example:** `Device(config)# exit`	Returns to privileged EXEC mode.
Step 16	**show running-config** **Example:** `Device# show running-config`	Displays the updated running configuration.

Configuring a Port for Link Fault RFI Support

Perform this task to put a port into a blocking state when an OAM PDU control request packet is received with the Link Fault Status flag set.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam remote-failure** {**critical-event** | **dying-gasp** | **link-fault**} **action** {**error-disable-interface**}
5. **exit**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface fastethernet 1/2`	Enters interface configuration mode.
Step 4	**ethernet oam remote-failure** {**critical-event** | **dying-gasp** | **link-fault**} **action** {**error-disable-interface**} **Example:** `Device(config-if)# ethernet oam remote-failure critical-event action error-disable-interface`	Sets the interface to the blocking state when a critical event occurs.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

Configuration Examples for Ethernet Operations Administration and Maintenance

The following example shows how to configure Ethernet OAM options using a template and overriding that configuration by configuring an interface. In this example, the network supports a Gigabit Ethernet interface between the customer edge device and provider edge device.

```
! Configure a global OAM template for both PE and CE configuration.
!
Device(config)# template oam
Device(config-template)# ethernet oam link-monitor symbol-period threshold low 10
Device(config-template)# ethernet oam link-monitor symbol-period threshold high 100
Device(config-template)# ethernet oam link-monitor frame window 100
Device(config-template)# ethernet oam link-monitor frame threshold low 10
Device(config-template)# ethernet oam link-monitor frame threshold high 100
Device(config-template)# ethernet oam link-monitor frame-period window 100
Device(config-template)# ethernet oam link-monitor frame-period threshold low 10
Device(config-template)# ethernet oam link-monitor frame-period threshold high 100
Device(config-template)# ethernet oam link-monitor frame-seconds window 1000
Device(config-template)# ethernet oam link-monitor frame-seconds threshold low 10
Device(config-template)# ethernet oam link-monitor frame-seconds threshold high 100
Device(config-template)# ethernet oam link-monitor receive-crc window 100
Device(config-template)# ethernet oam link-monitor receive-crc threshold high 100
Device(config-template)# ethernet oam link-monitor transmit-crc window 100
Device(config-template)# ethernet oam link-monitor transmit-crc threshold high 100
Device(config-template)# ethernet oam remote-failure dying-gasp action error-disable-interface
Device(config-template)# exit
!
! Enable Ethernet OAM on the CE interface
!
Device(config)# interface gigabitethernet 4/1/1
Device(config-if)# ethernet oam
!
! Apply the global OAM template named "oam" to the interface.
!
Device(config-if)# source template oam
!
! Configure any interface-specific link monitoring commands to override the template
configuration. The following example disables the high threshold link monitoring for receive
 CRC errors.
!
Device(config-if)# ethernet oam link-monitor receive-crc threshold high none
!
! Enable Ethernet OAM on the PE interface
!
Device(config)# interface gigabitethernet 8/1/1
Device(config-if)# ethernet oam
!
! Apply the global OAM template named "oam" to the interface.
```

```
!
Device(config-if)# source template oam
```

The following examples show how to verify various Ethernet OAM configurations and activities.

Verifying an OAM Session

The following example shows that the local OAM client, Gigabit Ethernet interface Gi6/1/1, is in session with a remote client with MAC address 0012.7fa6.a700 and OUI 00000C, which is the OUI for Cisco. The remote client is in active mode and has established capabilities for link monitoring and remote loopback for the OAM session.

```
Device# show ethernet oam summary
Symbols:          * - Master Loopback State,  # - Slave Loopback State
Capability codes: L - Link Monitor,  R - Remote Loopback
                  U - Unidirection,  V - Variable Retrieval
  Local                       Remote
Interface       MAC Address    OUI    Mode    Capability
 Gi6/1/1       0012.7fa6.a700 00000C active      L R
```

Verifying OAM Discovery Status

The following example shows how to verify OAM discovery status of a local client and a remote peer:

```
Device# show ethernet oam discovery interface gigabitethernet6/1/1
GigabitEthernet6/1/1
Local client
------------
  Administrative configurations:
    Mode:              active
    Unidirection:      not supported
    Link monitor:      supported (on)
    Remote loopback:   not supported
    MIB retrieval:     not supported
    Mtu size:          1500
  Operational status:
Port status:       operational
    Loopback status:   no loopback
    PDU permission:    any
    PDU revision:      1
Remote client
-------------
  MAC address: 0030.96fd.6bfa
  Vendor(oui): 0x00 0x00 0x0C (cisco)
  Administrative configurations:
    Mode:              active
   Unidirection:      not supported
   Link monitor:      supported
   Remote loopback:   not supported
   MIB retrieval:     not supported
   Mtu size:          1500
```

Verifying Information OAMPDU and Fault Statistics

The following example shows how to verify statistics for information OAM PDUs and local and remote faults:

```
Device# show ethernet oam statistics interface gigabitethernet6/1/1
GigabitEthernet6/1/1
Counters:
---------
Information OAMPDU Tx                    : 588806
Information OAMPDU Rx                    : 988
Unique Event Notification OAMPDU Tx      : 0
Unique Event Notification OAMPDU Rx      : 0
Duplicate Event Notification OAMPDU TX   : 0
Duplicate Event Notification OAMPDU RX   : 0
Loopback Control OAMPDU Tx               : 1
```

```
Loopback Control OAMPDU Rx            : 0
Variable Request OAMPDU Tx            : 0
Variable Request OAMPDU Rx            : 0
Variable Response OAMPDU Tx           : 0
Variable Response OAMPDU Rx           : 0
Cisco OAMPDU Tx                       : 4
Cisco OAMPDU Rx                       : 0
Unsupported OAMPDU Tx                 : 0
Unsupported OAMPDU Rx                 : 0
Frames Lost due to OAM                : 0
Local Faults:
-------------
0 Link Fault records
2 Dying Gasp records
Total dying gasps       : 4
Time stamp              : 00:30:39
Total dying gasps       : 3
Time stamp              : 00:32:39
0 Critical Event records
Remote Faults:
--------------
0 Link Fault records
0 Dying Gasp records
0 Critical Event records
Local event logs:
-----------------
0 Errored Symbol Period records
0 Errored Frame records
0 Errored Frame Period records
0 Errored Frame Second records
Remote event logs:
------------------
0 Errored Symbol Period records
0 Errored Frame records
0 Errored Frame Period records
0 Errored Frame Second records
```

Verifying Link Monitoring Configuration and Status

The following example shows how to verify link monitoring configuration and status on the local client. The highlighted Status field in the example shows that link monitoring status is supported and enabled (on).

```
Device# show ethernet oam status interface gigabitethernet6/1/1
GigabitEthernet6/1/1
General
-------
  Mode:                  active
  PDU max rate:          10 packets per second
  PDU min rate:          1 packet per 1 second
  Link timeout:          5 seconds
  High threshold action: no action
Link Monitoring
---------------
  Status: supported (on)
  Symbol Period Error
    Window:              1 million symbols
    Low threshold:       1 error symbol(s)
    High threshold:      none
  Frame Error
    Window:              10 x 100 milliseconds
    Low threshold:       1 error frame(s)
    High threshold:      none
Frame Period Error
    Window:              1 x 100,000 frames
    Low threshold:       1 error frame(s)
    High threshold:      none
  Frame Seconds Error
    Window:              600 x 100 milliseconds
    Low threshold:       1 error second(s)
    High threshold:      none
```

Verifying Status of a Remote OAM Client

The following example shows that the local client interface Gi6/1/1 is connected to a remote client. Note the values in the Mode and Capability fields.

```
Device# show ethernet oam summary
Symbols:           * - Master Loopback State,  # - Slave Loopback State
Capability codes: L - Link Monitor,  R - Remote Loopback
                  U - Unidirection,  V - Variable Retrieval
  Local                        Remote
Interface       MAC Address    OUI    Mode    Capability
 Gi6/1/1       0012.7fa6.a700 00000C active      L R
```

Additional References

Related Documents

Related Topic	Document Title
Ethernet CFM	"Configuring Ethernet Connectivity Fault Management in a Service Provider Network" module in the *Carrier Ethernet Configuration Guide*
NSF SSO Support in 802.3ah OAM	"Configuring Stateful Switchover" module in the *High Availability Configuration Guide* and "Configuring Nonstop Forwarding" in the *High Availability Configuration Guide*
ISSU Support in 802.3ah OAM	"Configuring In Service Software Upgrades" module in the *High Availability Configuration Guide*
Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases
Configuring CFM over an EFP Interface with the Cross Connect feature on the Cisco ASR 903 Router	Configuring the CFM over EFP Interface with Cross Connect Feature
Configuring Ethernet Virtual Connections on the Cisco ASR 903 Router	Configuring Ethernet Virtual Connections on the Cisco ASR 903 Router

Standards

Standard	Title
IEEE Draft P802.3ah/D3.3	*Ethernet in the First Mile - Amendment*
IETF VPLS OAM	*L2VPN OAM Requirements and Framework*
ITU-T	*ITU-T Y.1731 OAM Mechanisms for Ethernet-Based Networks*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Using Ethernet Operations Administration and Maintenance

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for Using Ethernet Operations, Administration, and Maintenance

Feature Name	Releases	Feature Information
Ethernet Operations, Administration, and Maintenance	12.4(15)T	Ethernet OAM is a protocol for installing, monitoring, and troubleshooting metro Ethernet networks and Ethernet WANs. It relies on a new, optional sublayer in the data link layer of the OSI model. The OAM features covered by this protocol are Discovery, Link Monitoring, Remote Fault Detection, Remote Loopback, and Cisco Proprietary Extensions. The Ethernet Operations, Administration, and Maintenance feature was integrated into Cisco IOS Release 12.4(15)T. The following commands were introduced or modified: **clear ethernet oam statistics, debug ethernet oam, ethernet oam, ethernet oam link-monitor frame, ethernet oam link-monitor frame-period, ethernet oam link-monitor frame-seconds, ethernet oam link-monitor high-threshold action, ethernet oam link-monitor on, ethernet oam link-monitor receive-crc, ethernet oam link-monitor supported, ethernet oam link-monitor symbol-period, ethernet oam link-monitor transmit-crc, ethernet oam remote-loopback, ethernet oam remote-loopback (interface), show ethernet oam discovery, show ethernet oam statistics, show ethernet oam status, show ethernet oam summary, source template (eoam), template (eoam)**.

CHAPTER 2

Configuring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network

Ethernet Connectivity Fault Management (CFM) is an end-to-end per-service Ethernet layer operations, administration, and maintenance (OAM) protocol. CFM includes proactive connectivity monitoring, fault verification, and fault isolation for large Ethernet metropolitan-area networks (MANs) and WANs.

The advent of Ethernet as a MAN and WAN technology imposes a new set of OAM requirements on Ethernet's traditional operations, which were centered on enterprise networks only. The expansion of Ethernet technology into the domain of service providers, where networks are substantially larger and more complex than enterprise networks and the user base is wider, makes operational management of link uptime crucial. More importantly, the timeliness in isolating and responding to a failure becomes mandatory for normal day-to-day operations, and OAM translates directly to the competitiveness of the service provider.

This document describes the implementation of IEEE 802.1ag Standard-Compliant CFM (IEEE CFM) in Cisco IOS software.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring IEEE Ethernet CFM in a Service Provider Network

- Network topology and network administration have been evaluated.
- Business and service policies have been established.
- Parser return codes (PRCs) have been implemented for all supported commands related to configuring CFM on a maintenance endpoint (MEP), maintenance intermediate point (MIP), level, service instance ID, cross-check timer, cross-check, and domain.
- To use Non-Stop Forwarding (NSF) and In Service Software Upgrade (ISSU), Stateful Switchover (SSO) must be configured and working properly.
- To deploy CFM and the Per VLAN Spanning Tree (PVST) Simulation feature, the Spanning Tree Protocol (STP) root switch must be inside the Multiple Spanning-Tree (MST) region.

Restrictions for Configuring IEEE Ethernet CFM in a Service Provider Network

- The IEEE CFM subsystem does not coexist in the same image as the Cisco pre-Standard CFM Draft 1 subsystem.
- IEEE CFM is supported on LAN cards. Linecards that do not support CFM will not boot up, but they display an error message.
- Unsupported line cards must be either removed or turned off.
- When physical ports are configured to a port channel on which CFM is configured, the following constraints apply:
    - Physical ports must allow use of the VLAN that is configured as part of the port channel's CFM configuration.
    - CFM on secondary port channels is not supported.
    - CFM configuration on Fast EtherChannel (FEC) port channels is not supported.
- CFM is not fully supported on an MPLS provider edge (PE) device. There is no interaction between CFM and an EoMPLS pseudowire. CFM packets can be transparently passed like regular data packets only via pseudowire, with the following restrictions:
    - For Policy Feature Card (PFC)-based EoMPLS, which uses a Cisco Catalyst LAN card as the MPLS uplink port, a CFM packet can be transparently passed via an EoMPLS pseudowire like

regular data packets. The EoMPLS endpoint interface, however, cannot be a MEP or a MIP, although a CFM MEP or MIP can be supported on regular Layer 2 switchport interfaces.

- High Availability (HA) feature support in CFM is platform dependent.
- CFM loopback messages will not be confined within a maintenance domain according to their maintenance level. The impact of not having CFM loopback messages confined to their maintenance levels occurs at these levels:
  - Architecture--CFM layering is violated for loopback messages.
  - Deployment--A user may potentially misconfigure a network and have loopback messages succeed.
  - Security--A malicious device that recognizes devices' MAC addresses and levels may potentially explore a network topology that should be transparent.
- PVST simulation is not supported on blocked ports.

Information About Configuring IEEE Ethernet CFM in a Service Provider Network

IEEE CFM

IEEE CFM is an end-to-end per-service Ethernet layer OAM protocol that includes proactive connectivity monitoring, fault verification, and fault isolation. End to end can be PE to PE or customer edge to customer edge (CE to CE). A service can be identified as a service provider VLAN (S-VLAN) or an Ethernet virtual circuit (EVC) service.

Being an end-to-end technology is the distinction between CFM and other metro-Ethernet OAM protocols. For example, MPLS, ATM, and SONET OAM help in debugging Ethernet wires but are not always end to end. 802.3ah OAM is a single-hop and per-physical-wire protocol. It is not end to end or service aware. Ethernet Local Management Interface (E-LMI) is confined between the user-end provider edge (uPE) and CE and relies on CFM for reporting status of the metro-Ethernet network to the CE.

Troubleshooting carrier networks offering Ethernet Layer 2 services is challenging. Customers contract with service providers for end-to-end Ethernet service and service providers may subcontract with operators to provide equipment and networks. Compared to enterprise networks, where Ethernet traditionally has been implemented, these constituent networks belong to distinct organizations or departments, are substantially larger and more complex, and have a wider user base. Ethernet CFM provides a competitive advantage to service providers for which the operational management of link uptime and timeliness in isolating and responding to failures is crucial to daily operations.

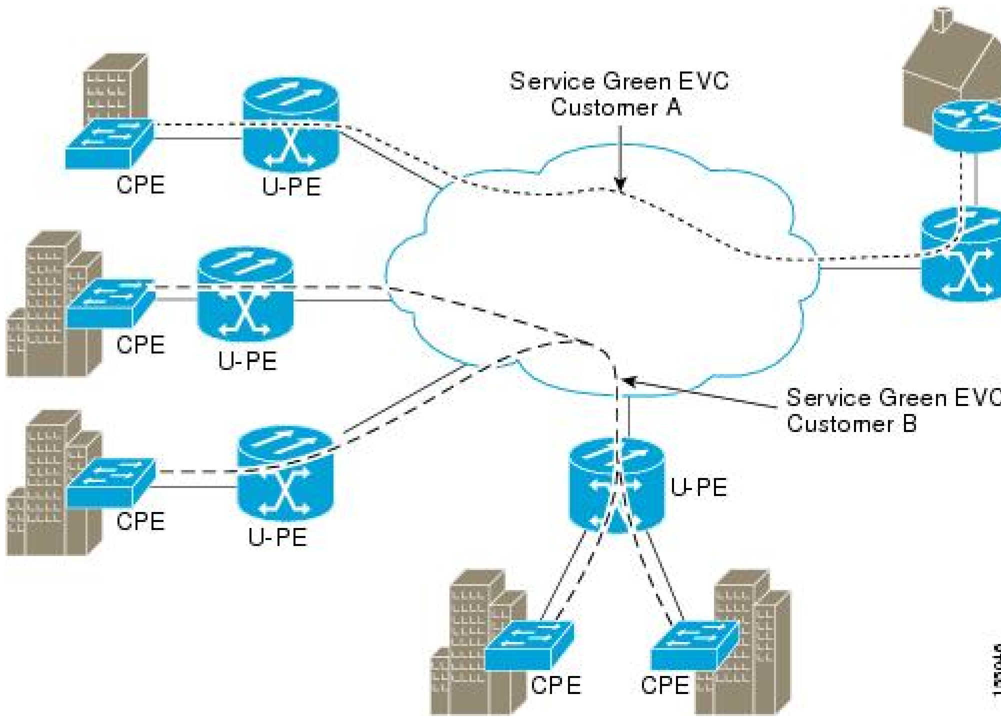
Benefits of IEEE CFM

- End-to-end service-level OAM technology
- Reduced operating expense for service provider Ethernet networks
- Competitive advantage for service providers

- Support for both distribution and access network environments with Down (toward the wire) MEPs

Customer Service Instance

A customer service is an EVC, which is identified by the encapsulation VLAN within an Ethernet island, and is identified by a globally unique service ID. A customer service can be point-to-point or multipoint-to-multipoint. The figure below shows two customer services. Service Green is point to point; Service Blue is multipoint to multipoint.



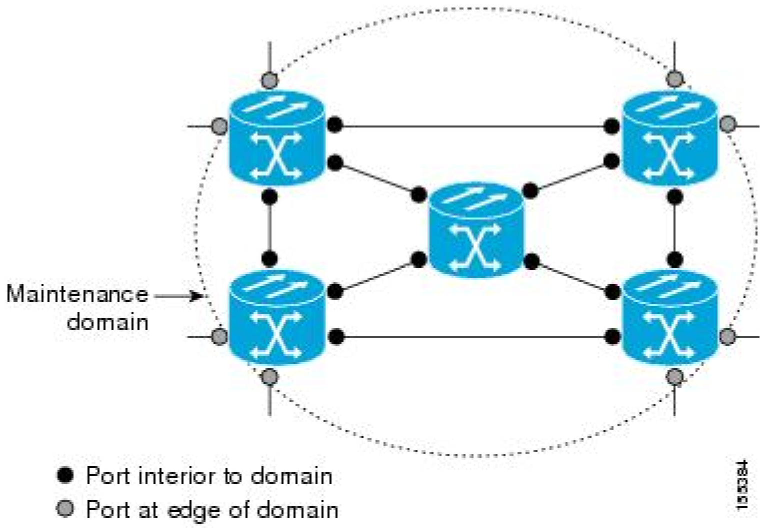
Maintenance Association

A maintenance association (MA) identifies a service that can be uniquely identified within a maintenance domain. There can be many MAs within a domain. The MA direction is specified when the MA is configured. The short MA name must be configured on a domain before MEPs can be configured. Configuring a MA is not required for devices that have only MIPs.

The CFM protocol runs for a specific MA.

Maintenance Domain

A maintenance domain is a management space for the purpose of managing and administering a network. A domain is owned and operated by a single entity and defined by the set of ports internal to it and at its boundary. The figure below illustrates a typical maintenance domain.



A unique maintenance level in the range of 0 to 7 is assigned to each domain by a network administrator. Levels and domain names are useful for defining the hierarchical relationship that exists among domains. The hierarchical relationship of domains parallels the structure of customer, service provider, and operator. The larger the domain, the higher the level value. For example, a customer domain would be larger than an operator domain. The customer domain may have a maintenance level of 7 and the operator domain may have a maintenance level of 0. Typically, operators would have the smallest domains and customers the largest domains, with service provider domains between them in size. All levels of the hierarchy must operate together.

Domains should not intersect because intersecting would mean management by more than one entity, which is not allowed. Domains may nest or touch but when two domains nest, the outer domain must have a higher maintenance level than the domain nested within it. Nesting maintenance domains is useful in the business model where a service provider contracts with one or more operators to provide Ethernet service to a customer. Each operator would have its own maintenance domain and the service provider would define its domain--a superset of the operator domains. Furthermore, the customer has its own end-to-end domain, which is in turn a superset of the service provider domain. Maintenance levels of various nesting domains should be communicated among the administering organizations. For example, one approach would be to have the service provider assign maintenance levels to operators.

CFM exchanges messages and performs operations on a per-domain basis. For example, running CFM at the operator level does not allow discovery of the network by the higher provider and customer levels.

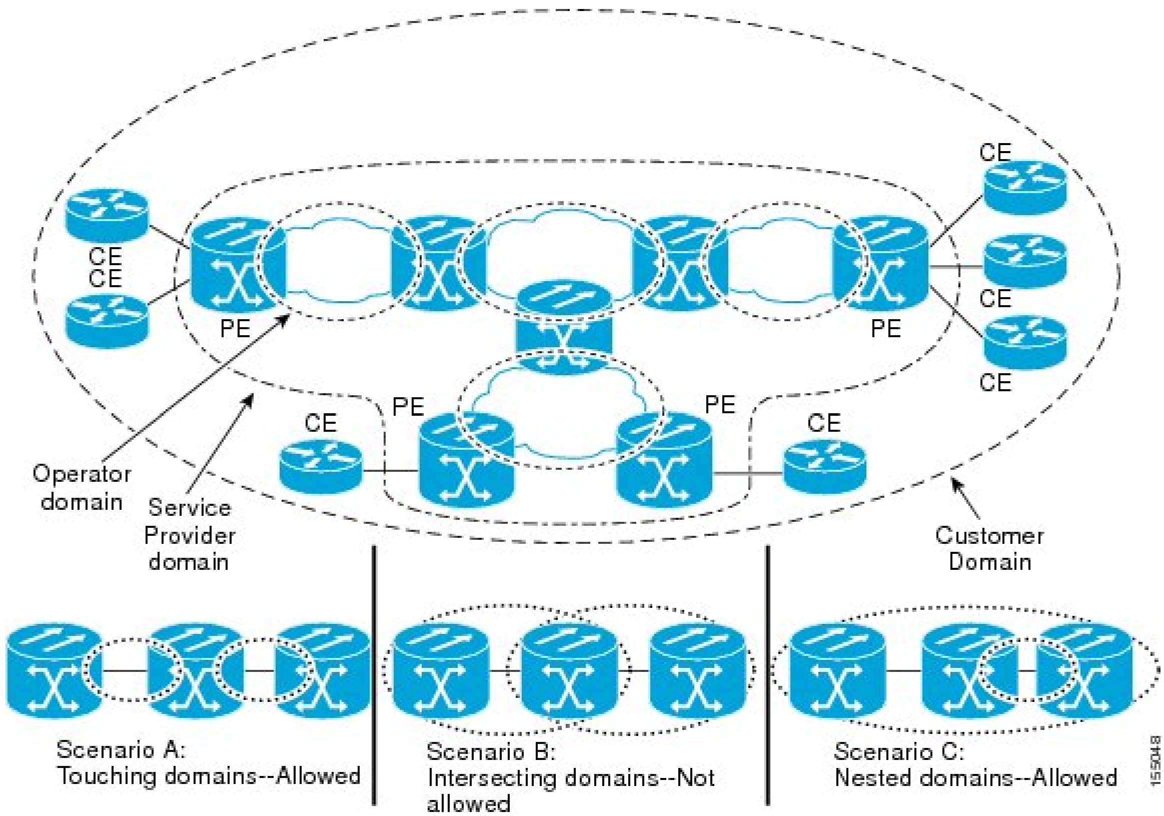
Network designers decide on domains and configurations.

The following characteristics of domains are supported:

- Name is a maximum of 154 characters
- Domain “null” is supported; the short maintenance association name is used as the identifier
- Domain configuration is not required for devices that have only MIPs
- Direction is specified when the maintenance association is configured
- Mix of Up (toward the bridge) and Down (toward the wire) MEPs is supported

A domain can be removed when all maintenance points within the domain have been removed and all remote MEP entries in the CCDB for the domain have been purged.

The figure below illustrates a hierarchy of operator, service provider, and customer domains and also illustrates touching, intersecting, and nested domains.



Maintenance Point

A maintenance point is a demarcation point on an interface or port that participates in CFM within a maintenance domain. Maintenance points on device ports act as filters that confine CFM frames within the bounds of a domain by dropping frames that do not belong to the correct level. Maintenance points must be explicitly configured on Cisco devices. Two classes of maintenance points exist, MEPs and MIPs.

Maintenance Association Endpoints

Maintenance association endpoints (MEPs) reside at the edge of a maintenance domain and confine CFM messages within the domain via the maintenance domain level. MEPs periodically transmit and receive continuity check messages (CCMs) from other MEPs within the domain. At the request of an administrator, linktrace and loopback messages can also be transmitted. MEPs are either “Up” (toward the bridge) or “Down” (toward the wire). The default direction is Up.

MEP supports multicast loopback and ping. When a multicast ping is done for a particular domain or service or vlan, all the related remote MEPs reply to the ping.

A port MEP supports a Down MEP with no VLAN and if a static remote MEP has not been detected, normal data traffic is stopped.

MEP configurations can be removed after all pending loopback and traceroute replies are removed and the service on the interface is set to transparent mode. To set the service to transparent mode, MIP filtering should not be configured.

Up MEPs

Up MEPs communicate through the Bridge Relay function and use the Bridge-Brain MAC address. An Up MEP performs the following functions:

- Sends and receives CFM frames at its level through the Bridge relay, not via the wire connected to the port on which the MEP is configured.
- Drops all CFM frames at its level (or lower level) that come from the direction of the wire.
- Processes all CFM frames at its level coming from the direction of the bridge.
- Drops all CFM frames at a lower level coming from the direction of the bridge.
- Transparently forwards all CFM frames at a higher level, independent of whether they come in from the bridge side or the wire side.
- If the port on which the Up MEP is configured is blocked by Spanning-Tree Protocol, the MEP can still transmit or receive CFM messages via the bridge function.

Down MEPs for Routed Ports and Switch Ports

Down MEPs communicate through the wire. They can be configured on routed ports and switch ports. A MIP configuration at a level higher than the level of a Down MEP is not required.

Down MEPs use the port MAC address. Down MEPs on port channels use the MAC address of the first member port. When port channel members change, the identities of Down MEPs do not have to change.

A Down MEP performs the following functions:

- Sends and receives CFM frames at its level via the wire connected to the port where the MEP is configured.
- Drops all CFM frames at its level (or at a lower level) that come from the direction of the bridge.
- Processes all CFM frames at its level coming from the direction of the wire.
- Drops all CFM frames at a lower level coming from the direction of the wire.
- If the port on which the Down MEP is configured is blocked by Spanning-Tree Protocol, the MEP can still transmit and receive CFM messages via the wire.
- Transparently forwards all CFM frames at a higher level, independent of whether they came in from the bridge or wire.

Maintenance Intermediate Points

Maintenance intermediate points (MIPs) are within a maintenance domain and catalog and forward information received from MEPs. MIPs are passive points that respond only to CFM linktrace and loopback messages. A MIP has only one level associated with it.

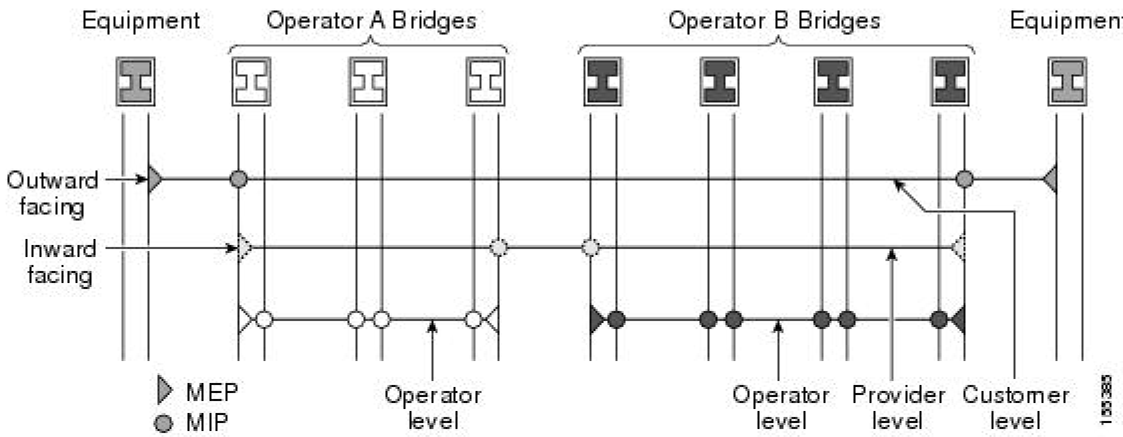
MIPs are defined as two MIP half functions (MHFs): An Up MHF that resides above the port filtering entities and a Down MHF that resides below the port filtering entities. The same configuration parameters and characteristics apply to both MHFs of a MIP, as follows:

- Can be created manually or dynamically (auto MIPs)
- Dynamically created depending on configured policies at managed objects (MA, maintenance domain, or the default domain level)
- Manual MIPs can be created under an interface and under a service instance within an interface.
- Auto MIP commands can be issued globally or under a domain or service.
- Auto MIPs can be created for VLANs at the default maintenance domain level if they are not attached to a specific MA, or they can be:
    - Created at a specified level for a maintenance domain or MA on any bridge port.
    - When a lower MEP-only option is given, auto MIPs are created at a specified level only where a MEP is configured at the next lower level for a maintenance domain or MA.
    - When an auto MIP command is not issued at the domain level or the MA level, auto MIPs are not created for a maintenance domain or MA level.
    - When an auto MIP command is not issued at the domain level but is issued at the MA level, auto MIPs are created at the MA level.
- Can be created per MA, which means that a MIP in a MA can be lower level than a MEP in another MA.
- Auto MIP creation command can be issued at the maintenance domain (level), which will create MIPs for all S-VLANs enabled or allowed on a port.
- Internal to a domain, not at the boundary.
- CFM frames received from MEPs and other MIPs are cataloged and forwarded, using both the wire and the Bridge relay.
- When MIP filtering is enabled, all CFM frames at a lower level are stopped and dropped, independent of whether they originate from the wire or the Bridge relay.
- All CFM frames at a higher level are forwarded, independent of whether they arrive from the wire or from the Bridge relay.
- Passive points respond only when triggered by CFM traceroute and loopback messages.
- Bridge-Brain MAC addresses are used.

If the port on which a MIP is configured is blocked by Spanning-Tree Protocol, the MIP can receive CFM messages and catalog them but cannot send them toward the Bridge relay. The MIP can receive and respond to CFM messages from the wire.

A MIP has only one level associated with it. The level filtering option is supported.

The figure below illustrates MEPs and MIPs at the operator, service provider, and customer levels.



CFM Messages

CFM uses standard Ethernet frames. CFM frames are distinguishable by EtherType and for multicast messages by MAC address. CFM frames are sourced, terminated, processed, and relayed by bridges. Routers can support only limited CFM functions.

Bridges that cannot interpret CFM messages forward them as normal data frames. All CFM messages are confined to a maintenance domain and to an MA. Three types of messages are supported:

- Continuity Check
- Linktrace
- Loopback

Continuity Check Messages

CFM continuity check messages (CCMs) are multicast heartbeat messages exchanged periodically among MEPs. They allow MEPs to discover other MEPs within a domain and allow MIPs to discover MEPs. CCMs are confined to a domain.

CFM CCMs have the following characteristics:

- Transmitted at a periodic interval by MEPs. The interval can be one of the following configurable values. The default is 10 seconds.
    - 10 seconds
    - 1 minute
    - 10 minutes

Note Default and supported interval values are platform dependent.

- Cataloged by MIPs at the same maintenance level.
- Terminated by remote MEPs at the same maintenance level.

- Unidirectional and do not solicit a response.
- Indicate the status of the bridge port on which the MEP is configured.

Linktrace Messages

CFM linktrace messages (LTMs) are multicast frames that a MEP transmits, at the request of an administrator, to track the path (hop-by-hop) to a destination MEP. They are similar to Layer 3 traceroute messages. LTMs allow the transmitting node to discover vital connectivity data about the path and allow the discovery of all MIPs along the path that belong to the same maintenance domain. LTMs are intercepted by maintenance points along the path and processed, transmitted, or dropped. At each hop where there is a maintenance point at the same level, a linktrace message reply (LTR) is transmitted back to the originating MEP. For each visible MIP, linktrace messages indicate ingress action, relay action, and egress action.

Linktrace messages include the destination MAC address, VLAN, and maintenance domain and they have Time To Live (TTL) to limit propagation within the network. They can be generated on demand using the CLI. LTMs are multicast and LTRs are unicast.

Loopback Messages

CFM loopback messages (LBMs) are unicast frames that a MEP transmits, at the request of an administrator, to verify connectivity to a particular maintenance point. A reply to a loopback message (LBR) indicates whether a destination is reachable but does not allow hop-by-hop discovery of the path. A loopback message is similar in concept to an Internet Control Message Protocol (ICMP) Echo (ping) message.

Because LBMs are unicast, they are forwarded like normal data frames except with the maintenance level restriction. If the outgoing port is known in the bridge’s forwarding database and allows CFM frames at the message’s maintenance level to pass through, the frame is sent out on that port. If the outgoing port is unknown, the message is broadcast on all ports in that domain.

A CFM LBM can be generated on demand using the CLI. The source of a loopback message must be a MEP; the destination may be a MEP or a MIP. Both CFM LBMs and LBRs are unicast. CFM LBMs specify the destination MAC address or MPID, VLAN, and maintenance domain.

Cross-Check Function

The cross-check function is a timer-driven postprovisioning service verification between dynamically discovered MEPs (via continuity check messages CCMs)) and expected MEPs (via configuration) for a service. The cross-check function verifies that all endpoints of a multipoint or point-to-point service are operational. The function supports notifications when the service is operational; otherwise it provides alarms and notifications for unexpected or missing endpoints.

The cross-check function is performed one time. You must initiate the cross-check function from the CLI every time you want a service verification.

SNMP Traps

The support provided by the Cisco IOS software implementation of CFM traps is Cisco proprietary information. MEPs generate two types of Simple Network Management Protocol (SNMP) traps, continuity check (CC) traps and cross-check traps.

CC Traps

- MEP up--Sent when a new MEP is discovered, the status of a remote port changes, or connectivity from a previously discovered MEP is restored after interruption.
- MEP down--Sent when a timeout or last gasp event occurs.
- Cross-connect--Sent when a service ID does not match the VLAN.
- Loop--Sent when a MEP receives its own CCMs.
- Configuration error--Sent when a MEP receives a continuity check with an overlapping MPID.

Cross-Check Traps

- Service up--Sent when all expected remote MEPs are up in time.
- MEP missing--Sent when an expected MEP is down.
- Unknown MEP--Sent when a CCM is received from an unexpected MEP.

Ethernet CFM and Ethernet OAM Interworking

Ethernet Virtual Circuit

An EVC as defined by the Metro Ethernet Forum is a port-level point-to-point or multipoint-to-multipoint Layer 2 circuit. EVC status can be used by a CE device either to find an alternative path in to the service provider network or in some cases, to fall back to a backup path over Ethernet or over another alternative service such as Frame Relay or ATM.

OAM Manager

The OAM manager is an infrastructure element that streamlines interaction between OAM protocols. The OAM manager requires two interworking OAM protocols; for example, Ethernet CFM 802.1ag and link level Ethernet OAM 802.3ah. Interaction is unidirectional from the OAM manager to the CFM protocol and the only information exchanged is the user network interface (UNI) port status. Additional port status values available include

- REMOTE_EE--Remote excessive errors
- LOCAL_EE--Local excessive errors
- TEST--Either remote or local loopback

After CFM receives the port status, it communicates that status across the CFM domain.

HA Feature Support in CFM

In access and service provider networks using Ethernet technology, HA is a requirement, especially on Ethernet OAM components that manage EVC connectivity. End-to-end connectivity status information is critical and must be maintained on a hot standby route processor (RP).

Note A hot standby RP has the same software image as the active RP and supports synchronization of line card, protocol, and application state information between RPs for supported features and protocols.

End-to-end connectivity status is maintained on the CE, PE, and access aggregation PE (uPE) network nodes based on information received by protocols such as Ethernet LMI, CFM, and 802.3ah. This status information is used to either stop traffic or switch to backup paths when an EVC is down.

Every transaction involves either accessing or updating data among various databases. If the database is synchronized across active and standby modules, the modules are transparent to clients.

The Cisco IOS infrastructure provides various component application program interfaces (APIs) that help to maintain a hot standby RP. Metro Ethernet HA clients E-LMI HA/ISSU, CFM HA/ISSU, and 802.3ah HA/ISSU interact with these components, update the database, and trigger necessary events to other components.

Benefits of CFM HA

- Elimination of network downtime for Cisco IOS software image upgrades, allowing for faster upgrades that result in high availability.
- Elimination of resource scheduling challenges associated with planned outages and late night maintenance windows.
- Accelerated deployment of new services and applications and facilitation of faster implementation of new features, hardware, and fixes than if HA wasn’t supported.
- Reduced operating costs due to outages while delivering high service levels.
- CFM updates its databases and controls its own HA messaging and versioning, and this control facilitates maintenance.

CFM HA in a Metro Ethernet Network

A standalone CFM implementation does not have explicit HA requirements. When CFM is implemented on a CE or PE with E-LMI, CFM must maintain the EVC state, which requires HA because the EVC state is critical in maintaining end-to-end connectivity. CFM configures the platform with maintenance level, domain, and maintenance point, learns the remote maintenance point information, and maps it to the appropriate EVC. CFM then aggregates data received from all remote ports and updates E-LMI; consequently HA requirements vary for CE and PE.

None of the protocols used in a Metro Ethernet Network (MEN) take action based on an EVC state, but a CE device that uses the E-LMI protocol and receives EVC information will stop sending traffic to the MEN when the EVC is down. When an EVC is down, the CE may also use a backup network, if available.

The CE receives the EVC ID, associated customer VLANs, UNI information, EVC state, and remote UNI ID and state from the MEN. The CE relies on the EVC state to send or stop traffic to the MEN via E-LMI.

The PE has EVC configuration and associated customer VLAN information and derives the EVC state and remote UNI from CFM. This information is sent to the CE using E-LMI.

Note PEs and CEs running 802.3ah OAM must maintain the port state so peers are not affected by a switchover. This information is also sent to remote nodes in CFM CCMs.

NSF SSO Support in IEEE CFM

The redundancy configurations SSO and NSF are both supported in IEEE CFM and are automatically enabled. A switchover from an active to a standby RP occurs when the active RP fails, is removed from the networking device, or is manually taken down for maintenance. NSF interoperates with the SSO feature to minimize network downtime following a switchover. The primary function of Cisco NSF is to continue forwarding packets following an RP switchover.

For detailed information about SSO, see the "Stateful Switchover" chapter of the *Cisco IOS High Availability Configuration Guide*. For detailed information about the NSF feature, see the "Cisco Nonstop Forwarding" chapter of the *Cisco IOS High Availability Configuration Guide*.

ISSU Support in IEEE CFM

ISSU allows you to perform a Cisco IOS software upgrade or downgrade without disrupting packet flow. CFM performs a bulk update and a runtime update of the continuity check database to the standby RP, including adding, deleting, or updating a row. This checkpoint data requires ISSU capability to transform messages from one release to another. All the components that perform active RP to standby RP updates using messages require ISSU support.

ISSU is automatically enabled in CFM and lowers the impact that planned maintenance activities have on network availability by allowing software changes while the system is in service. For detailed information about ISSU, see the "Cisco IOS In Service Software Upgrade Process" chapter of the *Cisco IOS High Availability Configuration Guide*.

IEEE CFM Bridge Domain Support

Note When an EFP with an inward-facing MEP (a PE interface toward a uPE interface) is configured with the default EFP encapsulation, the inward-facing MEPs on both ends receive CCMs from each other at a preset time interval. However, with the default encapsulation configured, packets are dropped and as a result, the CCMs are dropped at the ingress port. To stop packets from being dropped, at the default EFP configure the desired encapsulation using the cfm encapsulation command.

An Ethernet flow point (EFP) or a service instance is a logical demarcation point of a bridge domain on an interface. VLAN tags are used to match and map traffic to the EFP. VLAN IDs have local significance per port similar to ATM/Frame Relay virtual circuits. CFM is supported on a bridge domain associated with an EFP. The association between the bridge domain and the EFP allows CFM to use the encapsulation on the EFP. All EFPs in the same bridge domain form a broadcast domain. The bridge domain ID determines the broadcast domain.

The distinction between a VLAN port and the EFP is the encapsulation. VLAN ports use a default dot1q encapsulation. For EFPs untagged, single tagged, and double tagged, encapsulation exists with dot1q and IEEE dot1ad EtherTypes. Different EFPs belonging to the same bridge domain can use different encapsulations.

Note IEEE CFM support for bridge domains is available only on ES20 and ES40 line cards.

Untagged CFM packets can be associated with a maintenance point. An incoming untagged customer CFM packet has an EtherType of CFM and is mapped to an EVC (bridge domain) based on the encapsulation configured on the EFP. The EFP can be configured specifically to recognize these untagged packets.

Switchport VLANs and EFPs configured with bridge domains handle MEPs and MIPs for a service independently. The bridge domain-to-VLAN space mapping is different for different platforms. For bridge domain and switchport VLAN interworking (maintenance points, ingress and egress are on both switchports and EFPs), a bridge domain-VLAN service should be configured on platforms where the bridge domain and switchport VLAN represent the same broadcast domain. On the Cisco 7600 series router, a bridge domain and a switchport VLAN with the same number form a single broadcast domain.

How to Set Up IEEE Ethernet CFM in a Service Provider Network

Designing CFM Domains

Note To have an operator, service provider, or customer domain is optional. A network may have a single domain or multiple domains. The steps listed here show the sequence when all three types of domains will be assigned.

Before You Begin

- Knowledge and understanding of the network topology.
- Understanding of organizational entities involved in managing the network; for example, operators, service providers, network operations centers (NOCs), and customer service centers.
- Understanding of the type and scale of services to be offered.
- Agreement by all organizational entities on the responsibilities, roles, and restrictions for each organizational entity.
- Determination of the number of maintenance domains in the network.
- Determination of the nesting and disjoint maintenance domains.
- Assignment of maintenance levels and names to domains based on agreement between the service provider and operator or operators.
- Determination of whether the domain should be inward or outward.

SUMMARY STEPS

1. Determine operator level MIPs.
2. Determine operator level MEPs.
3. Determine service provider MIPs.
4. Determine service provider MEPs.
5. Determine customer MIPs.
6. Determine customer MEPs.

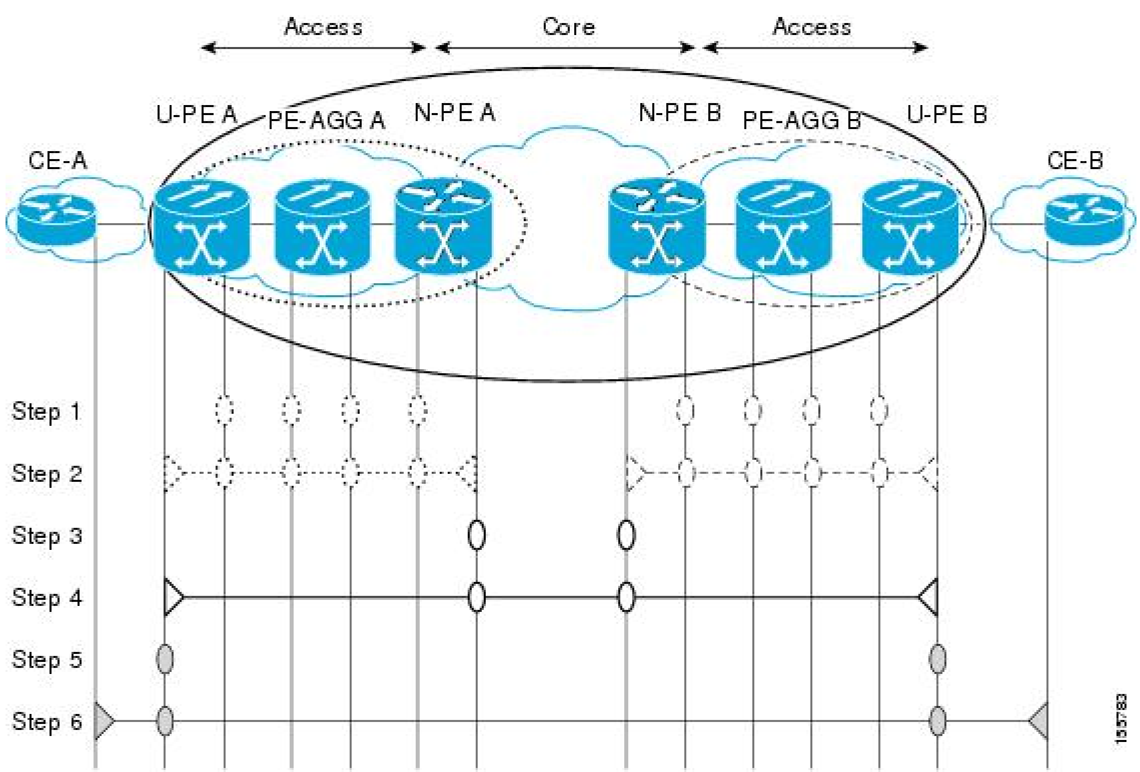
DETAILED STEPS

	Command or Action	Purpose
Step 1	Determine operator level MIPs.	Follow these steps: • Starting at lowest operator level domain, assign a MIP at every interface internal to the operator network to be visible to CFM. • Proceed to next higher operator level and assign MIPs. • Verify that every port that has a MIP at a lower level does not have maintenance points at a higher level. • Repeat steps a through d until all operator MIPs are determined.
Step 2	Determine operator level MEPs.	Follow these steps: • Starting at the lowest operator level domain, assign a MEP at every UNI that is part of a service instance. • Assign a MEP at the network to network interface (NNI) between operators, if there is more than one operator. • Proceed to next higher operator level and assign MEPs. • A port with a MIP at a lower level cannot have maintenance points at a higher level. A port with a MEP at a lower level should have either a MIP or MEP at a higher level.
Step 3	Determine service provider MIPs.	Follow these steps: • Starting at the lowest service provider level domain, assign service provider MIPs at the NNI between operators (if more than one). • Proceed to next higher service provider level and assign MIPs. • A port with a MIP at a lower level cannot have maintenance points at a higher level. A port with a MEP at a lower level should not have either a MIP or a MEP at a higher level.
Step 4	Determine service provider MEPs.	Follow these steps: • Starting at the lowest service provider level domain, assign a MEP at every UNI that is part of a service instance. • Proceed to next higher service provider level and assign MEPs. • A port with a MIP at a lower level cannot have maintenance points at a higher level. A port with a MEP at a lower level should have either a MIP or a MEP at a higher level.
Step 5	Determine customer MIPs.	Customer MIPs are allowed only on the UNIs at the uPEs if the service provider allows the customer to run CFM. Otherwise, the service provider can configure Cisco devices to block CFM frames. • Configure a MIP on every uPE, at the UNI port, in the customer maintenance domain.

	Command or Action	Purpose
		• Ensure the MIPs are at a maintenance level that is at least one higher than the highest level service provider domain.
Step 6	Determine customer MEPs.	Customer MEPs are on customer equipment. Assign an outward facing MEP within an outward domain at the appropriate customer level at the handoff between the service provider and the customer.

Examples

The figure below shows an example of a network with a service provider and two operators, A and B. Three domains are to be established to map to each operator and the service provider. In this example, for simplicity we assume that the network uses Ethernet transport end to end. CFM, however, can be used with other transports.



Configuring IEEE Ethernet CFM

Provisioning the Network

Provisioning the Network for CE-A

Perform this task to prepare the network for Ethernet CFM.

Before You Begin

To configure MIPs at different interfaces and service instances, you must configure an auto MIP under the domain and service.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **exit**
6. **ethernet cfm global**
7. **ethernet cfm ieee**
8. **ethernet cfm traceroute cache**
9. **ethernet cfm traceroute cache size** *entries*
10. **ethernet cfm traceroute cache hold-time** *minutes*
11. **snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**]
12. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**]
13. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 5	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 6	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 7	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 8	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 9	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.

	Command or Action	Purpose
Step 10	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 11	**snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM continuity check events.
Step 12	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown`	Enables SNMP trap generation for Ethernet CFM continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.

Step 13	**end**
	
	Example:
	
	`Router(config)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning the Network for U-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **exit**
5. **ethernet cfm domain** *domain-name* **level** *level-id*
6. **mep archive-hold-time** *minutes*
7. **exit**
8. **ethernet cfm mip** {**auto-create level** *level-id* **vlan** {*vlan-id*| *vlan-id-vlan-id*| **,** *vlan-id-vlan-id*}[**lower-mep-only**] [**sender-id chassis**]| **filter**}
9. **ethernet cfm domain** *domain-name* **level** *level-id*
10. **mep archive-hold-time** *minutes*
11. **mip auto-create** [**lower-mep-only**]
12. **exit**
13. **ethernet cfm global**
14. **ethernet cfm ieee**
15. **ethernet cfm traceroute cache**
16. **ethernet cfm traceroute cache size** *entries*
17. **ethernet cfm traceroute cache hold-time** *minutes*
18. **interface** *type number*
19. **ethernet cfm mip level** *level-id*
20. **exit**
21. **snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**]
22. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**]
23. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and places the CLI in Ethernet CFM configuration mode.

Step 4	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 5	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain at a particular maintenance level and places the CLI in Ethernet CFM configuration mode.
Step 6	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 7	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 8	**ethernet cfm mip** {**auto-create level** *level-id* **vlan** {*vlan-id*| *vlan-id-vlan-id*| **,** *vlan-id-vlan-id*}[**lower-mep-only**] [**sender-id chassis**]| **filter**} **Example:** `Router(config)# ethernet cfm mip auto-create level 1 vlan 2000`	Dynamically creates a MIP and provisions it globally at a specified maintenance level for VLAN IDs that are not associated with specific MAs or enables level filtering.

	Command or Action	Purpose
Step 9	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorA level 1`	Defines a CFM maintenance domain at a particular maintenance level and places the CLI in Ethernet CFM configuration mode.
Step 10	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 11	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.

Step 12	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 13	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 14	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 15	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 16	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.

	Command or Action	Purpose
Step 17	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 18	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet4/2`	Specifies an interface and places the CLI in interface configuration mode.
Step 19	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 20	**exit**
	Example:
	`Router(config-if)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 21	**snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 22	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.
Step 23	**end** **Example:** `Router(config)# end`	Returns the CLI to privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router#`	

Provisioning the Network for PE-AGG A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mip auto-create** [**lower-mep-only**]
5. **mep archive-hold-time** *minutes*
6. **exit**
7. **ethernet cfm global**
8. **ethernet cfm ieee**
9. **interface** *type number*
10. **ethernet cfm mip level** *level-id*
11. **interface** *type number*
12. **ethernet cfm mip level** *level-id*
13. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorA level 1`	Defines a domain and places the CLI in Ethernet CFM configuration mode.
Step 4	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.
Step 5	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 6	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 7	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 8	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 9	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet3/1`	Specifies an interface and places the CLI in interface configuration mode.
Step 10	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

	Command or Action	Purpose
Step 11	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet4/1`	Specifies an interface.
Step 12	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 13	**end**
	
	Example:
	`Router(config-if)# end`
	
	Example:
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning the Network for N-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **mip auto-create** [**lower-mep-only**]
6. **exit**
7. **ethernet cfm domain** *domain-name* **level** *level-id*
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm ieee**
12. **ethernet cfm traceroute cache**
13. **ethernet cfm traceroute cache size** *entries*
14. **ethernet cfm traceroute cache hold-time** *minutes*
15. **interface** *type number*
16. **ethernet cfm mip level** *level-id*
17. **exit**
18. **snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**]
19. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**]
20. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain and level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 5	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.

Step 6	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 7	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorA level 1`	Defines a CFM maintenance domain and level and places the CLI in Ethernet CFM configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 9	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

	Command or Action	Purpose
Step 10	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 12	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 13	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 14	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 15	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet3/0`	Specifies an interface and places the CLI in interface configuration mode.
Step 16	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 17	**exit**
	
	Example:
	
	`Router(config-if)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

	Command or Action	Purpose
Step 18	**snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 19	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.

Step 20	**end**
	
	Example:
	
	`Router(config)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning the Network for U-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **exit**
5. **ethernet cfm domain** *domain-name* **level** *level-id*
6. **mep archive-hold-time** *minutes*
7. **exit**
8. **ethernet cfm domain** *domain-name* **level** *level-id*
9. **mep archive-hold-time** *minutes*
10. **exit**
11. **ethernet cfm global**
12. **ethernet cfm ieee**
13. **ethernet cfm traceroute cache**
14. **ethernet cfm traceroute cache size** *entries*
15. **ethernet cfm traceroute cache hold-time** *minutes*
16. **interface** *type number*
17. **ethernet cfm mip level** *level-id*
18. **exit**
19. **snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**]
20. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**]
21. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.

Step 4	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 5	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 6	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 7	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 8	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorB level 2`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 9	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

	Command or Action	Purpose

Step 10	**exit**
	
	Example:
	`Router(config-ecfm)# exit`
	
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 11	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 12	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 13	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 14	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 15	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 16	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet2/0`	Specifies an interface and places the CLI in interface configuration mode.
Step 17	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP.

	Command or Action	Purpose

Step 18	**exit**
	
	Example:
	`Router(config-if)# exit`
	
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 19	**snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 20	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.

Step 21	**end**
	
	Example:
	`Router(config)# end`
	
	Example:
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning the Network for PE-AGG B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **mip auto-create** [**lower-mep-only**]
6. **exit**
7. **ethernet cfm global**
8. **ethernet cfm ieee**
9. **interface** *type number*
10. **ethernet cfm mip level** *level-id*
11. **interface** *type number*
12. **ethernet cfm mip level** *level-id*
13. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorB level 2`	Defines a domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

	Command or Action	Purpose
Step 5	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.

Step 6	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 7	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 8	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 9	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet1/1`	Specifies an interface and places the CLI in interface configuration mode.
Step 10	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP.
Step 11	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet2/1`	Specifies an interface.
Step 12	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

	Command or Action	Purpose

Step 13	**end**
	
	Example:
	
	`Router(config-if)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning the Network for U-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **exit**
6. **ethernet cfm domain** *domain-name* **level** *level-id*
7. **mep archive-hold-time** *minutes*
8. **mip auto-create** [**lower-mep-only**]
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm ieee**
12. **ethernet cfm traceroute cache**
13. **ethernet cfm traceroute cache size** *entries*
14. **ethernet cfm traceroute cache hold-time** *minutes*
15. **interface** *type number*
16. **ethernet cfm mip level** *level-id*
17. **exit**
18. **snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**]
19. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**]
20. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 5	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 6	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorB level 2`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 7	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

	Command or Action	Purpose
Step 8	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.

Step 9	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 10	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 12	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 13	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 14	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 15	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet1/2`	Specifies an interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 16	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 17	**exit**
	Example:
	`Router(config-if)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 18	**snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 19	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.

Step 20	**end**
	Example:
	`Router(config)# end`
	Example:
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning the Network for CE-B

SUMMARY STEPS

1.
2. **enable**
3. **configure terminal**
4. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
5. **mep archive-hold-time** *minutes*
6. **exit**
7. **ethernet cfm global**
8. **ethernet cfm ieee**
9. **ethernet cfm traceroute cache**
10. **ethernet cfm traceroute cache size** *entries*
11. **ethernet cfm traceroute cache hold-time** *minutes*
12. **snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**]
13. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**]
14. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1		**CE-B**
Step 2	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 3	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 4	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Router(config)# ethernet cfm domain Customer level 7 direction outward`	Defines an outward CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 5	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 6	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 7	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 8	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 9	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 10	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 11	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.

	Command or Action	Purpose
Step 12	**snmp-server enable traps ethernet cfm cc** [**mep-up**][**mep-down**][**config**] [**loop**] [**cross-connect**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 13	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown**| **mep-missing**| **service-up**] **Example:** `Router(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.

Step 14	**end**
	
	Example:
	
	`Router(config)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service

Provisioning Service for CE-A

Perform this task to set up service for Ethernet CFM. Optionally, when this task is completed, you may configure and enable the cross-check function. To perform this optional task, see "Configuring and Enabling the Cross-Check Function".

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
5. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
6. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
7. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
8. **exit**
9. **mep archive-hold-time** *minutes*
10. **exit**
11. **ethernet cfm global**
12. **ethernet cfm ieee**
13. **ethernet cfm traceroute cache**
14. **ethernet cfm traceroute cache size** *entries*
15. **ethernet cfm traceroute cache hold-time** *minutes*
16. **interface** *type number*
17. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
18. Do one of the following:
    - **switchport**
    - **switchport mode trunk**
19. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
20. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a specified maintenance level and places the CLI in Ethernet CFM configuration mode.
Step 4	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service Customer1 vlan 101 direction down`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 5	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 6	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 7	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 8	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 9	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

	Command or Action	Purpose

Step 10	**exit**
	
	Example:
	`Router(config-ecfm)# exit`
	
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 11	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 12	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 13	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 14	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 15	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 16	**interface** *type number* **Example:** `Router(config)# interface ethernet 0/3`	Specifies an interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 17	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain Customer mpid 701 vlan 100`	Sets a port as internal to a maintenance domain and defines it as a MEP.

Step 18	Do one of the following:
	• **switchport**
	• **switchport mode trunk**
	
	Example:
	
	`Router(config-if)# switchport`
	
	Example:
	
	`Router(config-if)# switchport mode trunk`
		Specifies a switchport or alternatively, specifies a trunking VLAN Layer 2 interface.

Step 19	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain Customer mpid 701 vlan 100`	Sets a port as internal to a maintenance domain and defines it as a MEP.

Step 20	**end**
	
	Example:
	
	`Router(config-if)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service for U-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **exit**
5. **exit**
6. **ethernet cfm domain** *domain-name* **level** *level-id*
7. **mep archive-hold-time** *minutes*
8. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
9. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
10. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
11. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
12. **exit**
13. **exit**
14. **ethernet cfm domain** *domain-name* **level** *level-id*
15. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
16. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
17. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
18. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
19. **exit**
20. **mep archive-hold-time** *minutes*
21. **exit**
22. **ethernet cfm global**
23. **ethernet cfm ieee**
24. **ethernet cfm traceroute cache**
25. **ethernet cfm traceroute cache size** *entries*
26. **ethernet cfm traceroute cache hold-time** *minutes*
27. **interface** *type number*
28. **ethernet cfm mip level** *level-id*
29. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
30. **interface** *type number*
31. **ethernet cfm mip level** *level-id*
32. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.

Step 4	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 5	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 6	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 7	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 8	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1 vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 9	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 10	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 11	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 12	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 13	**exit** **Example:** `Router(config-ecfm)# exit`	Returns the CLI to global configuration mode.

	Command or Action	Purpose
	Example: `Router(config)#`	
Step 14	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorA level 1`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 15	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1OpA vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 16	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 17	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 18	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 19	**exit**
	Example:
	`Router(config-ecfm-srv)# exit`
	Example:
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 20	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

Step 21	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 22	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 23	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 24	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 25	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 26	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 27	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet3/2`	Specifies an interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 28	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 7`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.
Step 29	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain Customer mpid 701 vlan 100`	Sets a port as internal to a maintenance domain and defines it as a MEP.
Step 30	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet 4/2`	Specifies an interface.
Step 31	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 32	**end**
	
	Example:
	
	`Router(config-if)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service for PE-AGG A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **mip auto-create** [**lower-mep-only**]
6. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
7. **exit**
8. **exit**
9. **ethernet cfm global**
10. **ethernet cfm ieee**
11. **interface** *type number*
12. **ethernet cfm mip level** *level-id*
13. **interface** *type number*
14. **ethernet cfm mip level** *level-id*
15. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorA level 1`	Defines a domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

	Command or Action	Purpose
Step 5	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.
Step 6	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1OpA vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.

Step 7	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 8	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 9	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 10	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 11	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet3/1`	Specifies an interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 12	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.
Step 13	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet4/1`	Specifies an interface.
Step 14	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 15	**end**
	
	Example:
	
	`Router(config-if)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service for N-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **mip auto-create** [**lower-mep-only**]
6. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
7. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
8. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
9. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
10. **exit**
11. **exit**
12. **ethernet cfm domain** *domain-name* **level** *level-id*
13. **mep archive-hold-time** *minutes*
14. **mip auto-create** [**lower-mep-only**]
15. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
16. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
17. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
18. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
19. **exit**
20. **exit**
21. **ethernet cfm global**
22. **ethernet cfm ieee**
23. **ethernet cfm traceroute cache**
24. **ethernet cfm traceroute cache size** *entries*
25. **ethernet cfm traceroute cache hold-time** *minutes*
26. **interface** *type number*
27. **ethernet cfm mip level** *level-id*
28. **interface** *type number*
29. **ethernet cfm mip level** *level-id*
30. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
31. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 5	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.
Step 6	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1 vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 7	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 8	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.

	Command or Action	Purpose
Step 9	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 10	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 11	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 12	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorA level 1`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 13	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 14	**mip auto-create** [**lower-mep-only**] **Example:** `Router(config-ecfm)# mip auto-create`	Enables the dynamic creation of a MIP at a maintenance domain level.

	Command or Action	Purpose
Step 15	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1OpA vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 16	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 17	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 18	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 19	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 20	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

	Command or Action	Purpose
Step 21	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 22	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 23	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 24	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 25	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 26	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet3/0`	Specifies an interface and places the CLI in interface configuration mode.
Step 27	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 1`	Provisions a manual MIP. • This is an optional manual MIP
Step 28	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet4/0`	Specifies an interface.
Step 29	**ethernet cfm mip level** *level-id*	Provisions a manual MIP.

	Command or Action	Purpose
	Example: `Router(config-if)# ethernet cfm mip level 4`	• This is an optional manual MIP
Step 30	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain Customer mpid 701 vlan 100`	Sets a port as internal to a maintenance domain and defines it as a MEP.

Step 31	**end**
	Example:
	`Router(config-if)# end`
	Example:
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service for U-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **exit**
5. **ethernet cfm domain** *domain-name* **level** *level-id*
6. **mep archive-hold-time** *minutes*
7. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
8. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
9. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
10. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
11. **exit**
12. **exit**
13. **ethernet cfm domain** *domain-name* **level** *level-id*
14. **mep archive-hold-time** *minutes*
15. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
16. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
17. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
18. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
19. **exit**
20. **exit**
21. **ethernet cfm global**
22. **ethernet cfm ieee**
23. **ethernet cfm traceroute cache**
24. **ethernet cfm traceroute cache size** *entries*
25. **ethernet cfm traceroute cache hold-time** *minutes*
26. **interface** *type number*
27. **ethernet cfm mip level** *level-id*
28. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
29. **interface** *type number*
30. **ethernet cfm mip level** *level-id*
31. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.

Step 4	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 5	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 6	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 7	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service Customer1 vlan 101 direction down`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 8	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]	Enables the transmission of CCMs.

	Command or Action	Purpose
	Example: `Router(config-ecfm-srv)# continuity-check`	
Step 9	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 10	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 11	**exit**
	Example:
	`Router(config-ecfm-srv)# exit`
	Example:
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 12	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 13	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorB level 2`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 14	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 15	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1 vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 16	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 17	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 18	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 19	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 20	**exit** **Example:** `Router(config-ecfm)# exit`	Returns the CLI to global configuration mode.

	Command or Action	Purpose
	Example: `Router(config)#`	
Step 21	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 22	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 23	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 24	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 25	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 26	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet1/0`	Specifies an interface and places the CLI in interface configuration mode.
Step 27	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 7`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

	Command or Action	Purpose
Step 28	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain Customer mpid 701 vlan 100`	Sets a port as internal to a maintenance domain and defines it as a MEP.
Step 29	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet2/0`	Specifies an interface.
Step 30	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 31	**end**
	
	Example:
	
	`Router(config)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service for PE-AGG B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
6. **exit**
7. **exit**
8. **ethernet cfm global**
9. **ethernet cfm ieee**
10. **interface** *type number*
11. **ethernet cfm mip level** *level-id*
12. **interface** *type number*
13. **ethernet cfm mip level** *level-id*
14. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorB level 2`	Defines a domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Set the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

	Command or Action	Purpose
Step 5	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1 vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.

Step 6	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 7	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 8	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 9	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 10	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet1/1`	Specifies an interface and places the CLI in interface configuration mode.
Step 11	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

	Command or Action	Purpose
Step 12	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet2/1`	Specifies an interface.
Step 13	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.

Step 14	**end**
	
	Example:
	
	`Router(config-if)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service for N-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep archive-hold-time** *minutes*
5. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
6. **exit**
7. **ethernet cfm domain** *domain-name* **level** *level-id*
8. **mep archive-hold-time** *minutes*
9. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
10. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
11. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
12. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
13. **exit**
14. **exit**
15. **ethernet cfm global**
16. **ethernet cfm ieee**
17. **ethernet cfm traceroute cache**
18. **ethernet cfm traceroute cache size** *entries*
19. **ethernet cfm traceroute cache hold-time** *minutes*
20. **interface** *type number*
21. **ethernet cfm mip level** *level-id*
22. **interface** *type number*
23. **ethernet cfm mip level** *level-id*
24. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
25. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 5	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1 vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.

Step 6	**exit**
	Example:
	`Router(config-ecfm-srv)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 7	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain OperatorB level 2`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.

	Command or Action	Purpose
Step 9	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service MetroCustomer1OpB vlan 101`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 10	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 11	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 12	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

Step 13	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 14	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

	Command or Action	Purpose
Step 15	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 16	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 17	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 18	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 19	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 20	**interface** *type number* **Example:** `Router(config)# interface gigabitethernet1/2`	Specifies an interface and places the CLI in interface configuration mode.
Step 21	**ethernet cfm mip level** *level-id* **Example:** `Router(config-if)# ethernet cfm mip level 2`	Provisions a manual MIP. • This is an optional use of a manual MIP and can override auto MIP configuration.
Step 22	**interface** *type number* **Example:** `Router(config-if)# interface gigabitethernet2/2`	Specifies an interface.
Step 23	**ethernet cfm mip level** *level-id*	Provisions a manual MIP.

	Command or Action	Purpose
	Example: `Router(config-if)# ethernet cfm mip level 4`	• This is an optional use of a manual MIP and can override auto MIP configuration.
Step 24	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain Customer mpid 701 vlan 100`	Sets a port as internal to a maintenance domain and defines it as a MEP.

Step 25	**end**
	Example:
	`Router(config-if)#`
	Example:
	`Router#`
		Returns the CLI to privileged EXEC mode.

Provisioning Service for CE-B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
4. **mep archive-hold-time** *minutes*
5. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
6. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
7. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
8. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
9. **exit**
10. **exit**
11. **ethernet cfm global**
12. **ethernet cfm ieee**
13. **ethernet cfm traceroute cache**
14. **ethernet cfm traceroute cache size** *entries*
15. **ethernet cfm traceroute cache hold-time** *minutes*
16. **interface** *type number*
17. **ethernet cfm mep level** *level-id* [**inward**| **outward domain** *domain-name*] **mpid** *id* **vlan** {**any** | *vlan-id* | **,** *vlan-id*| *vlan-id* **-** *vlan-id*| **,** *vlan-id* **-** *vlan-id*}
18. Do one of the following:
    - **switchport**
    -
    - **switchport mode trunk**
19. **ethernet cfm mep level** *level-id* [**inward**| **outward domain** *domain-name*] **mpid** *id* **vlan** {**any** | *vlan-id* | **,** *vlan-id*| *vlan-id* **-** *vlan-id*| **,** *vlan-id* **-** *vlan-id*}
20. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Router(config)# ethernet cfm domain Customer level 7 direction outward`	Defines a CFM maintenance domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep archive-hold-time** *minutes* **Example:** `Router(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 5	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service Customer1 vlan 101 direction down`	Configures a maintenance association within a maintenance domain and places the CLI into CFM service configuration mode.
Step 6	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 7	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Configures the time period between CCM transmissions.
Step 8	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check loss-threshold 10`	Sets the number of CCMs that should be missed before declaring that a remote MEP is down.

	Command or Action	Purpose

Step 9	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

Step 10	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 11	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 12	**ethernet cfm ieee** **Example:** `Router(config)# ethernet cfm ieee`	Enables the CFM IEEE version of CFM. • This command is automatically issued when the **ethernet cfm global** command is issued
Step 13	**ethernet cfm traceroute cache** **Example:** `Router(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 14	**ethernet cfm traceroute cache size** *entries* **Example:** `Router(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 15	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Router(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.

	Command or Action	Purpose
Step 16	**interface** *type number* **Example:** `Router(config)# interface ethernet 0/1`	Specifies an interface and places the CLI in interface configuration mode.
Step 17	**ethernet cfm mep level** *level-id* [**inward**| **outward domain** *domain-name*] **mpid** *id* **vlan** {**any** | *vlan-id* | **,** *vlan-id*| *vlan-id* **-** *vlan-id*| **,** *vlan-id* **-** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep level 7 outward domain Customer mpid 701 vlan 100`	Sets an interface as a domain boundary.

Step 18	Do one of the following:
	• **switchport**
	•
	• **switchport mode trunk**
	
	Example:
	
	`Router(config-if)# switchport`
	
	Example:
	
	Example:
	
	`Router(config-if)# switchport mode trunk`
		Specifies a switchport or alternatively, specifies a trunking VLAN Layer 2 interface.

Step 19	**ethernet cfm mep level** *level-id* [**inward**| **outward domain** *domain-name*] **mpid** *id* **vlan** {**any** | *vlan-id* | **,** *vlan-id*| *vlan-id* **-** *vlan-id*| **,** *vlan-id* **-** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep level 7 outward domain Customer mpid 701 vlan 100`	Provisions an interface as a domain boundary.
Step 20	**end** **Example:** `Router(config-if)# end`	Returns the CLI to privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router#`	

Configuring and Enabling the Cross-Check Function

Perform this task to configure and enable cross-checking for an Up MEP. This task requires you to configure and enable cross-checking on two devices. This task is optional.

Configuring and Enabling Cross-Checking for an Up MEP (U-PE A)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*]
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}}

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*] **Example:** `Router(config-ecfm)# mep crosscheck mpid 402 vlan 100`	Statically defines a remote MEP on a specified VLAN within the domain.

Step 5	**exit**
	
	Example:
	
	`Router(config-ecfm)# exit`
	
	Example:
	
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Router(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started

Step 7	**exit**
	
	Example:
	
	`Router(config)# exit`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}} **Example:** `Router# ethernet cfm mep crosscheck enable domain cust4 vlan 100`	Enables cross-checking between the list of configured remote MEPs of a domain and MEPs learned through CCMs.

Examples

The following example configures cross-checking on an Up MEP (U-PE A):

```
U-PE A
ethernet cfm domain ServiceProvider level 4
mep mpid 402
!
ethernet cfm mep crosscheck start-delay 60
```

The following example enables cross-checking on an Up MEP (U-PE A):

```
U-PE A
U-PEA# ethernet cfm mep crosscheck enable domain cust4 vlan 100
```

Configuring and Enabling Cross-Checking for an Up MEP (U-PE B)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*]
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM domain at a specified level and places the CLI in Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*] **Example:** `Router(config-ecfm)# mep crosscheck mpid 401 vlan 100`	Statically defines a remote MEP on a specified VLAN within the domain.

Step 5	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Router(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started.

Step 7	**exit**
	Example:
	`Router(config)# exit`
	Example:
	`Router#`
		Returns the CLI to privileged EXEC mode.

Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}} **Example:** `Router# ethernet cfm mep crosscheck enable domain cust4 vlan 100`	Enables cross-checking between the list of configured remote MEPs of a domain and MEPs learned through CCMs.

Examples

The following example configures cross-checking on an Up MEP (U-PE B):

U-PE B

```
ethernet cfm domain ServiceProvider level 4
mep mpid 401
!
ethernet cfm mep crosscheck start-delay 60
```

The following example enables cross-checking on an Up MEP (U-PE B):

```
U-PE B
U-PEB# ethernet cfm mep crosscheck enable domain cust4 vlan 100
```

Configuring and Enabling Cross-Checking for a Down MEP (CE-A)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep mpid** *mpid*
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines a CFM domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep mpid** *mpid* **Example:** `Router(config-ecfm)# mep mpid 702`	Statically defines the MEPs within a maintenance association.

	Command or Action	Purpose

Step 5	**exit**
	
	Example:
	`Router(config-ecfm)# exit`
	
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Router(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started.

Step 7	**exit**
	
	Example:
	`Router(config)# exit`
	
	Example:
	`Router#`
		Returns the CLI to privileged EXEC mode.

Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}} **Example:** `Router# ethernet cfm mep crosscheck enable domain cust4 vlan 100`	Enables cross-checking between the list of configured remote MEPs of a domain and MEPs learned through CCMs.

Configuring and Enabling Cross-Checking for a Down MEP (CE-B)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep mpid** *mpid*
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain Customer level 7`	Defines an outward CFM domain at a specified level and places the CLI in Ethernet CFM configuration mode.
Step 4	**mep mpid** *mpid* **Example:** `Router(config-ecfm)# mep mpid 702`	Statically defines the MEPs within a maintenance association.
Step 5	**exit** **Example:** `Router(config-ecfm)# exit`	Returns the CLI to global configuration mode.

	Command or Action	Purpose
	Example: `Router(config)#`	
Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Router(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started.

Step 7	**exit**
	
	Example:
	
	`Router(config)# exit`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id* **-** *vlan-id* | **,** *vlan-id* **-** *vlan-id*}} **Example:** `Router# ethernet cfm mep crosscheck enable domain cust4 vlan 100`	Enables cross-checking between the list of configured remote MEPs of a domain and MEPs learned through CCMs.

Configuring Ethernet OAM 802.3ah Interaction with CFM

For Ethernet OAM to function with CFM, you must configure an EVC and the OAM manager and associate the EVC with CFM. Additionally, you must use an Up MEP when you want interaction with the OAM manager.

Configuring the OAM Manager

Note If you configure, change, or remove a UNI service type, EVC, Ethernet service instance, or CE-VLAN configuration, all configurations are checked to ensure that UNI service types are matched with EVC configurations and Ethernet service instances are matched with CE-VLAN configurations. Configurations are rejected if the pairings do not match.

Perform this task to configure the OAM manager on a PE device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]
5. **exit**
6. **exit**
7. **ethernet evc** *evc-id*
8. **oam protocol** {**cfm svlan** *svlan-id* **domain**
9. **exit**
10. Repeat Steps 3 through 9 to define other CFM domains that you want OAM manager to monitor.
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain cstmr1 level 3`	Defines a CFM domain, sets the domain level, and places the command-line interface (CLI) in Ethernet CFM configuration mode.
Step 4	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**] **Example:** `Router(config-ecfm)# service vlan-id 10`	Configures a maintenance association within a maintenance domain and places the CLI into Ethernet CFM service configuration mode.
Step 5	**exit** **Example:** `Router(config-ecfm-srv)# exit`	Returns the CLI to Ethernet CFM configuration mode.

	Command or Action	Purpose
	Example: `Router(config-ecfm)#`	

Step 6	**exit**
	Example:
	`Router(config-ecfm)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 7	**ethernet evc** *evc-id* **Example:** `Router(config)# ethernet evc 50`	Defines an EVC and places the CLI in EVC configuration mode.
Step 8	**oam protocol** {**cfm svlan** *svlan-id* **domain** **Example:** *domain-name* | **ldp**} **Example:** `Router(config-evc)# oam protocol cfm svlan 10 domain cstmr1`	Configures the OAM protocol.

Step 9	**exit**
	Example:
	`Router(config-evc)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 10	Repeat Steps 3 through 9 to define other CFM domains that you want OAM manager to monitor.	--
Step 11	**end** **Example:** `Router(config)# end`	Returns the CLI to privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router#`	

Enabling Ethernet OAM

The order in which the global and interface configuration commands are issued determines the configuration. The last command that is issued has precedence.

Perform this task to enable Ethernet OAM on a device or on an interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **switchport**
5. **ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*]
6. **ethernet oam remote-loopback** {**supported** | **timeout** *seconds*}
7. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
8. **service instance** *id* **ethernet** [*evc-name*]
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 1/3`	Specifies an interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 4	**switchport** **Example:** `Router(config-if)# switchport`	Configures a switchport.
Step 5	**ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*] **Example:** `Router(config-if)# ethernet oam max-rate 50`	Enables Ethernet OAM on an interface.
Step 6	**ethernet oam remote-loopback** {**supported** | **timeout** *seconds*} **Example:** `Router(config-if)# ethernet oam remote-loopback supported`	Enables Ethernet remote loopback on the interface or sets a loopback timeout period.
Step 7	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain cstmr1 mpid 33 vlan 10`	Sets a port as internal to a maintenance domain and defines it as a MEP.
Step 8	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Router(config-if)# service instance 1 ethernet evc1`	Configures an Ethernet service instance and places the CLI in Ethernet CFM service configuration mode.

Step 9	**end**
	
	Example:
	
	`Router(config-ecfm-srv)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Configuring CFM for Bridge Domains

Perform this task to configure Ethernet CFM for bridge domains. This task is optional.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. Do one of the following:
    - **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]
5. **exit**
6. **exit**
7. **ethernet cfm domain** *domain-name* **level** *level-id*
8. **exit**
9. **ethernet cfm domain** *domain-name* **level** *level-id*
10. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]
11. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
12. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
13. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
14. **mep mpid** *mpid*
15. **exit**
16. **ethernet evc** *evc-name*
17. **exit**
18. **interface** *type number*
19. **no ip address**
20. **service instance** *id* **ethernet** [*evc-name*]
21. **encapsulation dot1q** *vlan-id*
22. **bridge-domain** *bridge-id*
23. **cfm mep domain** *domain-name* **mpid** *mpid-value*
24. **end**
25. **configure terminal**
26. **interface** *type name*
27. **no ip address**
28. **service instance** *id* **ethernet** [*evc-name*]
29. **encapsulation dot1q** *vlan-id*
30. **bridge-domain** *bridge-id*
31. **cfm mep domain** *domain-name* **mpid** *mpid-value*
32. **cfm mip level** *level-id*
33. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain CUSTOMER level 7`	Defines a CFM maintenance domain at a particular level and places the CLI in Ethernet CFM configuration mode.

Step 4	Do one of the following:
	
	• **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]
	
	Example:
	
	`Router(config-ecfm)# service s1 evc e1 vlan 10`
	
	Example:
	
	Example:
	
	`Router(config-ecfm)# service s1 evc e1`
		Configures a maintenance association within a maintenance domain and places the CLI into Ethernet CFM service configuration mode.

Step 5	**exit**
	
	Example:
	
	`Router(config-ecfm-srv)# exit`
	
	Example:
	
	`Router(config-ecfm)#`
		Returns the CLI to Ethernet CFM configuration mode.

	Command or Action	Purpose

Step 6	**exit**
	
	Example:
	`Router(config-ecfm)# exit`
	
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 7	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain MIP level 7`	Defines a CFM maintenance domain at a particular level and places the CLI in Ethernet CFM configuration mode.

Step 8	**exit**
	
	Example:
	`Router(config-ecfm)# exit`
	
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 9	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Router(config)# ethernet cfm domain PROVIDER level 4`	Defines a CFM maintenance domain at a particular level and places the CLI in Ethernet CFM configuration mode.
Step 10	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**] **Example:** `Router(config-ecfm)# service vlan-id 10`	Configures a maintenance association within a maintenance domain and places the CLI into Ethernet CFM service configuration mode.
Step 11	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 10s`	Enables the transmission of CCMs. • The time period between message transmissions is set.
Step 12	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]	Enables the transmission of CCMs. • The number of CCMs missed before the remote MEP is declared down is set.

	Command or Action	Purpose
	Example: `Router(config-ecfm-srv)# continuity-check loss-threshold 5`	
Step 13	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check static rmep`	Enables the transmission of CCMs. • Verification that the MEP received in the CCM is valid.
Step 14	**mep mpid** *mpid* **Example:** `Router(config-ecfm-srv)# mep mpid 200`	Statically defines MEPs within a maintenance association.

Step 15	**exit**
	Example:
	`Router(config-ecfm-srv)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 16	**ethernet evc** *evc-name* **Example:** `Router(config)# ethernet evc evc_100`	Defines an EVC and places the CLI in EVC configuration mode.

Step 17	**exit**
	Example:
	`Router(config-evc)# exit`
	Example:
	`Router(config)#`
		Returns the CLI to global configuration mode.

Step 18	**interface** *type number* **Example:** `Router(config)# interface Ethernet 1/0`	Specifies an interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 19	**no ip address** **Example:** `Router(config-if)# no ip address`	Disables IP processing.
Step 20	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Router(config-if)# service instance 100 ethernet evc_100`	Specifies an Ethernet service instance on an interface and places the CLI in service instance configuration mode.
Step 21	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-if-srv)# encapsulation dot1q 100`	Defines the matching criteria to map 802.1Q frames on an ingress interface to the appropriate service instance.
Step 22	**bridge-domain** *bridge-id* **Example:** `Router(config-if-srv)# bridge-domain 100`	Establishes a bridge domain.
Step 23	**cfm mep domain** *domain-name* **mpid** *mpid-value* **Example:** `Router(config-if-srv)# cfm mep domain CUSTOMER mpid 1001`	Configures a MEP for a domain.

Step 24	**end**
	
	Example:
	
	`Router(config-if-srv)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Step 25	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 26	**interface** *type name* **Example:** `Router(config)# interface Ethernet 1/1`	Specifies an interface and places the CLI in interface configuration mode.

	Command or Action	Purpose
Step 27	**no ip address** **Example:** `Router(config-if)# no ip address`	Disables IP processing.
Step 28	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Router(config-if)# service instance 100 ethernet evc_100`	Configures an Ethernet service instance on an interface and places the CLI in service instance configuration mode.
Step 29	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-if-srv)# encapsulation dot1q 100`	Defines the matching criteria to map 802.1Q frames on an ingress interface to the appropriate service instance.
Step 30	**bridge-domain** *bridge-id* **Example:** `Router(config-if-srv)# bridge-domain 100`	Establishes a bridge domain.
Step 31	**cfm mep domain** *domain-name* **mpid** *mpid-value* **Example:** `Router(config-if-srv)# cfm mep domain PROVIDER mpid 201`	Configures a MEP for a domain.
Step 32	**cfm mip level** *level-id* **Example:** `Router(config-if-srv)# cfm mip level 4`	Configures a MIP at a specified level.

Step 33	**end**
	
	Example:
	
	`Router(config-if-srv)# end`
	
	Example:
	
	`Router#`
		Returns the CLI to privileged EXEC mode.

Troubleshooting Tips

To verify and isolate a fault, start at the highest level maintenance domain and do the following:

1. Check the device error status.
2. When a error exists, perform a loopback test to confirm the error.
3. Run a traceroute to the destination to isolate the fault.
4. If the fault is identified, correct the fault.
5. If the fault is not identified, go to the next lower maintenance domain and repeat steps 1 through 4 at that maintenance domain level.
6. Repeat the first four steps, as needed, to identify and correct the fault.

Configuration Examples for Configuring IEEE Ethernet CFM in a Service Provider Network

Example: Provisioning a Network

This configuration example shows only CFM-related commands. All commands that are required to set up the data path and configure the VLANs on the device are not shown. However, it should be noted that CFM traffic will not flow into or out of the device if the VLANs are not properly configured.

CE-A Configuration

```
!
ethernet cfm global
ethernet cfm ieee
!
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm mip auto-create level 7 vlan 1-4094
!
interface gigabitethernet3/2
 ethernet cfm mip level 7 vlan 101   <<<< Manual MIP
 ethernet cfm mep domain ServiceProvider-L4 mpid 401 vlan 101
 ethernet cfm mep domain OperatorA-L1 mpid 101 vlan 101
!
interface gigabitethernet4/2
 ethernet cfm mip level 1 vlan 101   <<<< Manual MIP
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
```

U-PE A Configuration

```
!
ethernet cfm global
ethernet cfm ieee
!
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
```

```
!
ethernet cfm mip auto-create level 7 vlan 1-4094
!
interface gigabitethernet3/2
 ethernet cfm mip level 7 vlan 101   <<<< Manual MIP
 ethernet cfm mep domain ServiceProvider-L4 mpid 401 vlan 101
 ethernet cfm mep domain OperatorA-L1 mpid 101 vlan 101
!
interface gigabitethernet4/2
 ethernet cfm mip level 1 vlan 101   <<<< Manual MIP
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
```

PE-AGG A Configuration

```
ethernet cfm global
ethernet cfm ieee
ethernet cfm domain OperatorA-L1 level 1
mep archive-hold-time 65
  mip auto-create
  service MetroCustomer1OpA vlan 101
!
interface gigabitethernet3/1
 ethernet cfm mip level 1 vlan 101   <<<< Manual MIP
!
interface gigabitethernet4/1
 ethernet cfm mip level 1    <<<< Manual MIP
```

N-PE A Configuration

```
!
ethernet cfm global
ethernet cfm ieee
!
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain ServiceProvider-L4 level 4
 mep archive-hold-time 60
 mip auto-create
 service MetroCustomer1 vlan 101
  continuity-check
!
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
 mip auto-create
service MetroCustomer1OpA vlan 101
  continuity-check
!
interface gigabitethernet3/0
 ethernet cfm mip level 1    <<<< manual MIP
!
interface gigabitethernet4/0
 ethernet cfm mip level 4    <<<< manual MIP
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
```

U-PE B Configuration

```
!
ethernet cfm global
ethernet cfm ieee
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain Customer-L7 level 7
 mip auto-create
 service Customer1 vlan 101 direction down
!
```

```
ethernet cfm domain ServiceProvider-L4 level 4
 mep archive-hold-time 60
 service MetroCustomer1 vlan 101
  continuity-check
!
ethernet cfm domain OperatorB level 2
 mip auto-create
 mep archive-hold-time 65
 service MetroCustomer1OpB vlan 101
  continuity-check
!
interface gigabitethernet1/0
 ethernet cfm mip level 7   <<<< manual MIP
!
interface gigabitethernet2/0
 ethernet cfm mip level 2   <<<< manual MIP
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
```

PE-AGG B Configuration

```
ethernet cfm global
ethernet cfm ieee
!
ethernet cfm domain OperatorB level 2
 mep archive-hold-time 65
 mip auto-create
 service MetroCustomer1OpB vlan 101
!
interface gigabitethernet1/1
 ethernet cfm mip level 2   <<<< manual MIP
!
interface gigabitethernet2/1
 ethernet cfm mip level 2   <<<< manual MIP
```

N-PE B Configuration

```
!
ethernet cfm global
ethernet cfm ieee
!
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain ServiceProvider level 4
 mep archive-hold-time 60
 mip auto-create
 service MetroCustomer1 vlan 101
  continuity-check
!
ethernet cfm domain OperatorB level 2
 mep archive-hold-time 65
 mip auto-create
 service MetroCustomer1OpB vlan 101
  continuity-check
!
interface gigabitethernet1/2
ethernet cfm mip level 2    <<<< manual MIP
!
interface gigabitethernet2/2
 ethernet cfm mip level 4   <<<< manual MIP
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
```

CE-B Configuration

```
!
ethernet cfm global
ethernet cfm ieee
ethernet cfm traceroute cache
```

```
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain Customer-L7 level 7
 service Customer1 vlan 101 direction down
  continuity-check
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
```

Example: Provisioning Service

CE-A Configuration

```
!
ethernet cfm global
ethernet cfm ieee
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain Customer-L7 level 7
 service Customer1 vlan 101 direction down
  continuity-check
!
interface gigabitethernet3/2
 ethernet cfm mep domain Customer-L7 mpid 701 vlan 101
```

U-PE A Configuration

```
!
ethernet cfm global
ethernet cfm ieee
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm mip auto-create level 7 vlan 1-4094
!
ethernet cfm domain ServiceProvider-L4 level 4
 mep archive-hold-time 60
 service MetroCustomer1 vlan 101
  continuity-check
!
ethernet cfm domain OperatorA-L1 level 1
 mep archive-hold-time 65
 mip auto-create
 service MetroCustomer1OpA vlan 101
  continuity-check
!
interface gigabitethernet3/2
 ethernet cfm mip level 7 vlan 101   <<<< Manual MIP
 ethernet cfm mep domain ServiceProvider-L4 mpid 401 vlan 101
 ethernet cfm mep domain OperatorA-L1 mpid 101 vlan 101
!
interface gigabitethernet4/2
 ethernet cfm mip level 1 vlan 101   <<<< Manual MIP
```

PE-AGG A Configuration

```
ethernet cfm global
ethernet cfm ieee
ethernet cfm domain OperatorA-L1 level 1
mep archive-hold-time 65
  mip auto-create
  service MetroCustomer1OpA vlan 101
!
interface gigabitethernet3/1
 ethernet cfm mip level 1 vlan 101   <<<< Manual MIP
```

```
!
interface gigabitethernet4/1
 ethernet cfm mip level 1    <<<< Manual MIP
```

N-PE A Configuration

```
!
ethernet cfm global
ethernet cfm ieee
!
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain ServiceProvider-L4 level 4
 mep archive-hold-time 60
 mip auto-create
 service MetroCustomer1 vlan 101
  continuity-check
!
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
 mip auto-create
service MetroCustomer1OpA vlan 101
  continuity-check
!
interface gigabitethernet3/0
 ethernet cfm mip level 1    <<<< manual MIP
!
interface gigabitethernet4/0
 ethernet cfm mip level 4    <<<< manual MIP
 ethernet cfm mep domain OperatorA mpid 102 vlan 101
```

U-PE B Configuration

```
!
ethernet cfm global
ethernet cfm ieee
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain Customer-L7 level 7
 mip auto-create
 service Customer1 vlan 101 direction down
!
ethernet cfm domain ServiceProvider-L4 level 4
 mep archive-hold-time 60
 service MetroCustomer1 vlan 101
  continuity-check
!
ethernet cfm domain OperatorB level 2
 mep archive-hold-time 65
 service MetroCustomer1OpB vlan 101
  continuity-check
!
interface gigabitethernet1/0
 ethernet cfm mip level 7   <<<< manual MIP
 ethernet cfm mep domain ServiceProvider-L4 mpid 402 vlan 101
 ethernet cfm mep domain OperatorB mpid 201 vlan 101
!
interface gigabitethernet2/0
 ethernet cfm mip level 2   <<<< manual MIP
```

N-PE B Configuration

```
!
ethernet cfm global
ethernet cfm ieee
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
```

```
ethernet cfm domain ServiceProvider level 4
 mep archive-hold-time 60
 mip auto-create
 service MetroCustomer1 vlan 101
  continuity-check
!
ethernet cfm domain OperatorB level 2
 mep archive-hold-time 65
 mip auto-create
 service MetroCustomer1OpB vlan 101
  continuity-check
!
interface gigabitethernet1/2
ethernet cfm mip level 2      <<<< manual MIP
!
interface gigabitethernet2/2
 ethernet cfm mip level 4     <<<< manual MIP
 ethernet cfm mep domain OperatorB mpid 202 vlan 101
```

CE-B Configuration

```
!
ethernet cfm global
ethernet cfm ieee
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
ethernet cfm domain Customer-L7 level 7
 service Customer1 vlan 101 direction down
  continuity-check
!
interface gigabitethernet3/2
 ethernet cfm mep domain Customer-L7 mpid 702 vlan 101
```

Additional References

Related Documents

Related Topic	Document Title
CFM commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases
Configuring Ethernet connectivity fault management in a service provider network (Cisco pre-Standard CFM Draft 1)	"Configuring Ethernet Connectivity Fault Management in a Service Provider Network" module in the *Cisco IOS Carrier Ethernet Configuration Guide*
Ethernet Local Management Interface on a provider edge device	"Configuring Ethernet Local Management Interface on a Provider Edge Device" module in the *Cisco IOS Carrier Ethernet Configuration Guide*

Related Topic	Document Title
IP SLAs for Metro Ethernet	"IP SLAs for Metro Ethernet"
NSF/SSO and MPLS	"NSF/SSO - MPLS LDP and LDP Graceful Restart"
ISSU feature and functions	"Cisco IOS Broadband High Availability In Service Software Upgrade"
Performing an ISSU	"Cisco IOS In Service Software Upgrade Process and Enhanced Fast Software Upgrade Process"
SSO	"Stateful Switchover" chapter of the *Cisco IOS High Availability Configuration Guide*

Standards

Standard	Title
IEEE 802.1ag Standard	*802.1ag - Connectivity Fault Management*
IEEE 802.3ah	*IEEE 802.3ah Ethernet in the First Mile*
IETF VPLS OAM	*L2VPN OAM Requirements and Framework*
ITU-T	ITU-T Y.1731 OAM Mechanisms for Ethernet-Based Networks

MIBs

MIB	MIBs Link
CISCO-ETHER-CFM-MIB	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

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

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring IEEE Ethernet CFM in a Service Provider Network

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for Configuring IEEE CFM in a Service Provider Network

Feature Name	Releases	Feature Information
802.1ag - IEEE D8.1 Standard-Compliant CFM, Y.1731 multicast LBM / AIS / RDI / LCK, IP SLA for Ethernet	12.2(33)SXI2 15.1(1)T	

Feature Name	Releases	Feature Information
		Ethernet CFM is an end-to-end per-service-instance Ethernet layer OAM protocol. CFM includes proactive connectivity monitoring, fault verification, and fault isolation for large Ethernet MANs and WANs. This feature is the implementation of IEEE 802.1ag Standard-Compliant CFM in Cisco software. The following commands were introduced or modified: **alarm**, **clear ethernet cfm errors**, **clear ethernet cfm maintenance-points remote**, **clear ethernet cfm statistics**, **clear ethernet cfm traceroute-cache**, **continuity-check**, **cos**(CFM), **debug cfm**, **debug ethernet cfm all**, **debug ethernet cfm diagnostic**, **debug ethernet cfm error**, **debug ethernet cfm events**, **debug ethernet cfm ha**, **debug ethernet cfm packets**, **ethernet cfm alarm**, **ethernet cfm cc**, **ethernet cfm domain level**, **ethernet cfm global**, **ethernet cfm ieee**, **ethernet cfm interface**, **ethernet cfm logging**, **ethernet cfm mep crosscheck**, **ethernet cfm mep crosscheck start-delay**, **ethernet cfm mep domain mpid**, **ethernet cfm mip**, **ethernet cfm mip level**, **ethernet cfm traceroute cache**, **ethernet cfm traceroute cache hold-time**, **ethernet cfm traceroute cache size**, **id** (CFM), **maximum meps**, **mep archive-hold-time**, **mep mpid**, **mip auto-create**, **mip auto-create**(cfm-srv), **ping ethernet**, **sender-id**, **sender-id** (cfm-srv), **service**, **show ethernet cfm domain**, **show ethernet cfm errors**, **show ethernet cfm maintenance-points local**, **show ethernet cfm maintenance-points**

Feature Name	Releases	Feature Information
		remote, **show ethernet cfm maintenance-points remote detail**, **show ethernet cfm mpdb**, **show ethernet cfm statistics**, **show ethernet cfm traceroute-cache**, **snmp-server enable traps ethernet cfm cc**, **snmp-server enable traps ethernet cfm crosscheck**, **traceroute ethernet**.
IEEE 802.1ag-2007 Compliant CFM - Bridge Domain Support	12.2(33)SRE 12.2(50)SY	This feature provides support for bridge domains in IEEE 802.1ag Standard-Compliant CFM in Cisco IOS software. The following commands were introduced or modified: **cfm encapsulation**, **cfm mep domain**, **debug ethernet cfm all**, **debug ethernet cfm events**, **debug ethernet cfm packets**, **ethernet cfm mep crosscheck**, **service evc**, **show ethernet cfm maintenance-points remote crosscheck**, **show ethernet cfm maintenance-points remote detail**.

Glossary

CCM --continuity check message. A multicast CFM frame that a MEP transmits periodically to ensure continuity across the maintenance entities to which the transmitting MEP belongs, at the MA level on which the CCM is sent. No reply is sent in response to receiving a CCM.

configuration error list --Used to maintain a list of informational configuration errors for the port whenever a MEP is created or deleted. The information is displayed using the **show ethernet cfm** command

EVC --Ethernet virtual connection. An association of two or more user-network interfaces.

fault alarm --An out-of-band signal, typically an SNMP notification, that notifies a system administrator of a connectivity failure.

maintenance domain --The network or part of the network belonging to a single administration for which faults in connectivity are to be managed. The boundary of a maintenance domain is defined by a set of destination service access points (DSAPs), each of which may become a point of connectivity to a service instance.

maintenance domain name --The unique identifier of a domain that CFM is to protect against accidental concatenation of service instances.

MCL --maximum configured level. The highest level (0-7) service for Up MEPs, Down MEPs, or a MIP. This value is kept per service, either VLAN or bridge domain.

MEP --maintenance endpoint. An actively managed CFM entity associated with a specific DSAP of a service instance, which can generate and receive CFM frames and track any responses. It is an endpoint of a single MA, and terminates a separate maintenance entity for each of the other MEPs in the same MA.

MEP CCDB --A database, maintained by every MEP, that maintains received information about other MEPs in the maintenance domain.

MIP --maintenance intermediate point. A CFM entity, associated with a specific pair of ISS SAPs or EISS Service Access Points, which reacts and responds to CFM frames. It is associated with a single maintenance association and is an intermediate point within one or more maintenance entities.

MIP CCDB --A database of information about the MEPs in the maintenance domain. The MIP CCDB can be maintained by a MIP.

MP --maintenance point. Either a MEP or a MIP.

MPID --maintenance endpoint identifier. A small integer, unique over a given MA, that identifies a specific MEP.

OAM --operations, administration, and maintenance. A term used by several standards bodies to describe protocols and procedures for operating, administrating, and maintaining networks. Examples are ATM OAM and IEEE Std. 802.3ah OAM.

operator --Entity that provides a service provider a single network of provider bridges or a single Layer 2 or Layer 3 backbone network. An operator may be identical to or a part of the same organization as the service provider. For purposes of IEEE P802.1ag/D1.0, Draft Standard for Local and Metropolitan Area Networks, the operator and service provider are presumed to be separate organizations.

Terms such as “customer,” “service provider,” and “operator” reflect common business relationships among organizations and individuals that use equipment implemented in accordance with IEEE P802.1ag/D1.0.

UNI --user-network interface. A common term for the connection point between an operator’s bridge and customer equipment. A UNI often includes a C-VLAN-aware bridge component. The term UNI is used broadly in the IEEE P802.1ag/D1.0 standard when the purpose for various features of CFM are explained. UNI has no normative meaning.

Up MEP --A MEP that resides in a bridge and transmits to and receives CFM messages from the direction of the bridge relay entity.

CHAPTER 3

Configuring ITU-T Y.1731 Fault Management Functions in IEEE CFM

This document describes the implementation of the ITU-Y.1731 fault management functions Ethernet Alarm Indication Signal (ETH-AIS) and Ethernet Remote Defect Indication (ETH-RDI) as part of the IEEE Ethernet Connectivity Fault Management (CFM) protocol.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring ITU-T Y.1731 Fault Management Functions

Business Requirements

- Business and service policies have been established.
- Network topology and network administration have been evaluated.

Technical Requirements

- CFM must be configured and enabled for Y.1731 fault management features to function.
- A server maintenance endpoint (SMEP) is needed to support the ETH-AIS function.
- Maintenance intermediate points (MIPs) must be configured to support AIS messages; they are generated only on an interface on which a MIP is configured.

Restrictions for Configuring ITU-T Y.1731 Fault Management Functions

- Because of a port-ASIC hardware limitation, IEEE CFM cannot coexist with the Per VLAN Spanning Tree (PVST) protocol, and IEEE CFM cannot operate with the following line cards on the same system:
  - FI_WS_X6196_RJ21
  - FI_WS_X6196_RJ45
  - FI_WS_X6548_RJ21
  - FI_WS_X6548_RJ45
- CFM loopback messages are not confined within a maintenance domain according to their maintenance level. The impact of not having CFM loopback messages confined to their maintenance levels occurs at these levels:
  - Architecture--CFM layering is violated for loopback messages.
  - Deployment--A user may misconfigure a network and have loopback messages succeed.
  - Security--A malicious device that recognizes devices' MAC addresses and levels may explore a network topology that should be transparent.
- Routed interfaces are supported only in Cisco IOS Release 12.4(11)T.
- IEEE CFM is not fully supported on a Multiprotocol Label Switching (MPLS) provider edge (PE) device. There is no interaction between IEEE CFM and an Ethernet over MPLS (EoMPLS) pseudowire. A CFM packet can be transparently passed like regular data packets only via pseudowire, with the following restriction:

    - For policy feature card (PFC)-based EoMPLS, which uses a Cisco Catalyst LAN card as the MPLS uplink port, a CFM packet can be transparently passed via an EoMPLS pseudowire the same way regular data packets are passed. The EoMPLS endpoint interface, however, cannot be a maintenance endpoint (MEP) or an MIP, although a CFM MEP or MIP can be supported on regular Layer 2 switchport interfaces.

- CFM configuration is not supported on an EtherChannel in FastEthernet Channel (FEC) mode.

Information About Configuring ITU-T Y.1731 Fault Management Functions

Continuity Check Messages

CFM continuity check messages (CCMs) are multicast heartbeat messages exchanged periodically among MEPs. CCMs allow MEPs to discover other MEPs within a domain and allow MIPs to discover MEPs. CCMs are confined to a domain.

For more information about CCMs, see the “Continuity Check Messages” section of the "Configuring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network" configuration module.

Server MEPs

Server MEPs (SMEPs) are virtual MEPs that perform two functions--server layer termination for CFM maintenance associations defined at a link or at the transport layer and server-Ethernet adaptation. When a SMEP detects a defect at the server layer, it issues frames containing ETH-AIS information.

Defect Conditions Detected by a MEP

The defect conditions that a MEP detects and subsequently acts upon are the following:

- AIS condition--A MEP receives an AIS frame.
- Dying gasp--An unrecoverable and vendor-specific condition. Dying gasp is generated in the following conditions:
    - Administratively disabling 802.3ah
    - Link down caused by administration down
    - Power failure
    - Reload

Note Administratively disabling 802.3ah does not disrupt traffic and should not generate an AIS. If a Reason field is empty, however, disabling always generates an AIS when Cisco routers and non-Cisco routers are interworking.

A notification about the defect condition may be sent immediately and continuously.

- Loss of continuity (LOC) condition--A MEP stops receiving CCMs from a peer MEP. An LOC condition is a MEP down error.

LOC results when a remote MEP lifetime timer expires and causes an AIS condition for the local MEP. The LOC condition is cleared when connectivity is restored.

- Mismerge condition--A CCM with a correct maintenance level but incorrect maintenance ID indicates that frames from a different service instance are merged with the service instance represented by the receiving MEP's maintenance ID. A mismerge condition is a cross-connect error.
- RDI condition--A MEP receives a CCM with the RDI field set.
- Signal fail condition--Declared by a MEP or the server layer termination function to notify the SMEP about a defect condition in the server layer. Signal fail conditions are as follows:
    - Configuration error
    - Cross-connect error
    - LOC
    - Loop error
    - MEP missing
    - MEP unknown (same as unexpected MEP)

Signal fail conditions cause AIS defect conditions for the MEP, resulting in the MEP receiving an AIS frame.

A MEP that detects a signal fail condition sends AIS frames to each of the client layer or sublayer maintenance associations.

- Unexpected MEP condition--A CCM with a correct maintenance level, correct maintenance ID, and an unexpected maintenance point ID (MPID) that is the same as the receiving MEP's MPID. An unexpected MEP condition is either a cross-check error or a configuration error.

Determination of an unexpected MPID is possible when a MEP maintains a list of its peer MPIDs. Peer MPIDs must be configured on each MEP during provisioning.

ETH-AIS Function

The ETH-AIS function suppresses alarms when a defect condition is detected at either the server layer or the server sublayer (virtual MEP). Transmission of frames carrying ETH-AIS information can be either enabled or disabled on either a MEP or a SMEP and can be sent at the client maintenance level by either a MEP or SMEP when a defect condition is detected.

SMEPs monitor the entire physical link so that an AIS is generated for each VLAN or server on the network. MEPs monitor VLANs, Ethernet virtual circuits (EVCs), and SMEPs where link up or link down and 802.3ah interworking are supported. A MEP that detects a connectivity fault at a specific level multicasts an AIS in the direction opposite the detected failure at the client maintenance association (MA) level.

An AIS causes a receiving MEP to suppress traps to prevent the network management system (NMS) from receiving an excessive number of redundant traps and also so that clients are asynchronously informed about faults.

In a point-to-point topology, a MEP has a single peer MEP and there is no ambiguity regarding the peer MEP for which it should suppress alarms when it receives ETH-AIS information.

In a multipoint Ethernet topology, a MEP that receives a frame with ETH-AIS information cannot determine which remote peer lost connectivity. The MEP also cannot determine the associated subset of peer MEPs for which it should suppress alarms because the ETH-AIS information does not include that MEP information. Because the MEP cannot determine the affected peer MEPs, it suppresses alarms for all peer MEPs whether or not there is connectivity.

Due to independent restoration capabilities within Spanning Tree Protocol (STP) environments, ETH-AIS is not expected to be applied in these environments; however, ETH-AIS transmission is configurable in STP environments by a network administrator.

ETH-AIS Transmission Reception and Processing

Only a MEP or a SMEP can be configured to send frames with ETH-AIS information. When a MEP detects a defect condition, it immediately begins transmitting frames with ETH-AIS information at the configured client maintenance level, which is the level at which the MIP is configured on the interface. Frames are transmitted to peer MEPs in the direction opposite the fault. The first AIS frame must always be transmitted immediately following the detection of a defect condition, but thereafter frames are transmitted at a frequency based on the configured AIS transmission period. The transmitting MEP continues to transmit frames with ETH-AIS information until the defect condition is removed. The period flag in the frame’s header indicates the transmission interval. The default is that a MEP clears a defect condition only if no AIS frames are received within a time period equal to 3.5 times the configured transmission interval.

Note An AIS transmission period of one second is recommended; however, an AIS transmission period of one minute is supported to enable ETH-AIS across all VLANs supported by IEEE CFM.

When a MEP receives a frame with ETH-AIS information, it examines the frame to ensure that the maintenance association level corresponds to its own maintenance association level. The MEP detects the AIS condition and suppresses loss-of-continuity alarms associated with all its peer MEPs. Peer MEPs can resume generating loss-of-continuity alarms only when the receiving MEP exits the AIS condition.

The client layer or client sublayer may consist of multiple maintenance associations that should also be notified to suppress alarms when either a server layer or server sublayer MEP detects a defect condition. The first AIS frame for all client layer or sublayer maintenance associations must be transmitted within one second after the defect condition is detected.

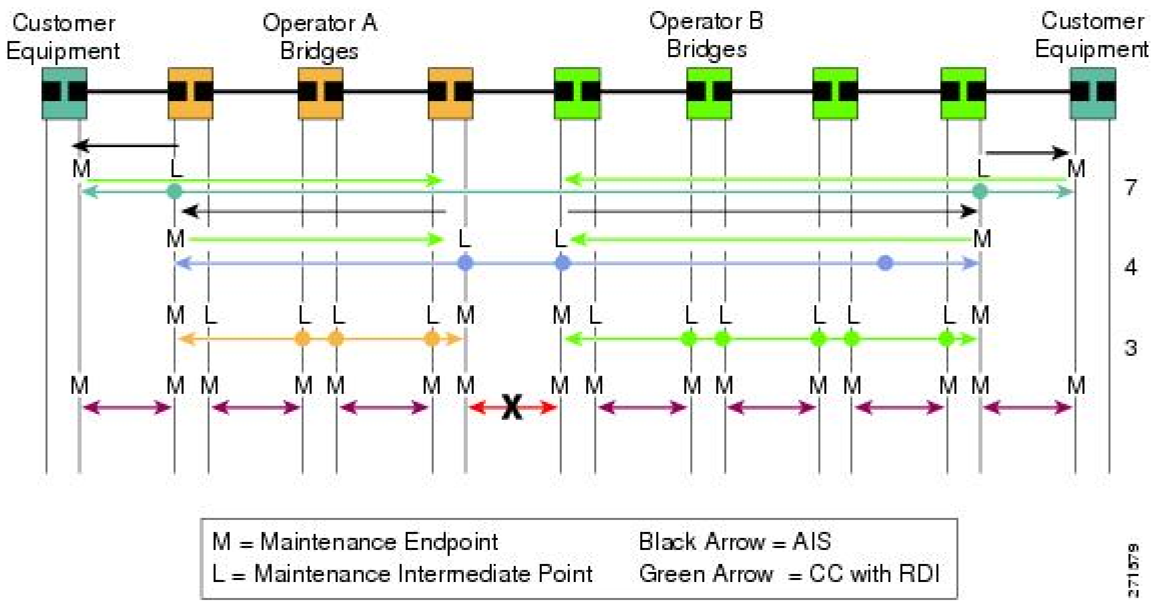
AIS and 802.3ah Interworking

The following conditions impact SMEP AIS conditions:

- By default, link down events cause the SMEP to enter the AIS condition and generate AIS frames for all services at the immediate client maintenance association level.
- Link up events cause the SMEP to exit the AIS state and stop generating AIS frames.

- Local fault detection results from dying gasp, link fault, or critical 802.3ah Remote Fault Indication (RFI). When 802.3ah is reestablished, the SMEP exits the AIS state and stops generating AIS frames.
- Local fault detection due to crossing of a high threshold with a configurable action of error disabling the interface.
- RFI received from a dying gasp, link fault, or critical event.

If a detected fault is due to dying gasp, the link goes down in both directions, creating AIS and RDI frame flow as shown in the figure below.



ETH-RDI Function

The ETH-RDI function is used by a MEP to communicate to its peer MEPs that a defect condition has been encountered. ETH-RDI is used only when ETH-CC transmission is enabled.

ETH-RDI has the following two applications:

- Single-ended fault management--A receiving MEP detects an RDI defect condition, which is correlated with other defect conditions in the MEP and may become the cause of a fault. If ETH-RDI information is not received by a single MEP, there are no defects in the entire MA.
- Contribution to far-end performance monitoring--A defect condition in the far end is used as an input to the performance monitoring process.

A MEP in a defect condition transmits CCMs with ETH-RDI information. A MEP that receives a CCM examines it to ensure that its maintenance association level corresponds to its configured maintenance association level and detects the RDI condition if the RDI field is set. The receiving MEP sets the RDI field in CCMs for the duration of a defect condition, and if the MEP is enabled for CCM transmission, transmits CCMs based on the configured transmission interval. When the defect condition clears, the MEP clears the RDI field in CCMs for subsequent transmissions.

In a point-to-point Ethernet connection, a MEP can clear an RDI condition when it receives the first CCM with the RDI field cleared from its peer MEP. In a multipoint Ethernet connection, a MEP cannot determine the peer MEP with the default condition and can clear an RDI condition only when it receives a CCM with the RDI field cleared from each of its peer MEPs.

The ETH-RDI function is part of continuity checking and is enabled by default. For more information about continuity checking, see the "Configuring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network" configuration module.

How to Configure ITU-T Y.1731 Fault Management Functions

ETH-AIS and ETH-RDI both are enabled by default when CFM is configured, but each can also be manually enabled by a separate command during CFM configuration. Perform these tasks to either disable or enable the functions.

Disabling the ETH-AIS Function

Perform this task to disable the ETH-AIS function.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm ais link-status global**
4. **disable**
5. **exit**
6. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
7. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
8. **no ais** [**expiry-threshold** | **level** | **period** | **suppress-alarms**]
9. **end**

DETAILED STEPS

	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	**ethernet cfm ais link-status global** **Example:** `Device(config)# ethernet cfm ais link-status global`	Globally enables AIS generation and enters CFM SMEP AIS configuration mode.
Step 4	**disable** **Example:** `Device(config-ais-link-cfm)# disable`	Disables AIS transmission.
Step 5	**exit** **Example:** `Device(config-ais-link-cfm)# exit`	Returns the CLI to global configuration mode.
Step 6	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Device(config)# ethernet cfm domain PROVIDERDOMAIN level 4`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 7	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Device(config-ecfm)# service customer101provider evc customer101provider@101 vlan 101`	Configures a maintenance association within a maintenance domain and enters Ethernet CFM service configuration mode.
Step 8	**no ais** [**expiry-threshold** | **level** | **period** | **suppress-alarms**] **Example:** `Device(config-ecfm-srv)# no ais`	Disables the AIS function for a specific maintenance association.
Step 9	**end** **Example:** `Device(config-ecfm-srv)# end`	Returns the CLI to privileged EXEC mode.

Enabling ETH-AIS for a Single Interface SMEP and Disabling ETH-AIS for All Other Ports

Perform this task to manually enable the ETH-AIS function.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
4. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
5. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
6. **ais** [**expiry-threshold** *threshold* | **level** *level-id* | **period** *seconds*| **suppress-alarms**]
7. **ais** [**expiry-threshold** *threshold* | **level** *level-id* | **period** *seconds*| **suppress-alarms**]
8. **exit**
9. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
10. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
11. **ethernet cfm ais link-status global**
12. disable
13. **interface** *type number*
14. **ethernet oam remote-loopback** {**supported** | **timeout** *seconds*}
15. **ethernet cfm mip level** *level-id* [**vlan** {*vlan-id*| *vlan-id* **-** *vlan-id*| **,** *vlan-id* **-** *vlan-id*}]
16. **ethernet cfm ais link-status** [**level** *level-id*| **period** *seconds*]
17. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Device(config)# ethernet cfm domain PROVIDERDOMAIN level 4`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Device(config-ecfm)# service customer101provider evc customer101provider@101 vlan 101`	Configures a maintenance association within a maintenance domain and enters Ethernet CFM service configuration mode.
Step 5	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Device(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 6	**ais** [**expiry-threshold** *threshold* | **level** *level-id* | **period** *seconds*| **suppress-alarms**] **Example:** `Device(config-ecfm-srv)# ais period 1`	Enables the AIS function for a specific maintenance association.
Step 7	**ais** [**expiry-threshold** *threshold* | **level** *level-id* | **period** *seconds*| **suppress-alarms**] **Example:** `Device(config-ecfm-srv)# ais level 7`	Enables the AIS function for a specific maintenance association.
Step 8	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns the CLI to Ethernet CFM configuration mode.
Step 9	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Device(config-ecfm)# service customer110provider evc customer110provider@110 vlan 110`	Configures a maintenance association within a maintenance domain and enters Ethernet CFM service configuration mode.

	Command or Action	Purpose
Step 10	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Device(config-ecfm-srv)# continuity-check`	Enables the transmission of CCMs.
Step 11	**ethernet cfm ais link-status global** **Example:** `Device(config-ecfm-srv)# ethernet cfm ais link-status global`	Globally enables AIS generation and places the CLI in CFM SMEP AIS configuration mode (config-ais-link-cfm) to configure AIS commands for a SMEP.
Step 12	disable **Example:** `Device(config-ais-link-cfm)# disable`	Disables the generation of AIS frames resulting from a link-status change.
Step 13	**interface** *type number* **Example:** `Device(config-ais-link-cfm)# interface ethernet 0/1`	Configures an interface type and enters interface configuration mode.
Step 14	**ethernet oam remote-loopback** {**supported** | **timeout** *seconds*} **Example:** `Device(config-if)# ethernet oam remote-loopback supported`	Enables the support of Ethernet OAM remote loopback operations on an interface or sets a remote loopback timeout period.
Step 15	**ethernet cfm mip level** *level-id* [**vlan** {*vlan-id*| *vlan-id* **-** *vlan-id*| **,** *vlan-id* **-** *vlan-id*}] **Example:** `Device(config-if)# ethernet cfm mip level 4 vlan 101`	Provisions a MIP at a specified maintenance level on an interface.
Step 16	**ethernet cfm ais link-status** [**level** *level-id*| **period** *seconds*] **Example:** `Device(config-if)# ethernet cfm ais link-status`	Enables AIS generation from a SMEP.
Step 17	**end** **Example:** `Device(config-if)# end`	Returns the CLI to privileged EXEC mode.

Configuration Examples for Configuring ITU-T Y.1731 Fault Management Functions

Example: Enabling IEEE CFM on an Interface

The following example shows how to enable IEEE CFM on an interface:

```
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
service MetroCustomer1 vlan 100
!
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
service MetroCustomer1OpA vlan 100
!
ethernet cfm enable
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet3/0
ethernet cfm mip level 1
!
interface gigabitethernet4/0
ethernet cfm mip level 4
ethernet cfm mep level 1 mpid 102 vlan 100
!
ethernet cfm cc enable level 1 vlan 100
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
```

Example: Enabling AIS

The following example shows how to enable AIS:

```
!
ethernet cfm domain PROVIDER_DOMAIN level 4
 service customer101provider evc customer101provider@101 vlan 101
  continuity-check
  ais period 1
  ais level 7
 service customer110provider evc customer110provider@110 vlan 110
  continuity-check
!
ethernet cfm ais link-status global
 disable
!
!
interface Ethernet 0/1
 no ip address
 ethernet oam remote-loopback supported
 ethernet oam
 ethernet cfm mip level 4 vlan 1,101,110
 ethernet cfm ais link-status
!
```

Example: Show Commands Output

The following sample output from the **show ethernet cfm maintenance-point local detail** command shows the settings for the local MEP:

```
Device# show ethernet cfm maintenance-points local detail

MEP Settings:
-------------
MPID: 2101
DomainName: PROVIDERDOMAIN
Level: 4
Direction: I
Vlan: 101
Interface: Et0/1
CC-Status: Enabled
MAC: aabb.cc03.8410
Defect Condition: AIS
presentRDI: TRUE
AIS-Status: Enabled
AIS Period: 1000(ms)
AIS Expiry Threshold: 3.5
Level to transmit AIS: Default
Suppress Alarm configuration: Enabled
Suppressing Alarms: Yes
```

The following sample output from the **show ethernet cfm smep** command shows the settings for a SMEP:

```
Device# show ethernet cfm smep
SMEP Settings:
--------------
Interface: Ethernet0/0
AIS-Status: Enabled
AIS Period: 60000 (ms)
Level to transmit AIS: 4
Defect Condition: No Defect
```

The following sample output from the **show ethernet cfm smep interface** command shows the settings for a specific interface on a SMEP:

```
Device# show ethernet cfm smep interface ethernet 0/1
SMEP Settings:
--------------
Interface: Ethernet0/1
LCK-Status: Enabled
LCK Period: 60000 (ms)
Level to transmit LCK: Default
AIS-Status: Enabled
AIS Period: 60000 (ms)
Level to transmit AIS: Default
Defect Condition: No Defect
Router#
```

The following sample output from the **show ethernet cfm errors** command shows the Ethernet CFM errors on a device:

```
Device# show ethernet cfm errors
Level    Vlan    MPID    Remote MAC        Reason          Service ID
5        102     -       aabb.cc00.ca10    Receive AIS     service test
```

The following sample output from the **show ethernet cfm maintenance-points remote detail** command shows the detailed information about a specific remote MEP:

```
Device# show ethernet cfm maintenance-points remote detail mpid 66
MAC Address: aabb.cc00.ca10
Domain/Level: PROVIDERDOMAIN/4
EVC: test
```

```
MPID: 66 (Can ping/traceroute)
Incoming Port(s): Ethernet0/2
CC Lifetime(sec): 75
Age of Last CC Message(sec): 8
Receive RDI: TRUE
Frame Loss: 0%
CC Packet Statistics: 2/0 (Received/Error)
R1#MAC Address: aabb.cc00.ca10
Domain/Level: PROVIDERDOMAIN/4
EVC: test
MPID: 66 (Can ping/traceroute)
Incoming Port(s): Ethernet0/2
CC Lifetime(sec): 75
Age of Last CC Message(sec): 8
Receive RDI: TRUE
Frame Loss: 0%
CC Packet Statistics: 2/0 (Received/Error)
```

Additional References

Related Documents

Related Topic	Document Title
IEEE CFM	"Configuring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network"
Using OAM	"Using Ethernet Operations, Administration, and Maintenance"
IEEE CFM and Y.1731 commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases

Standards

Standard	Title
IEEE 802.1ag	*802.1ag - Connectivity Fault Management*
IEEE 802.3ah	*Ethernet in the First Mile*
ITU-T	*ITU-T Y.1731 OAM Mechanisms for Ethernet-Based Networks*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring ITU-T Y.1731 Fault Management Functions

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 3: Feature Information for Configuring ITU-T Y.1731 Fault Management Functions

Feature Name	Releases	Feature Information
Configuring ITU-T Y.1731 Fault Management Functions	12.2(50)SY 15.1(1)SY	The ITU-Y.1731 Fault Management Functions feature adds to IEEE CFM the ETH-AIS and ETH-RDI functions for fault detection, fault verification, and fault isolation in large MANs and WANs. In Cisco IOS Release 12.2(50)SY, this feature was introduced. In Cisco IOS Release 15.1(1)SY, this feature was integrated. The following commands were introduced or modified: **ais**, **clear ethernet cfm ais**, **disable**(CFM-AIS-link), **ethernet cfm ais link-status**, **ethernet cfm ais link-status global**, **level**(cfm-ais-link), **period**(cfm-ais-link), **show ethernet cfm errors**, **show ethernet cfm maintenance-points local**, **show ethernet cfm maintenance-points remote detail**, **show ethernet cfm smep**.

CHAPTER 4

IEEE 802.1s on Bridge Domains

The IEEE 802.1s on Bridge Domains feature enables Multiple Spanning Tree (MST) on Ethernet Virtual Circuits (EVCs).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for IEEE 802.1s on Bridge Domains

- MST must be configured.

Restrictions for IEEE 802.1s on Bridge Domains

- Service instances on a port-channel are not supported on Cisco 7600 series routers.
- Service instances with “encapsulation default” are not supported.
- Service instances with “encapsulation untagged” without the dot1q option are not supported.
- Service instances with “encapsulation priority-tagged” are not supported.

Information About IEEE 802.1s on Bridge Domains

EVC

An EVC as defined by the Metro Ethernet Forum is a port-level point-to-point or multipoint-to-multipoint Layer 2 circuit. It is an end-to-end representation of a single instance of a Layer 2 service being offered by a provider to a customer. An EVC embodies the different parameters on which the service is being offered. A service instance is the instantiation of an EVC on a specified port.

Service instances are configured under a port channel. The traffic, carried by the service instance is load balanced across member links. Service instances under a port channel are grouped and each group is associated with one member link. Ingress traffic for a single EVC can arrive on any member of the bundle. All egress traffic for a service instance uses only one of the member links. Load balancing is achieved by grouping service instances and assigning them to a member link.

Ethernet virtual connection services (EVCS) uses the concepts of EVCs and service instances to provide Layer 2 switched Ethernet services. EVC status can be used by a Customer Edge (CE) device either to find an alternative path in to the service provider network or in some cases, to fall back to a backup path over Ethernet or over another alternative service such as Frame Relay or ATM.

For information about the Metro Ethernet Forum standards, see the Standards table in the Additional References section.

MST and STP

Spanning Tree Protocol (STP) is a Layer 2 link-management protocol that provides path redundancy while preventing undesirable loops in the network. For a Layer 2 Ethernet network to function properly, only one active path can exist between any two stations. STP operation is transparent to end stations, which cannot detect whether they are connected to a single VLAN segment or to a switched LAN of multiple segments.

Cisco 7600 series routers use STP (the IEEE 802.1D bridge protocol) on all VLANs. By default, a single instance of STP runs on each configured VLAN (provided you do not manually disable STP). You can enable and disable STP on a per-VLAN basis.

MST maps multiple VLANs into a spanning tree instance, with each instance having a spanning tree topology independent of other spanning tree instances. This architecture provides multiple forwarding paths for data traffic, enables load balancing, and reduces the number of spanning tree instances required to support many VLANs. MST improves the fault tolerance of the network because a failure in one instance (a forwarding path) does not affect other instances.

To participate in MST instances, routers must be consistently configured with the same MST configurations. A collection of interconnected routers that have the same MST configuration forms an MST region. For two or more routers to be in the same MST region, they must have the same VLAN-to-instance mapping, the same configuration revision number, and the same MST name.

The MST configuration controls the MST region to which each router belongs. The configuration includes the name of the region, the revision number, and the MST VLAN-to-instance assignment map.

A region can have one or multiple members with the same MST configuration; each member must be capable of processing Rapid Spanning Tree Protocol (RSTP) bridge protocol data units (BPDUs). There is no limit to the number of MST regions in a network, but each region can support up to 65 spanning tree instances. Instances can be identified by any number in the range from 0 to 4094. You can assign a VLAN to only one spanning tree instance at a time.

MST on Service Instances with Bridge Domains

The IEEE 802.1s on Bridge Domains feature uses VLAN IDs for service-instance-to-MST-instance mapping. EVC service instances with the same VLAN ID (the outer VLAN IDs in the QinQ case) as the one in a particular MST instance will be mapped to that MST instance.

EVC service instances can have encapsulations with a single tag as well as double tags. In the case of double tag encapsulations, the outer VLAN ID is used for the MST instance mapping, and the inner VLAN ID is ignored.

Because MST requires bridge ports, you must configure a bridge domain for service instances to participate in the MST instances. Additionally, because MST runs by sending untagged BPDUs on the wire, independently of any VLAN, a native VLAN is required on the interface with EVC service instances. By default, switch ports have a native VLAN. However, if the port is not a switch port, you must specify a native VLAN using an EVC service instance.

Because a VLAN ID is required for EVC service-instance-to-MST-instance mapping, the following EVC service instances without any VLAN IDs in the encapsulation are not supported:

- Untagged (encapsulation untagged)
- Priority-tagged (encapsulation priority-tagged)
- Default (encapsulation default)

How to Configure IEEE 802.1s on Bridge Domains

Configuring MST on EVC Bridge Domains

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot* / *subslot* / *port* [**.***subinterface-number*]
4. **service instance** *id* **ethernet** [*evc-id*]
5. **encapsulation dot1q** *vlan-id* [**native**]
6. **bridge-domain** *bridge-id* [**split-horizon** [**group** *group-id*]]

DETAILED STEPS

	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** *type slot* / *subslot* / *port* [**.***subinterface-number*] **Example:** `Device(config)# interface gigabitethernet 4/0/0`	Specifies the interface to configure and enters interface configuration mode.
Step 4	**service instance** *id* **ethernet** [*evc-id*] **Example:** `Device(config-if)# service instance 101 ethernet`	Creates a service instance (an instance of an Ethernet virtual circuit [EVC]) on an interface and enters service instance configuration mode.
Step 5	**encapsulation dot1q** *vlan-id* [**native**] **Example:** `Device(config-if-srv)# encapsulation dot1q 13`	Defines the matching criteria to be used in order to map ingress dot1q frames on an interface to the appropriate service instance.

	Command or Action	Purpose
Step 6	**bridge-domain** *bridge-id* [**split-horizon** [**group** *group-id*]] **Example:** `Device(config-if-srv)# bridge-domain 12`	Binds the service instance to a bridge domain instance.

Troubleshooting Tips

To verify and isolate a fault, start at the highest level maintenance domain and do the following:

- Check the device error status.
- When an error exists, perform a loopback test to confirm the error.
- Run a traceroute to the destination to isolate the fault.
- If the fault is identified, correct the fault.
- If the fault is not identified, go to the next lower maintenance domain and repeat these four steps at that maintenance domain level.
- Repeat the first four steps, as needed, to identify and correct the fault.

Configuration Examples for IEEE 802.1s on Bridge Domains

Example: Configuring MST on EVC Bridge Domains

In the following example, the two interfaces participate in MST instance 0, the default instance to which all VLANs are mapped:

```
Device# enable
Device# configure terminal
Device(config)# interface gigabitethernet 4/0/0
Device(config-if)# service instance 1 ethernet
Device(config-if-srv)# encapsulation dot1q 2
Device(config-if-srv)# bridge-domain 100
Device(config-if-srv)# exit
Device(config-if)# exit
Device(config)# interface gigabitethernet 4/0/3
Device(config-if)# service instance 1 ethernet
Device(config-if-srv)# encapsulation dot1q 2
Device(config-if-srv)# bridge-domain 100
Device(config-if-srv)# end
```

Issue the following command to verify the configuration:

```
Device# show spanning-tree vlan 2

MST0
```

```
 Spanning tree enabled protocol mstp
 Root ID   Priority   32768
    Address   0009.e91a.bc40
    This bridge is the root
    Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
 Bridge ID   Priority   32768 (priority 32768 sys-id-ext 0)
     Address   0009.e91a.bc40
    Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
Interface       Role Sts Cost       Prio.Nbr  Type
-------------------      ---- --- ---------      --------  --------------------------------
Gi4/0/0       Desg FWD 20000       128.1537  P2p
Gi4/0/3       Back BLK 20000       128.1540  P2p
```

In the following example, Gigabit Ethernet interface 4/0/0 and Gigabit Ethernet interface 4/0/3 are connected back to back. Each has a service instance attached to it. The service instance on both interfaces has an encapsulation VLAN ID of 2. Changing the VLAN ID from 2 to 8 in the encapsulation directive for the service instance on interface gi4/0/0 stops the Multiservice Transport Platform (MSTP) from running in the MST instance to which the old VLAN is mapped and starts the MSTP in the MST instance to which the new VLAN is mapped:

```
Device(config-if)# interface gigabitethernet 4/0/0
Device(config-if)# service instance 1 ethernet
Device(config-if-srv)# encapsulation dot1q 8
Device(config-if-srv)# end
```

Use the **show spanning-tree vlan** command to verify the configuration, as shown in the following two examples.

```
Device# show spanning-tree vlan 2

MST1
 Spanning tree enabled protocol mstp
 Root ID    Priority    32769
    Address    0009.e91a.bc40
    This bridge is the root
    Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
 Bridge ID    Priority    32769 (priority 32768 sys-id-ext 1)
    Address    0009.e91a.bc40
    Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
Interface      Role Sts Cost       Prio.Nbr  Type
-------------------  ---- --- ---------         --------  --------------------------------
Gi4/0/3       Desg FWD 20000       128.1540  P2p

Device# show spanning-tree vlan 8

MST2
 Spanning tree enabled protocol mstp
 Root ID    Priority    32770
    Address    0009.e91a.bc40
    This bridge is the root
    Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
 Bridge ID    Priority    32770 (priority 32768 sys-id-ext 2)
    Address    0009.e91a.bc40
    Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
Interface      Role Sts Cost       Prio.Nbr  Type
-------------------  ---- --- ---------         --------  --------------------------------
Gi4/0/0       Desg FWD 20000      128.1537  P2p
```

In the following example, Gigabit Ethernet interface 4/0/3 with a service instance that has an outer encapsulation VLAN ID of 2 and a bridge domain of 100 receives a new service:

```
Device# enable
Device# configure terminal
Device(config)# interface gigabitethernet 4/0/3
Device((config-if)# service instance 2 ethernet
Device((config-if-srv)# encapsulation dot1q 2 second-dot1q 100
Device((config-if-srv)# bridge-domain 200
```

Now two service instances are configured on Gigabit Ethernet interface4/0/3 and both of them have the same outer VLAN 2:

```
interface GigabitEthernet4/0/3
  no ip address
 service instance 1 ethernet
 encapsulation dot1q 2
 bridge-domain 100
!
service instance 2 ethernet
 encapsulation dot1q 2 second-dot1q 100
  bridge-domain 200
```

The preceding configuration does not affect the MSTP operation on the interface; there is no state change for Gigabit Ethernet interface gi4/0/3 in the MST instance to which it belongs.

Use the**show spanning-tree mst** command to display the information about the Multiple Spanning Tree (MST) protocol, as shown below.

```
Device# show spanning-tree mst 1

##### MST1  vlans mapped:    2
Bridge    address 0009.e91a.bc40   priority        32769 (32768 sysid 1)
Root    this switch for MST1
Interface      Role Sts Cost      Prio.Nbr Type
----------------      ---- --- ---------  --------- --------------------------------
Gi4/0/3      Desg FWD 20000      128.1540 P2p
```

Additional References

Related Documents

Related Topic	Document Title
Configuration guide	*Cisco IOS Carrier Ethernet Configuration Guide*, Release 12.2SR
Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for IEEE 802.1s on Bridge Domains

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 4: Feature Information for IEEE 802.1s on Bridge Domains

Feature Name	Releases	Feature Information
IEEE 802.1s on Bridge Domains	12.2(50)SY	The IEEE 802.1s on Bridge Domains feature enables MST on EVC interfaces. The following commands were introduced or modified: **bridge-domain (**service instance**), debug ethernet l2ctrl, debug l2ctrl**.

CHAPTER 5

Cisco Bridge-Domain MIB

This document describes the attributes and tables of the CISCO-BRIDGE-DOMAIN-MIB, the supported operations, and related CLI commands.

A bridge domain is a means for defining an Ethernet broadcast domain on a bridging device and an alternative to 802.1D bridge groups and to 802.1Q VLAN bridging. Members of a bridge domain learn addresses and participate in Spanning-Tree Protocol (STP) and operations, administration, and maintenance (OAM) protocols. The purpose of a bridge domain MIB is to provide a Simple Network Management Protocol (SNMP) network management interface for a configured bridge domain. A bridge domain MIB also helps network management personnel learn the details of various broadcast domains configured in a network.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for the Cisco Bridge-Domain MIB

SNMP contexts must be configured before you can poll the CISCO-BRIDGE-DOMAIN-MIB.

Restrictions for the Cisco Bridge-Domain MIB

- The CISCO-BRIDGE-DOMAIN-MIB does not support notifications in Cisco IOS Release 12.2(50)SY.
- Customer bridge domains (C-MACs) are not supported in Cisco IOS Release 12.2(50)SY.

Information About the Cisco Bridge-Domain MIB

The CISCO-BRIDGE-DOMAIN-MIB is delivered as an SNMP MIB and follows the general MIB architecture for the Cisco IOS software. The CISCO-BRIDGE-DOMAIN-MIB contains objects to manage multiple instances of SNMP context support for bridge domains and can be used to learn the details of various broadcast domains configured in the network.

CISCO-BRIDGE-DOMAIN-MIB Objects

The CISCO-BRIDGE-DOMAIN-MIB has one attribute object and one table object. Bridge domain attributes are managed using the SNMP context-aware infrastructure. Every configured bridge domain is related to an SNMP context so if you know the context, you can obtain the attributes.

CISCO-BRIDGE-DOMAIN-MIB Attributes

The cbdMembersConfigured attribute is the only attribute defined. This attribute denotes the number of members configured on a bridge domain, and the variable used to populate the attribute is called "numb_of_bd_members."

The cbdMembersConfigured attribute is read-only (Get operations are allowed). Set operations are not supported because bridge domain attributes are related to current bridge domain configurations on the system.

CISCO-BRIDGE-DOMAIN-MIB Tables

The cbdMemberInfo table is the only table defined. This table contains the bridge-domain attributes that correspond to the members configured for each bridge domain. Each row in the table is a unique entry for each interface that belongs to a specific bridge domain and a specific service.

All the objects in the cbdMemberInfoTable table are read-only. Set operations are not supported in Cisco IOS Release 12.2(50)SY. This table is indexed by ifIndex and cbdSIIndex.

The following table describes each object.

Table 5: Objects in the Table cbdMemberInfoTable

Object	Description	Variable to Populate Object or Object Value
cbdMemberAdminState	Administrative state of the bridge domain member.	bd_pp_admin_state_t
cbdMembercMac	Indicates if the bridge domain member is configured as a C-MAC.	If a C-MAC is configured on one or more members of the bridge domain, the value is 1; otherwise, the value is 0. **Note** In Cisco IOS Release 12.2(50)SY, the value is always zero because C-MAC is not supported in the release.
cbdMemberOperState	Operational state of the bridge domain member.	bd_pp_oper_state_t
cbdMemberSplitHorizon	Indicates if split horizon is configured.	If split horizon is configured, this object has a value of 1; otherwise the value is 0.
cbdMemberSplitHorizonNum	Number of the split horizon group the member belongs to.	bdomain_port_is_sh_member
cbdMemberStatus	Enables the SNMP agent to create, modify, and delete rows in the cbdMemberInfoTable.	The only value allowed is “active,” which is equal to 1.
cbdMemberStorageType	Specifies the storage type of this row and can have only a value of “nonVolatile.” Other values are not applicable and are not supported.	The only value allowed is “nonVolatile,” which is equal to 3.
cbdMemberType	Type of bridge domain member. • Ethernet service instance • ATM VC • FR VC	bd_pp_type_t
cbdSIIndex	Member index that identifies the service instance to which the bridge domain is attached. Denotes the service instance number for Ethernet service instance cbdSIIndex.	Efp_id for Ethernet service instance

How to Configure a Bridge Domain and a Related SNMP Context

Perform this task to configure a bridge domain and a related SNMP context, which the CISCO-BRIDGE-DOMAIN-MIB can be used to manage.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bridge-domain** *bridge-id*
4. **snmp context** *context-name*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**bridge-domain** *bridge-id* **Example:** `Router(config)# bridge-domain 5`	Configures components on bridge domain 5 and enters the bridge domain configuration mode.
Step 4	**snmp context** *context-name* **Example:** `Router(config-bdomain)# snmp context bd5`	Creates an SNMP context for bridge domain 5.
Step 5	**end** **Example:** `Router(config-bdomain)# end`	Exits bridge domain configuration mode and returs to privleged EXEC mode.

Configuration Examples for the Cisco Bridge-Domain MIB

Example: Bridge Domain and SNMP Context Configurations

The following example shows how two bridge domains and their corresponding SNMP contexts are configured.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# bridge-domain 2
Router(config-bdomain)# snmp context bd2
Router(config-bdomain)# bridge-domain 3
Router(config-bdomain)# snmp context bd3
Router(config-bdomain)# end
```

Example: Verifying Context Configurations

Contexts must be configured before you can poll the CISCO-BRIDGE-DOMAIN-MIB. The following sample output of the **show snmp context mapping** command shows that an SNMP context is configured for each of two bridge domains. This output reflects the configuration in the previous example, "Bridge Domain and SNMP Context Configurations."

```
Router# show snmp context mapping
Context: bd2
  VRF Name:
  BD Index: 2
Context: bd3
  VRF Name:
  BD Index: 3
```

Additional References

Related Documents

Related Topic	Document Title
Ethernet CFM	Configuring Ethernet Connectivity Fault Management in a Service Provider Network
IEEE 802.3ah	*IEEE 802.3ah Ethernet in the First Mile*
ITU-T Y.1731 fault management functions	*Configuring ITU-T Y.1731 Fault Management Functions*
Delivering and filtering syslog messages	*Reliable Delivery and Filtering for Syslog*
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases

Related Topic	Document Title
Cisco IOS Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*

Standards

Standard	Title
IEEE P802.1ag/D1.0	*Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks - Amendment 5: Connectivity Fault Management*
IETF VPLS OAM	*L2VPN OAM Requirements and Framework*
ITU-T	ITU-T Y.1731 OAM Mechanisms for Ethernet-Based Networks

MIBs

MIB	MIBs Link
• CISCO-ETHER-CFM-MIB • CISCO-IEEE-CFM-MIB	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 3164	*The BSD syslog Protocol*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for the Cisco Bridge-Domain MIB

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 6: Feature Information for the Cisco Bridge-Domain MIB

Feature Name	Releases	Feature Information
Bridge Domain MIB	15.0(1)S	The CISCO-BRIDGE-DOMAIN-MIB is delivered as an SNMP MIB and follows the general MIB architecture for Cisco IOS software. This MIB contains objects to manage multiple instances of SNMP context support for bridge domains and can be used to learn the details of various broadcast domains configured in the network. The following commands were introduced or modified: **show snmp context mapping**, **snmp context**.

CHAPTER 6

Configuring Ethernet Local Management Interface at a Provider Edge

The advent of Ethernet as a metropolitan-area network (MAN) and WAN technology imposes a new set of Operation, Administration, and Management (OAM) requirements on Ethernet's traditional operations, which had centered on enterprise networks only. The expansion of Ethernet technology into the domain of service providers, where networks are substantially larger and more complex than enterprise networks and the user-base is wider, makes operational management of link uptime crucial. More importantly, the timeliness in isolating and responding to a failure becomes mandatory for normal day-to-day operations, and OAM translates directly to the competitiveness of the service provider.

The “Configuring Ethernet Local Management Interface at a Provide Edge” module provides general information about configuring an Ethernet Local Management Interface (LMI), an OAM protocol, on a provider edge (PE) device.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring Ethernet Local Management Interface at a Provider Edge

- Ethernet Operation, Administration, and Management (OAM) must be operational in the network.
- For Ethernet OAM to operate, the provider edge (PE) side of a connection must be running Ethernet Connectivity Fault Management (CFM) and Ethernet Local Management Interface (LMI).
- All VLANs used on a PE device to connect to a customer edge (CE) device must also be created on that CE device.
- To use nonstop forwarding (NSF) and In Service Software Upgrade (ISSU), stateful switchover (SSO) must be configured and working properly.

Restrictions for Configuring Ethernet Local Management Interface at a Provider Edge

- Ethernet Local Management Interface (LMI) is not supported on routed ports, EtherChannel port channels, ports that belong to an EtherChannel, private VLAN ports, IEEE 802.1Q tunnel ports, Ethernet over Multiprotocol Label Switching (MPLS) ports, or Ethernet Flow Points (EFPs) on trunk ports.
- Ethernet LMI cannot be configured on VLAN interfaces.
- The high availability (HA) features NSF/SSO--E-LMI Support and ISSU--E-LMI Support are not supported on a customer edge (CE) device.

Information About Configuring Ethernet Local Management Interface at a Provider Edge

Ethernet Virtual Circuits Overview

An Ethernet virtual circuit (EVC) as defined by the Metro Ethernet Forum is a port level point-to-point or multipoint-to-multipoint Layer 2 circuit. EVC status can be used by a customer edge (CE) device to find an alternative path in to the service provider network or in some cases to fall back to a backup path over Ethernet or another alternative service such as ATM.

Ethernet LMI Overview

Ethernet Local Management Interface (LMI) is an Ethernet Operation, Administration, and Management (OAM) protocol between a customer edge (CE) device and a provider edge (PE) device. Ethernet LMI provides CE devices with the status of Ethernet virtual circuits (EVCs) for large Ethernet metropolitan-area networks (MANs) and WANs and provides information that enables CE devices to autoconfigure. Specifically, Ethernet LMI runs on the PE-CE User-Network Interface (UNI) link and notifies a CE device of the operating state of an EVC and the time when an EVC is added or deleted. Ethernet LMI also communicates the attributes of an EVC.

Ethernet LMI interoperates with Ethernet Connectivity Fault Management (CFM), an OAM protocol that runs within the provider network to collect OAM status. Ethernet CFM runs at the provider maintenance level (user provider edge [UPE] to UPE at the UNI). Ethernet LMI relies on the OAM Ethernet Infrastructure (EI) to interwork with CFM to learn the end-to-end status of EVCs across CFM domains.

Ethernet LMI is disabled globally by default. When Ethernet LMI is enabled globally, all interfaces are automatically enabled. Ethernet LMI can also be enabled or disabled at the interface to override the global configuration. The last Ethernet LMI command issued is the command that has precedence. No EVCs, Ethernet service instances, or UNIs are defined, and the UNI bundling service is bundling with multiplexing.

Ethernet CFM Overview

Ethernet Connectivity Fault Management (CFM) is an end-to-end per-service-instance (per VLAN) Ethernet layer Operation, Administration, and Management (OAM) protocol that includes proactive connectivity monitoring, fault verification, and fault isolation. End-to-end CFM can be from provider edge (PE) device to PE device or from customer edge (CE) device to CE device. For more information about Ethernet CFM, see "Configuring Ethernet Connectivity Fault Management in a Service Provider Network" in the *Carrier Ethernet Configuration Guide*.

OAM Manager Overview

The OAM manager is an infrastructure element that streamlines interaction between Operation, Administration, and Management (OAM) protocols. The OAM manager requires two interworking OAM protocols, Ethernet Connectivity Fault Management (CFM) and Ethernet Local Management Interface (LMI). No interactions are required between Ethernet LMI and the OAM manager on the customer edge (CE) side. On the User Provider-Edge (UPE) side, the OAM manager defines an abstraction layer that relays data collected from Ethernet CFM to the Ethernet LMI device.

Ethernet LMI and the OAM manager interaction is unidirectional, from the OAM manager to Ethernet LMI on the UPE side of the device. An information exchange results from an Ethernet LMI request or is triggered by the OAM manager when it receives notification from the OAM protocol that the number of UNIs has changed. A change in the number of UNIs may cause a change in Ethernet virtual circuit (EVC) status.

The OAM manager calculates EVC status given the number of active user network interfaces (UNIs) and the total number of associated UNIs. You must configure CFM to notify the OAM manager of all changes to the number of active UNIs or to the remote UNI ID for a given service provider VLAN (S-VLAN) domain.

The information exchanged is as follows:

- EVC name and availability status (active, inactive, partially active, or not defined)

- Remote UNI name and status (up, disconnected, administratively down, excessive frame check sequence [FCS] failures, or not reachable)
- Remote UNI counts (the total number of expected UNIs and the number of active UNIs)

Benefits of Ethernet LMI at a Provider Edge

- Communication of end-to-end status of the Ethernet virtual circuit (EVC) to the customer edge (CE) device
- Communication of EVC and user network interface (UNI) attributes to a CE device
- Competitive advantage for service providers

HA Features Supported by Ethernet LMI

In access and service provider networks using Ethernet technology, high availability (HA) is a requirement, especially on Ethernet operations, administration, and management (OAM) components that manage Ethernet virtual circuit (EVC) connectivity. End-to-end connectivity status information is critical and must be maintained on a hot standby Route Processor (RP) (a standby RP that has the same software image as the active RP and supports synchronization of line card, protocol, and application state information between RPs for supported features and protocols).

End-to-end connectivity status is maintained on the customer edge (CE), provider edge (PE), and access aggregation PE (uPE) network nodes based on information received by protocols such as Ethernet Local Management Interface (LMI), Connectivity Fault Managment (CFM), and 802.3ah. This status information is used to either stop traffic or switch to backup paths when an EVC is down.

Metro Ethernet clients (E-LMI, CFM, 802.3ah) maintain configuration data and dynamic data, which is learned through protocols. Every transaction involves either accessing or updating data in the various databases. If the database is synchronized across active and standby modules, the modules are transparent to clients.

The Cisco infrastructure provides component application programming interfaces (APIs) that are helpful in maintaining a hot standby RP. Metro Ethernet HA clients (E-LMI, HA/ISSU, CFM HA/ISSU, 802.3ah HA/ISSU) interact with these components, update the database, and trigger necessary events to other components.

Benefits of Ethernet LMI HA

- Elimination of network downtime for Cisco software image upgrades, resulting in higher availability.
- Elimination of resource scheduling challenges associated with planned outages and late night maintenance windows
- Accelerated deployment of new services and applications and faster implementation of new features, hardware, and fixes due to the elimination of network downtime during upgrades
- Reduced operating costs due to outages while the system delivers higher service levels due to the elimination of network downtime during upgrades

NSF SSO Support in Ethernet LMI

The redundancy configurations stateful switchover (SSO) and nonstop forwarding (NSF) are supported in Ethernet Local Management Interface (LMI) and are automatically enabled. A switchover from an active to a standby Route Processor (RP) or a standby Route Switch Processor (RSP) occurs when the active RP or RSP fails, is removed from the networking device, or is manually taken down for maintenance. The primary function of Cisco NSF is to continue forwarding IP packets following an RP or RSP switchover. NSF also interoperates with the SSO feature to minimize network downtime following a switchover.

For detailed information about the SSO and NSF features, see the *High Availability Configuration Guide*.

ISSU Support in Ethernet LMI

In Service Software Upgrade (ISSU) allows you to perform a Cisco software upgrade or downgrade without disrupting packet flow. Ethernet Local Management Interface (LMI) performs updates of the parameters within the Ethernet LMI database to the standby route processor (RP) or standby route switch processor (RSP). This checkpoint data requires ISSU capability to transform messages from one release to another. All the components that perform active processor to standby processor updates using messages require ISSU support. ISSU is automatically enabled in Ethernet LMI.

ISSU lowers the impact that planned maintenance activities have on network availability by allowing software changes while the system is in service. For detailed information about ISSU, see the *High Availability Configuration Guide*.

How to Configure Ethernet Local Management Interface at a Provider Edge

Configuring Ethernet LMI Interaction with CFM

For Ethernet Local Management Interface (LMI) to function with Connectivity Fault Management (CFM), you must configure Ethernet virtual circuits (EVCs), Ethernet service instances including untagged Ethernet flow points (EFPs), and Ethernet LMI customer VLAN mapping. Most of the configuration occurs on the provider edge (PE) device on the interfaces connected to the customer edge (CE) device. On the CE device, you need only enable Ethernet LMI on the connecting interface. Also, you must configure operations, administration, and management (OAM) parameters; for example, EVC definitions on PE devices on both sides of a metro network.

CFM and OAM interworking requires an inward facing Maintenance Entity Group End Point (MEP).

Configuring the OAM Manager

Note If you configure, change, or remove a user network interface (UNI) service type, Ethernet virtual circuit (EVC), Ethernet service instance, or customer edge (CE)-VLAN configuration, all configurations are checked to ensure that the configurations match (UNI service type with EVC or Ethernet service instance and CE-VLAN configuration). The configuration is rejected if the configurations do not match.

Perform this task to configure the OAM manager on a provider edge (PE) device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** *csi-id* **evc** *evc-name* **vlan** *vlan-id*
5. **continuity-check**
6. **continuity-check interval** *time*
7. **exit**
8. **exit**
9. **ethernet evc** *evc-id*
10. **oam protocol** {**cfm domain** *domain-name* | **ldp**}
11. **uni count** *value* [**multipoint**]
12. **exit**
13. Repeat Steps 3 through 12 to define other CFM domains that you want OAM manager to monitor.
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-id*]
16. **ethernet lmi ce-vlan map** {*vlan-id* [**untagged**] | **any** | **default** | **untagged**}
17. **ethernet lmi interface**
18. **encapsulation dot1q** *vlan-id*
19. **bridge-domain** *domain-number*
20. **cfm mep domain** *domain-name* **mpid** *mpid-id*
21. **exit**
22. **service instance** *service-instance-id* **ethernet**
23. **encapsulation untagged**
24. **l2protocol peer**
25. **bridge-domain** *bridge-domain-number*
26. **exit**
27. **ethernet uni** [**bundle** [**all-to-one**] | **id** *uni-id* | **multiplex**]
28. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain cstmr1 level 3`	Defines a Connectivity Fault Management (CFM) domain, sets the domain leve,l and enters Ethernet CFM configuration mode.
Step 4	**service** *csi-id* **evc** *evc-name* **vlan** *vlan-id* **Example:** `Device(config-ecfm)# service csi2 evc evc_1 vlan 10`	Defines a universally unique customer service instance (CSI) and VLAN ID within the maintenance domain, and enters Ethernet CFM service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Enables the transmission of continuity check messages (CCMs).
Step 6	**continuity-check interval** *time* **Example:** `Device(config-ecfm-srv)# continuity-check interval 1s/10s/1m/10m`	Enables the transmission of continuity check messages (CCMs) at specific intervals.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet CFM configuration mode.
Step 8	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 9	**ethernet evc** *evc-id* **Example:** `Device(config)# ethernet evc 50`	Defines an EVC and enters EVC configuration mode.
Step 10	**oam protocol** {**cfm domain** *domain-name* | **ldp**} **Example:** `Device(config-evc)# oam protocol cfm domain cstmr1`	Configures the Ethernet virtual circuit (EVC) operations, administration, and management (OAM) protocol as CFM for the CFM domain maintenance level as configured in Steps 3 and 4. **Note** If the CFM domain does not exist, this command is rejected, and an error message is displayed.
Step 11	**uni count** *value* [**multipoint**] **Example:** `Device(config-evc)# uni count 3`	(Optional) Sets the User Network Interface (UNI) count for the EVC. • If this command is not issued, the service defaults to a point-to-point service. If a value of 2 is entered, point-to-multipoint service becomes an option. If a value of 3 or greater is entered, the service is point-to-multipoint. **Note** If you enter a number greater than the number of endpoints, the UNI status is partially active even if all endpoints are up. If you enter a UNI count less than the number of endpoints, status might be active, even if all endpoints are not up.
Step 12	**exit** **Example:** `Device(config-evc)# exit`	Returns to global configuration mode.
Step 13	Repeat Steps 3 through 12 to define other CFM domains that you want OAM manager to monitor. **Example:** —	
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 1/3/1`	Specifies a physical interface connected to the CE device and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-id*] **Example:** `Device(config-if)# service instance 400 ethernet 50`	Configures an Ethernet service instance on the interface and enters Ethernet service configuration mode. • The Ethernet service instance identifier is a per-interface service identifier and does not map to a VLAN.

	Command or Action	Purpose
Step 16	**ethernet lmi ce-vlan map** {*vlan-id* [**untagged**] | **any** | **default** | **untagged**} **Example:** `Device(config-if-srv)# ethernet lmi ce-vlan map 30`	Configures an Ethernet LMI customer VLAN-to-EVC map for a particular UNI. **Note** To specify both VLAN IDs and untagged VLANs in the map, specify the VLAN IDs first and then specify the **untagged** keyword as follows: **ethernet lmi ce-vlan map 100,200,300,untagged**. Also, if the **untagged** keyword is not specified in the map configuration, the main interface line protocol on the Customer Edge (CE) device will be down.
Step 17	**ethernet lmi interface** **Example:** `Device(config-if-srv)# ethernet lmi interface`	Enables Ethernet local management interface (LMI) on a UNI.
Step 18	**encapsulation dot1q** *vlan-id* **Example:** `Device(config-if-srv)# encapsulation dot1q 2`	Defines the matching criteria to map 802.1Q frames ingress on an interface to the appropriate service instance.
Step 19	**bridge-domain** *domain-number* **Example:** `Device(config-if-srv)# brdige-domain 1`	Binds a service instance to a bridge domain instance.
Step 20	**cfm mep domain** *domain-name* **mpid** *mpid-id* **Example:** `Device(config-if-srv)# cfm mep domain provider mpid 10`	Configures a maintenance endpoint (MEP) for a domain.
Step 21	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.
Step 22	**service instance** *service-instance-id* **ethernet** **Example:** `Device(config-if)# service instance 22 ethernet`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.

	Command or Action	Purpose
Step 23	**encapsulation untagged** **Example:** `Device(config-if-srv)# encapsulation untagged`	Defines the matching criteria to map untagged ingress Ethernet frames on an interface to the appropriate service instance.
Step 24	**l2protocol peer** **Example:** `Device(config-if-srv)# l2protocol peer`	Configures transparent Layer 2 protocol peering on the interface.
Step 25	**bridge-domain** *bridge-domain-number* **Example:** `Device(config-if-srv)# bridge-domain 1`	Binds a service instance to a bridge domain instance.
Step 26	**exit** **Example:** `Device(config-if)# exit`	Returns to interface configuration mode.
Step 27	**ethernet uni** [**bundle** [**all-to-one**] | **id** *uni-id* | **multiplex**] **Example:** `Device(config-if)# ethernet uni bundle`	Sets UNI bundling attributes.
Step 28	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Enabling Ethernet LMI

The order in which the global and interface configuration commands are issued determines the configuration. The last command that is issued has precedence.

Perform this task to enable Ethernet Local Management Interface (LMI) on a device or on an interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet lmi interface**
5. **ethernet lmi** {**n393** *value* | **t392** *value*}
6. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface ethernet 1/3`	Defines an interface to configure as an Ethernet LMI interface and enters interface configuration mode.
Step 4	**ethernet lmi interface** **Example:** `Device(config-if)# ethernet lmi interface`	Configures Ethernet LMI on the interface. • When Ethernet LMI is enabled globally, it is enabled on all interfaces unless you disable it on specific interfaces. If Ethernet LMI is disabled globally, you can use this command to enable it on specified interfaces.
Step 5	**ethernet lmi** {**n393** *value* | **t392** *value*} **Example:** `Device(config-if)# ethernet lmi n393 10`	Configures Ethernet LMI parameters for the UNI.
Step 6	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Displaying Ethernet LMI and OAM Manager Information

Perform this task to display Ethernet Local Management Interface (LMI) or Operation, Administration, and Management (OAM) manager information. After step 1, all the steps are optional and can be performed in any order.

SUMMARY STEPS

1. **enable**
2. **show ethernet lmi** {{**evc** [**detail** *evc-id* [**interface** *type number*] | **map interface** *type number*]} | {**parameters** | **statistics**} **interface** *type number* | **uni map** [**interface** *type number*]}
3. **show ethernet service evc** [**detail** | **id** *evc-id* [**detail**] | **interface** *type number* [**detail**]]
4. **show ethernet service instance** [**detail** | **id** *id* | **interface** *type number* | **policy-map** | **stats**]
5. **show ethernet service interface** [*type number*] [**detail**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ethernet lmi** {{**evc** [**detail** *evc-id* [**interface** *type number*] | **map interface** *type number*]} | {**parameters** | **statistics**} **interface** *type number* | **uni map** [**interface** *type number*]} **Example:** `Device# show ethernet lmi evc`	Displays information that was sent to the customer edge (CE).
Step 3	**show ethernet service evc** [**detail** | **id** *evc-id* [**detail**] | **interface** *type number* [**detail**]] **Example:** `Device# show ethernet service evc`	Displays information about all Ethernet virtual circuits (EVCs) or about a specified EVC.
Step 4	**show ethernet service instance** [**detail** | **id** *id* | **interface** *type number* | **policy-map** | **stats**] **Example:** `Device# show ethernet service instance detail`	Displays information about customer service instances.

	Command or Action	Purpose
Step 5	**show ethernet service interface** [*type number*] [**detail**] **Example:** `Device# show ethernet service interface ethernet 1/3 detail`	Displays interface-only information about Ethernet customer service instances for all interfaces or for a specified interface.

Examples

The following example shows sample output from the **show ethernet lmi** command using the **evc** keyword:

```
Device# show ethernet lmi evc

St  EVC Id                                                        Port
--- ------------------------------------------------------------ --------------
A  EVC_MP2MP_101                                                 Gi0/1
A  EVC_P2P_110                                                   Gi0/1
```

The following example is sample output from the **show ethernet service evc** command:

```
Device# show ethernet service evc

Identifier                     Type  Act-UNI-cnt Status
50                             MP-MP     0       NotDefined
```

The following is sample output from the **show ethernet service interface** command using the **detail** keyword:

```
Device# show ethernet service interface gigabitethernet 1/3/1 detail

Interface: Gigabitethernet 1/3/1
ID: uni2
CE-VLANS: 30
EVC Map Type: Bundling
Associated EVCs:
    EVC-ID                          CE-VLAN
    50                              30
Associated Service Instances:
    Service-Instance-ID CE-VLAN
    400                 30
```

The following is sample output from the **show ethernet service instance** command using the **detail** keyword:

```
Device# show ethernet service instance detail

Service Instance ID: 400
Associated Interface: GigabitEthernet1/3/1
Associated EVC: 50
CE-Vlans: 30
State: AdminDown
EFP Statistics:
   Pkts In   Bytes In   Pkts Out  Bytes Out
         0          0          0          0
```

Configuration Examples for Ethernet Local Management Interface at a Provider Edge

Example: Ethernet OAM Manager on a PE Device Configuration

This example shows a sample configuration of Operation, Administration, and Management (OAM) manager, Connectivity Fault Management (CFM), and Ethernet Local Management Interface (LMI) on a provider edge (PE) device. In this example, a bridge domain is specified.

```
Device> enable
Device# configure terminal
Device(config)# ethernet cfm global
Device(config)# ethernet cfm domain provider level 4
Device(config-ecfm)# service customer_1 evc test1 vlan 10
Device(config-ecfm-srv)# continuity-check
Device(config-ecfm-srv)# continuity-check interval 1s/10s/1m/10m
Device(config-ecfm-srv)# exit
Device(config-ecfm)# exit
Device(config)# ethernet evc test1
Device(config-evc)# uni count 3
Device(config-evc)# oam protocol cfm domain provider
Device(config-evc)# exit
Device(config)#  interface gigabitEthernet 0/5/1
Device(config-if)# ethernet lmi interface
Device(config-if)# ethernet uni id CISCO
Device(config-if)# service instance 1 ethernet
Device(config-if-srv)# encapsulation untagged
Device(config-if-srv)# l2protocol peer
Device(config-if-srv)# bridge-domain 1
Device(config-if-srv)# exit
Device(config-if)# service instance 2 ethernet1
Device(config-if-srv)# ethernet lmi ce-vlan map 101
Device(config-if-srv)# encapsulation dot1q 2
Device(config-if-srv)# bridge-domain 2
Device(config-if-srv)# cfm mep domain provider mpid 10
Device(config-if-srv-ecfm-mep)# end
```

This example shows a configuration of OAM manager, CFM, and Ethernet LMI over an Xconnect configuration:

```
Device> enable
Device# configure terminal
Device(config)# ethernet cfm global
Device(config)# ethernet cfm domain provider level 4
Device(config-ecfm)# service customer_1 evc test1
Device(config-ecfm-srv)# continuity-check
Device(config-ecfm-srv)# continuity-check interval 1s,10s,1m,10m
Device(config-ecfm-srv)# exit
Device(config-ecfm)# exit
Device(config)# ethernet evc test1
Device(config-evc)# oam protocol cfm domain provider
Device(config-evc)# exit
Device(config)#  interface gigabitEthernet 0/5/1
Device(config-if)# ethernet lmi interface
Device(config-if)# ethernet uni id CISCO
Device(config-if)# service instance 1 ethernet
Device(config-if-srv)# encapsulation untagged
Device(config-if-srv)# l2protocol peer
Device(config-if-srv)# bridge-domain 1
Device(config-if-srv)# exit
Device(config-if)# service instance 2 ethernet
```

```
Device(config-if-srv)# ethernet lmi ce-vlan map 101
Device(config-if-srv)# encapsulation dot1q 2
Device(config-if-srv)# xconnect 10.1.1.1 100 encapsulation mpls
Device(cfg-if-ether-vc-xconn)# exit
Device(config-if-srv)# cfm mep domain provider mpid 10
Device(config-if-srv-ecfm-mep)# end
```

Example: Ethernet LMI on a CE Device Configuration

This example shows how to configure Ethernet Local Management Interface (LMI) globally on a customer edge (CE) device:

```
Device# configure terminal
Device(config)# ethernet lmi global
Device(config)# ethernet lmi ce
Device(config)# exit
```

Additional References for Configuring Ethernet Local Management Interface at a Provider Edge

Related Documents

Related Topic	Document Title
Ethernet Connectivity Fault Management (CFM)	"Configuring Ethernet Connectivity Fault Management in a Service Provider Network" in the *Carrier Ethernet Configuration Guide*
Ethernet Local Management Interface (LMI)	"Enabling Ethernet Local Management Interface" in the *Carrier Ethernet Configuration Guide*
Remote Port Shutdown feature	"Configuring Remote Port Shutdown" in the *Carrier Ethernet Configuration Guide*
IEEE 802.3ah	*IEEE 802.3ah Ethernet in the First Mile*
Cisco high availability (HA) configuration information	*High Availability Configuration Guide*
Ethernet LMI commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases

Standards

Standard	Title
IEEE P802.1ag/D5.2	*Draft Standard for Local and Metropolitan Area Networks*
ITU-T	*ITU-T Y.1731 OAM Mechanisms for Ethernet-Based Networks*
IETF VPLS OAM	*L2VPN OAM Requirements and Framework*
Metro Ethernet Forum 16 Technical Specification	*Technical Specification MEF 16- Ethernet Local Management Interface*
ITU-T Q.3/13	*Liaison statement on Ethernet OAM (Y.17ethoam)*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring Ethernet Local Management Interface at a Provider Edge

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 7: Feature Information for Configuring Ethernet Local Management Interface at a Provider Edge

Feature Name	Releases	Feature Information
Ethernet Local Management Interface at a Provider Edge	12.2(33)SRB 12.2(33)SXI	Ethernet LMI is an Ethernet OAM protocol between a CE device and a PE device. Ethernet LMI provides CE devices with the status of EVCs for large Ethernet MANs and WANs and provides information that enables CE devices to autoconfigure. Specifically, Ethernet LMI runs on the PE-CE UNI link and notifies a CE device of the operating state of an EVC and when an EVC is added or deleted. Ethernet LMI also communicates the attributes of an EVC. In Cisco IOS Release 12.2(33)SRB, this feature was introduced on the Cisco 7600 series router. The following commands were introduced or modified: **debug ethernet lmi**, **debug ethernet service, ethernet evc**, **ethernet lmi ce-vlan map**, **ethernet uni**, **oam protocol**, **service instance ethernet**, **show ethernet service evc**, **show ethernet service instance**, **show ethernet service interface, uni count**.

Feature Name	Releases	Feature Information
ISSU Support in E-LMI	12.2(33)SRD 15.0(1)S	ISSU allows you to perform a Cisco IOS software upgrade or downgrade without disrupting packet flow. ISSU lowers the impact that planned maintenance activities have on network availability by allowing software changes while the system is in service. In Cisco IOS Release 12.2(33)SRD, this feature was introduced on the Cisco 7600 series router. The following commands were introduced or modified: **debug ethernet lmi**.
NSF/SSO Support in E-LMI	12.2(33)SRD 15.0(1)S	The redundancy configurations SSO and NSF are supported in Ethernet LMI and are automatically enabled. A switchover from an active to a standby RP occurs when the active RP fails, is removed from the networking device, or is manually taken down for maintenance. The primary function of Cisco NSF is to continue forwarding IP packets following an RP switchover. NSF also interoperates with the SSO feature to minimize network downtime following a switchover. In Cisco IOS Release 12.2(33)SRD, this feature was introduced on the Cisco 7600 series router. The following commands were introduced or modified: **debug ethernet lmi**.

CHAPTER 7

Configuring Ethernet Connectivity Fault Management in a Service Provider Network

Ethernet Connectivity Fault Management (CFM) is an end-to-end per-service-instance Ethernet layer operations, administration, and maintenance (OAM) protocol. It includes proactive connectivity monitoring, fault verification, and fault isolation for large Ethernet metropolitan-area networks (MANs) and WANs.

The advent of Ethernet as a MAN and WAN technology imposes a new set of OAM requirements on Ethernet's traditional operations, which were centered on enterprise networks only. The expansion of Ethernet technology into the domain of service providers, where networks are substantially larger and more complex than enterprise networks and the user base is wider, makes operational management of link uptime crucial. More importantly, the timeliness in isolating and responding to a failure becomes mandatory for normal day-to-day operations, and OAM translates directly to the competitiveness of the service provider.

Note As an alternative, CFM can be configured over an Ethernet flow point (EFP) interface by using the cross connect functionality. For more information about this alternative, see Configuring the CFM over EFP Interface with Cross Connect Feature.

Prerequisites for Configuring Ethernet CFM in a Service Provider Network

Business Requirements

- Network topology and network administration have been evaluated.
- Business and service policies have been established.
- Partial Route Computation (PRC) codes have been implemented for all supported commands related to configuring High Availability (HA) on a maintenance endpoint (MEP), maintenance intermediate point (MIP), level, service instance ID, cross-check timer, cross-check, and domain.

Restrictions for Configuring Ethernet CFM in a Service Provider Network

- CFM loopback messages will not be confined within a maintenance domain according to their maintenance level. The impact of not having CFM loopback messages confined to their maintenance levels occurs at these levels:
    - Architecture—CFM layering is violated for loopback messages.
    - Deployment—A user may potentially misconfigure a network and have loopback messages succeed.
    - Security—A malicious device that recognizes devices' MAC addresses and levels may potentially explore a network topology that should be transparent.
- CFM is not fully supported on a Multiprotocol Label Switching (MPLS) provider edge (PE) device. There is no interaction between CFM and an Ethernet over MPLS (EoMPLS) pseudowire.
- CFM configuration is not supported on an EtherChannel in FastEthernet Channel (FEC) mode.
- The HA features NFS/SSO Support in CFM 802.1ag/1.0d and ISSU Support in CFM 802.1ag/1.0d are not supported on customer edge (CE) devices.
- The NFS/SSO Support in CFM 802.1ag/1.0d feature is not supported for the traceroute and error databases.

Information About Configuring Ethernet CFM in a Service Provider Network

Ethernet CFM

Ethernet CFM is an end-to-end per-service-instance Ethernet layer OAM protocol that includes proactive connectivity monitoring, fault verification, and fault isolation. End to end can be PE to PE or CE to CE. A service can be identified as a service provider VLAN (S-VLAN) or an EVC service.

Being an end-to-end technology is the distinction between CFM and other metro-Ethernet OAM protocols. For example, MPLS, ATM, and SONET OAM help in debugging Ethernet wires but are not always end-to-end. 802.3ah OAM is a single-hop and per-physical-wire protocol. It is not end to end or service aware.

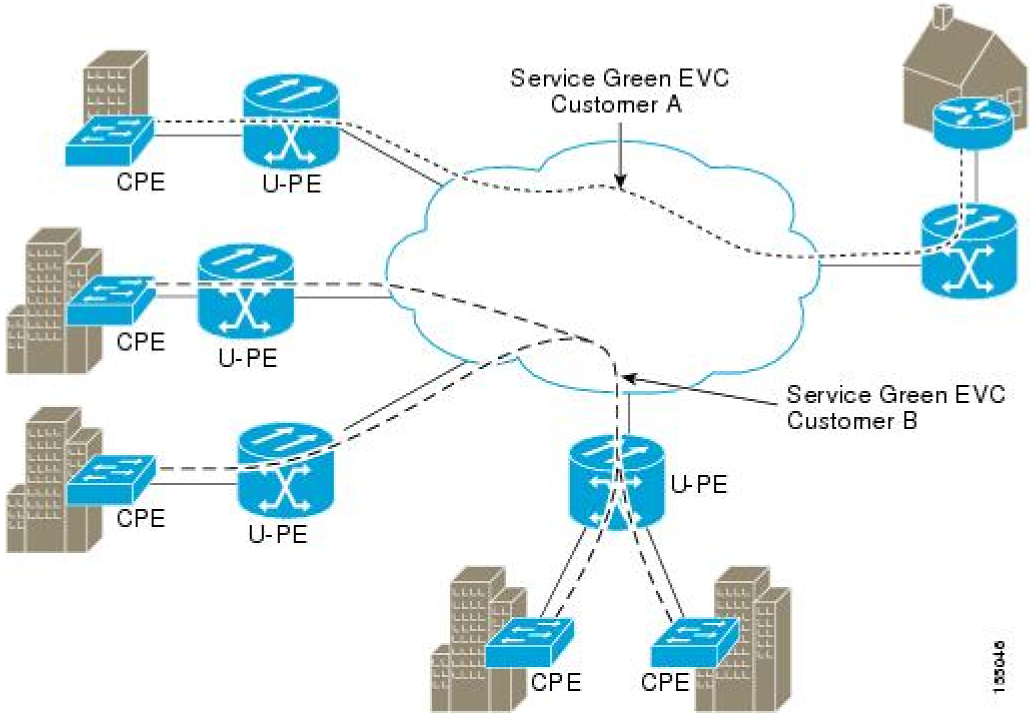
Troubleshooting carrier networks offering Ethernet Layer 2 services is challenging. Customers contract with service providers for end-to-end Ethernet service and service providers may subcontract with operators to provide equipment and networks. Compared to enterprise networks, where Ethernet traditionally has been implemented, these constituent networks belong to distinct organizations or departments, are substantially larger and more complex, and have a wider user base. Ethernet CFM provides a competitive advantage to service providers for which the operational management of link uptime and timeliness in isolating and responding to failures is crucial to daily operations.

Benefits of Ethernet CFM

- End-to-end service-level OAM technology
- Reduced operating expense for service provider Ethernet networks
- Competitive advantage for service providers
- Supports both distribution and access network environments with the outward facing MEPs enhancement

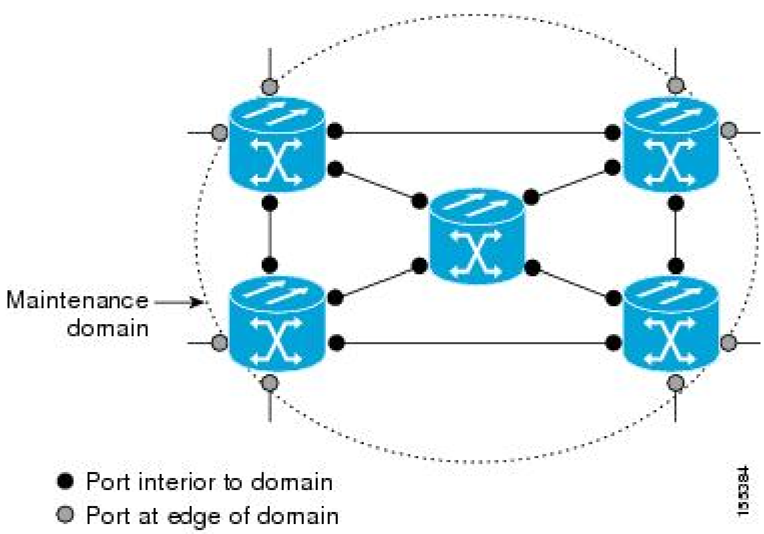
Customer Service Instance

A customer service instance is an Ethernet virtual connection (EVC), which is identified by an S-VLAN within an Ethernet island, and is identified by a globally unique service ID. A customer service instance can be point-to-point or multipoint-to-multipoint. The figure below shows two customer service instances. Service Instance Green is point to point; Service Instance Blue is multipoint to multipoint.



Maintenance Domain

A maintenance domain is a management space for the purpose of managing and administering a network. A domain is owned and operated by a single entity and defined by the set of ports internal to it and at its boundary. The figure below illustrates a typical maintenance domain.

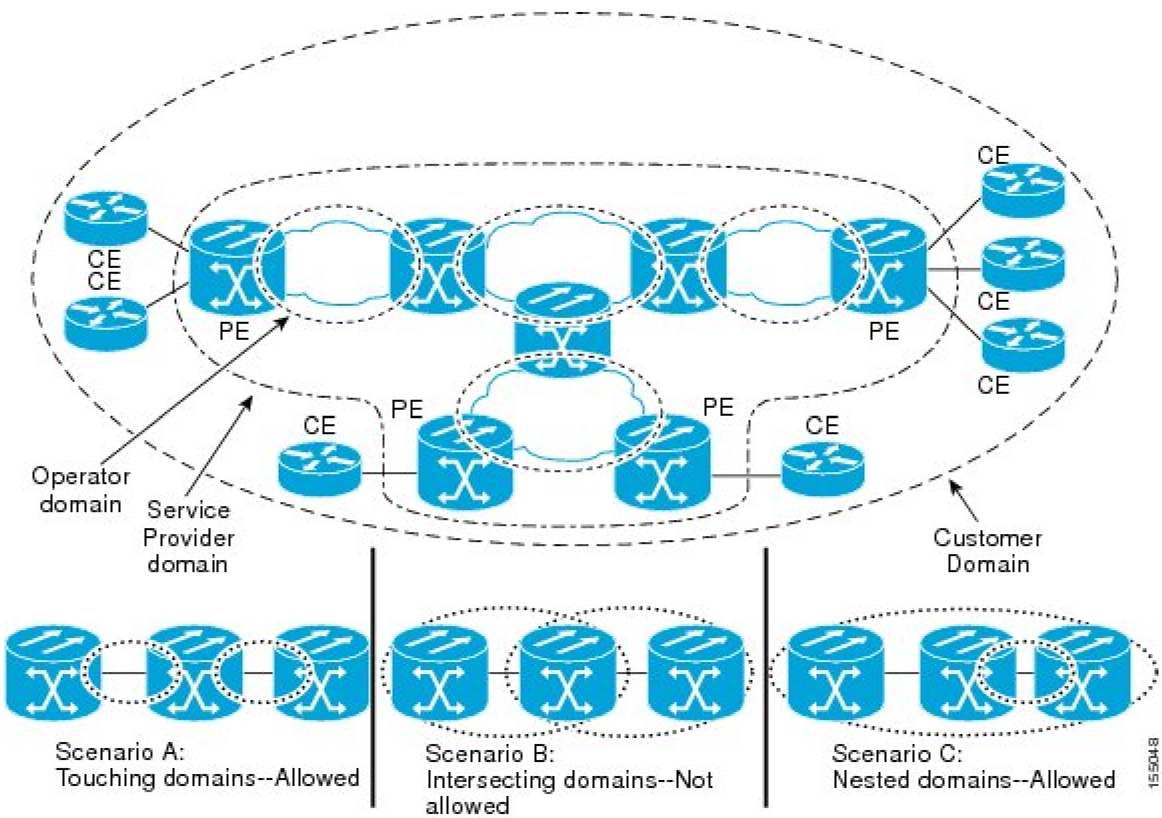


A unique maintenance level in the range of 0 to 7 is assigned to each domain by a network administrator. Levels and domain names are useful for defining the hierarchical relationship that exists among domains. The hierarchical relationship of domains parallels the structure of customer, service provider, and operator. The larger the domain, the higher the level value. For example, a customer domain would be larger than an operator domain. The customer domain may have a maintenance level of 7 and the operator domain may have a maintenance level of 0. Typically, operators would have the smallest domains and customers the largest domains, with service provider domains between them in size. All levels of the hierarchy must operate together.

Domains should not intersect because intersecting would mean management by more than one entity, which is not allowed. Domains may nest or touch but when two domains nest, the outer domain must have a higher maintenance level than the domain nested within it. Nesting maintenance domains is useful in the business model where a service provider contracts with one or more operators to provide Ethernet service to a customer. Each operator would have its own maintenance domain and the service provider would define its domain—a superset of the operator domains. Furthermore, the customer has its own end-to-end domain which is in turn a superset of the service provider domain. Maintenance levels of various nesting domains should be communicated among the administering organizations. For example, one approach would be to have the service provider assign maintenance levels to operators.

CFM exchanges messages and performs operations on a per-domain basis. For example, running CFM at the operator level does not allow discovery of the network by the higher provider and customer levels.

Network designers decide on domains and configurations. The figure below illustrates a hierarchy of operator, service provider, and customer domains and also illustrates touching, intersecting, and nested domains.



Maintenance Point

A maintenance point is a demarcation point on an interface (port) that participates in CFM within a maintenance domain. Maintenance points on device ports act as filters that confine CFM frames within the bounds of a domain by dropping frames that do not belong to the correct level. Maintenance points must be explicitly configured on Cisco devices. Two classes of maintenance points exist, MEPs and MIPs.

Maintenance Endpoints

Maintenance endpoints (MEPs) have the following characteristics:

- Per maintenance domain (level) and service (S-VLAN or EVC)
- At the edge of a domain, define the boundary
- Within the bounds of a maintenance domain, confine CFM messages
- When configured to do so, proactively transmit Connectivity Fault Management (CFM) continuity check messages (CCMs)
- At the request of an administrator, transmit traceroute and loopback messages

Inward Facing MEPs

Inward facing means the MEP communicates through the Bridge Relay function and uses the Bridge-Brain MAC address. An inward facing MEP performs the following functions:

- Sends and receives CFM frames at its level through the relay function, not via the wire connected to the port on which the MEP is configured.
- Drops all CFM frames at its level (or lower level) that come from the direction of the wire.
- Processes all CFM frames at its level coming from the direction of the relay function.
- Drops all CFM frames at a lower level coming from the direction of the relay function.
- Transparently forwards all CFM frames at its level (or a higher level), independent of whether they come in from the relay function side or the wire side.

Note A MEP of level L (where L is less than 7) requires a MIP of level M > L on the same port; hence, CFM frames at a level higher than the level of the MEP will be catalogued by this MIP.

- If the port on which the inward MEP is configured is blocked by Spanning-Tree Protocol, the MEP can no longer transmit or receive CFM messages.

Outward Facing MEPs for Port Channels

Outward facing means that the MEP communicates through the wire. Outward facing MEPs can be configured on port channels (using cross connect functionality). A MIP configuration at a level higher than the level of the outward facing MEP is not required.

Outward facing MEPs on port channels use the Bridge-Brain MAC address of the first member link. When port channel members change, the identities of outward facing MEPs do not have to change.

An outward facing MEP performs the following functions:

- Sends and receives CFM frames at its level via the wire connected to the port where the MEP is configured.

- Drops all CFM frames at its level (or at a lower level) that come from the direction of the relay function.
- Processes all CFM frames at its level coming from the direction of the wire.
- Drops all CFM frames at a lower level coming from the direction of the wire.
- Transparently forwards all CFM frames at levels higher than the level of the outward facing MEP, independent of whether they come in from the relay function side or the wire side.
- If the port on which the outward MEP is configured is blocked by the Spanning-Tree Protocol, the MEP can still transmit and receive CFM messages via the wire.

Maintenance Intermediate Points

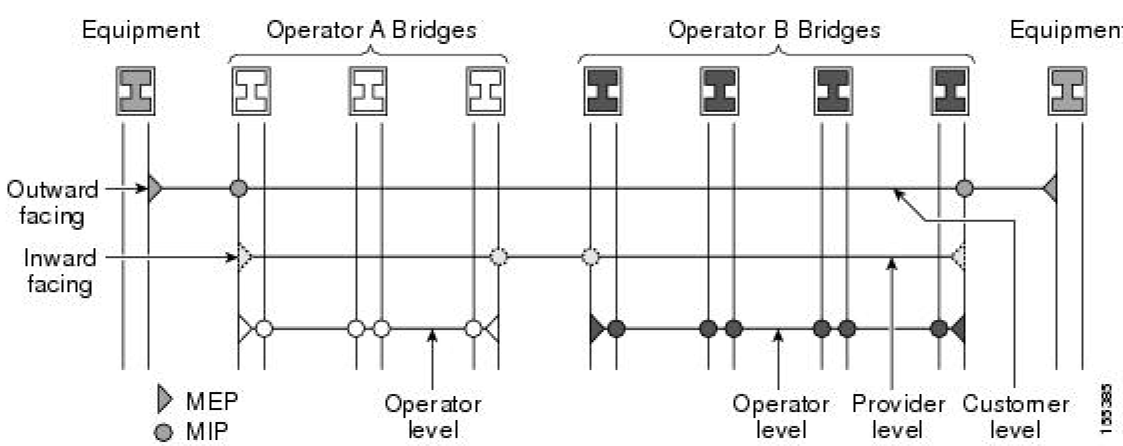
MIPs have the following characteristics:

- Per maintenance domain (level) and for all S-VLANs enabled or allowed on a port.
- Internal to a domain, not at the boundary.
- CFM frames received from MEPs and other MIPs are cataloged and forwarded, using both the wire and the relay function.
- All CFM frames at a lower level are stopped and dropped, independent of whether they originate from the wire or relay function.
- All CFM frames at a higher level are forwarded, independent of whether they arrive from the wire or relay function.
- Passive points respond only when triggered by CFM traceroute and loopback messages.
- Bridge-Brain MAC addresses are used.

If the port on which a MIP is configured is blocked by Spanning-Tree Protocol, the MIP cannot receive CFM messages or relay them toward the relay function side. The MIP can, however, receive and respond to CFM messages from the wire.

A MIP has only one level associated with it and the command-line interface (CLI) does not allow you to configure a MIP for a domain that does not exist.

The figure below illustrates MEPs and MIPs at the operator, service provider, and customer levels.



CFM Messages

CFM uses standard Ethernet frames. CFM frames are distinguishable by EtherType and for multicast messages by MAC address. CFM frames are sourced, terminated, processed, and relayed by bridges. Routers can support only limited CFM functions.

Bridges that cannot interpret CFM messages forward them as normal data frames. All CFM messages are confined to a maintenance domain and to an S-VLAN (PE-VLAN or Provider-VLAN). Three types of messages are supported:

- Continuity Check
- Loopback
- Traceroute

Continuity Check Messages

CFM CCMs are multicast heartbeat messages exchanged periodically among MEPs. They allow MEPs to discover other MEPs within a domain and allow MIPs to discover MEPs. CCMs are confined to a domain and S-VLAN.

CFM CCMs have the following characteristics:

- Transmitted at a configurable periodic interval by MEPs. The interval can be from 10 seconds to 65535 seconds, the default is 30.
- Contain a configurable hold-time value to indicate to the receiver the validity of the message. The default is 2.5 times the transmit interval.
- Catalogued by MIPs at the same maintenance level.
- Terminated by remote MEPs at the same maintenance level.
- Unidirectional and do not solicit a response.
- Carry the status of the port on which the MEP is configured.

Loopback Messages

CFM loopback messages are unicast frames that a MEP transmits, at the request of an administrator, to verify connectivity to a particular maintenance point. A reply to a loopback message indicates whether a destination is reachable but does not allow hop-by-hop discovery of the path. A loopback message is similar in concept to an Internet Control Message Protocol (ICMP) Echo (ping) message.

A CFM loopback message can be generated on demand using the CLI. The source of a loopback message must be a MEP; the destination may be a MEP or a MIP. CFM loopback messages are unicast; replies to loopback messages also are unicast. CFM loopback messages specify the destination MAC address, VLAN, and maintenance domain.

Traceroute Messages

CFM traceroute messages are multicast frames that a MEP transmits, at the request of an administrator, to track the path (hop-by-hop) to a destination MEP. They allow the transmitting node to discover vital connectivity data about the path, and allow the discovery of all MIPs along the path that belong to the same maintenance domain. For each visible MIP, traceroute messages indicate ingress action, relay action, and egress action. Traceroute messages are similar in concept to User Datagram Protocol (UDP) traceroute messages.

Traceroute messages include the destination MAC address, VLAN, and maintenance domain and they have Time To Live (TTL) to limit propagation within the network. They can be generated on demand using the CLI. Traceroute messages are multicast; reply messages are unicast.

Cross-Check Function

The cross-check function is a timer-driven post-provisioning service verification between dynamically discovered MEPs (via CCMs) and expected MEPs (via configuration) for a service. The cross-check function verifies that all endpoints of a multipoint or point-to-point service are operational. The function supports notifications when the service is operational; otherwise it provides alarms and notifications for unexpected endpoints or missing endpoints.

The cross-check function is performed one time. You must initiate the cross-check function from the CLI every time you want a service verification.

SNMP Traps

The support provided by the Cisco software implementation of CFM traps is Cisco proprietary information. MEPs generate two types of Simple Network Management Protocol (SNMP) traps, continuity check (CC) traps and cross-check traps.

CC Traps

- MEP up—Sent when a new MEP is discovered, the status of a remote port changes, or connectivity from a previously discovered MEP is restored after interruption.
- MEP down—Sent when a timeout or last gasp event occurs.
- Cross-connect—Sent when a service ID does not match the VLAN.
- Loop—Sent when a MEP receives its own CCMs.
- Configuration error—Sent when a MEP receives a continuity check with an overlapping MPID.

Cross-Check Traps

- Service up—Sent when all expected remote MEPs are up in time.
- MEP missing—Sent when an expected MEP is down.
- Unknown MEP—Sent when a CCM is received from an unexpected MEP.

Ethernet CFM and Ethernet OAM Interaction

To understand how CFM and OAM interact, you should understand the following concepts:

Ethernet Virtual Circuit

An EVC as defined by the Metro Ethernet Forum is a port-level point-to-point or multipoint-to-multipoint Layer 2 circuit. EVC status can be used by a CE device either to find an alternative path in to the service provider network or in some cases, to fall back to a backup path over Ethernet or over another alternative service such as ATM.

OAM Manager

The OAM manager is an infrastructure element that streamlines interaction between OAM protocols. The OAM manager requires two interworking OAM protocols, in this case Ethernet CFM and Ethernet OAM. Interaction is unidirectional from the OAM manager to the CFM protocol and the only information exchanged is the user network interface (UNI) port status. Additional port status values available include

- REMOTE_EE—Remote excessive errors
- LOCAL_EE—Local excessive errors
- TEST—Either remote or local loopback

After CFM receives the port status, it communicates that status across the CFM domain.

CFM over Bridge Domains

Connectivity Fault Management (CFM) over bridge domains allows untagged CFM packets to be associated with a maintenance end point (MEP). An incoming untagged customer CFM packet has an EtherType of CFM and is mapped to an Ethernet virtual circuit (EVC) or bridge domain based on the encapsulation configured on the Ethernet flow point (EFP). The EFP is configured specifically to recognize these untagged packets.

An EFP is a logical demarcation point of an EVC on an interface and can be associated with a bridge domain. The VLAN ID is used to match and map traffic to the EFP. VLAN IDs have local significance per port similar to an ATM virtual circuit. CFM is supported on a bridge domain associated with an EFP. The association between the bridge domain and the EFP allows CFM to use the encapsulation on the EFP. All EFPs in the same bridge domain form a broadcast domain. The bridge domain ID determines the broadcast domain.

The distinction between a VLAN port and the EFP is the encapsulation. VLAN ports use a default dot1q encapsulation. For EFPs, untagged, single tagged, and double tagged encapsulation exists with dot1q and IEEE dot1ad EtherTypes. Different EFPs belonging to the same bridge domain can use different encapsulations.

HA Features Supported by CFM

In access and service provider networks using Ethernet technology, High Availability (H)A is a requirement, especially on Ethernet OAM components that manage EVC connectivity. End-to-end connectivity status information is critical and must be maintained on a hot standby Route Switch Processor (RSP).

Note A hot standby Route Switch Processor (RSP) has the same software image as the active RSP and supports synchronization of protocol and application state information between RSPs for supported features and protocols.

End-to-end connectivity status is maintained on the customer edge (CE), provider edge (PE), and access aggregation PE (uPE) network nodes based on information received by protocols such as Connectivity Fault Management (CFM) and 802.3ah. This status information is used to either stop traffic or switch to backup paths when an EVC is down.

Every transaction involves either accessing or updating data among various databases. If the database is synchronized across active and standby modules, the modules are transparent to clients.

The Cisco infrastructure provides various component application program interfaces (APIs) that help to maintain a hot standby RSP. Metro Ethernet HA clients HA/ISSU, CFM HA/ISSU, and 802.3ah HA/ISSU interact with these components, update the database, and trigger necessary events to other components.

Benefits of CFM HA

- Elimination of network downtime for Cisco software image upgrades, allowing for faster upgrades.
- Elimination of resource scheduling challenges associated with planned outages and late night maintenance windows.
- Accelerated deployment of new services and applications and facilitation of faster implementation of new features.
- Reduced operating costs due to outages while delivering higher service levels.
- CFM updates its databases and controls its own HA messaging and versioning, and this control facilitates maintenance.

CFM HA in a Metro Ethernet Network

A standalone Connectivity Fault Management (CFM) implementation does not have explicit high availability (HA) requirements. When CFM is implemented on a customer edge (CE) or provider edge (PE), CFM must maintain the Ethernet virtual circuit (EVC) state, which requires HA because the EVC state is critical in maintaining end-to-end connectivity. CFM configures the platform with maintenance level, domain, and maintenance point, learns the remote maintenance point information, and maps it to the appropriate EVC. CFM then aggregates data received from all remote ports; consequently HA requirements vary for CE and PE.

The CE receives the EVC ID, associated customer VLANs, UNI information, EVC state, and remote UNI ID and state from the MEN. The CE relies on the EVC state to send or stop traffic to the MEN.

The PE has EVC configuration and associated customer VLAN information and derives the EVC state and remote UNI from CFM.

Note PEs and CEs running 802.3ah OAM must maintain the port state so peers are not affected by a switchover. This information is also sent to remote nodes in CFM CC messages.

NSF SSO Support in CFM 802.1ag 1.0d

The redundancy configurations Stateful Switchover (SSO) and Nonstop Forwarding (NSF) are both supported in Ethernet Connectivity Fault Management (CFM) and are automatically enabled. A switchover from an active to a standby Route Switch Processor (RSP) occurs when the active RSP fails, is removed from the networking device, or is manually taken down for maintenance. NSF interoperates with the SSO feature to minimize network downtime following a switchover. The primary function of Cisco NSF is to continue forwarding IP packets following an RSP switchover.

For detailed information about SSO, see the “Configuring Stateful Switchover” module of the *High Availability Configuration Guide*. For detailed information about the NSF feature, see the “Configuring Cisco Nonstop Forwarding” module of the *High Availability Configuration Guide*.

ISSU Support in CFM 802.1ag 1.0d

In Service Upgrades (ISSUs) allow you to perform a Cisco software upgrade or downgrade without disrupting packet flow. Connectivity Fault Management (CFM) performs a bulk update and a runtime update of the continuity check database to the standby Route Switch Processor (RSP), including adding, deleting, or updating a row. This checkpoint data requires ISSU capability to transform messages from one release to another. All the components that perform active RSP to standby RSP updates using messages require ISSU support.

ISSU is automatically enabled in CFM and lowers the impact that planned maintenance activities have on network availability by allowing software changes while the system is in service. For detailed information about ISSU, see the “Performing an In Service Software Upgrade ” module of the *High Availability Configuration Guide*.

How to Set Up Ethernet CFM in a Service Provider Network

Designing CFM Domains

Note To have an operator, service provider, or customer domain is optional. A network may have a single domain or multiple domains. The steps listed here show the sequence when all three types of domains will be assigned.

Before You Begin

- Knowledge and understanding of the network topology.
- Understanding of organizational entities involved in managing the network; for example, operators, service providers, network operations centers (NOCs), and customer service centers.
- Understanding of the type and scale of services to be offered.
- Agreement by all organizational entities on the responsibilities, roles, and restrictions for each organizational entity.
- Determination of the number of maintenance domains in the network.
- Determination of the nesting and disjoint maintenance domains.
- Assignment of maintenance levels and names to domains based on agreement between the service provider and operator or operators.
- Determination of whether the domain should be inward or outward.

SUMMARY STEPS

1. Determine operator level MIPs.
2. Determine operator level MEPs.
3. Determine service provider MIPs.
4. Determine service provider MEPs.
5. Determine customer MIPs.
6. Determine customer MEPs.

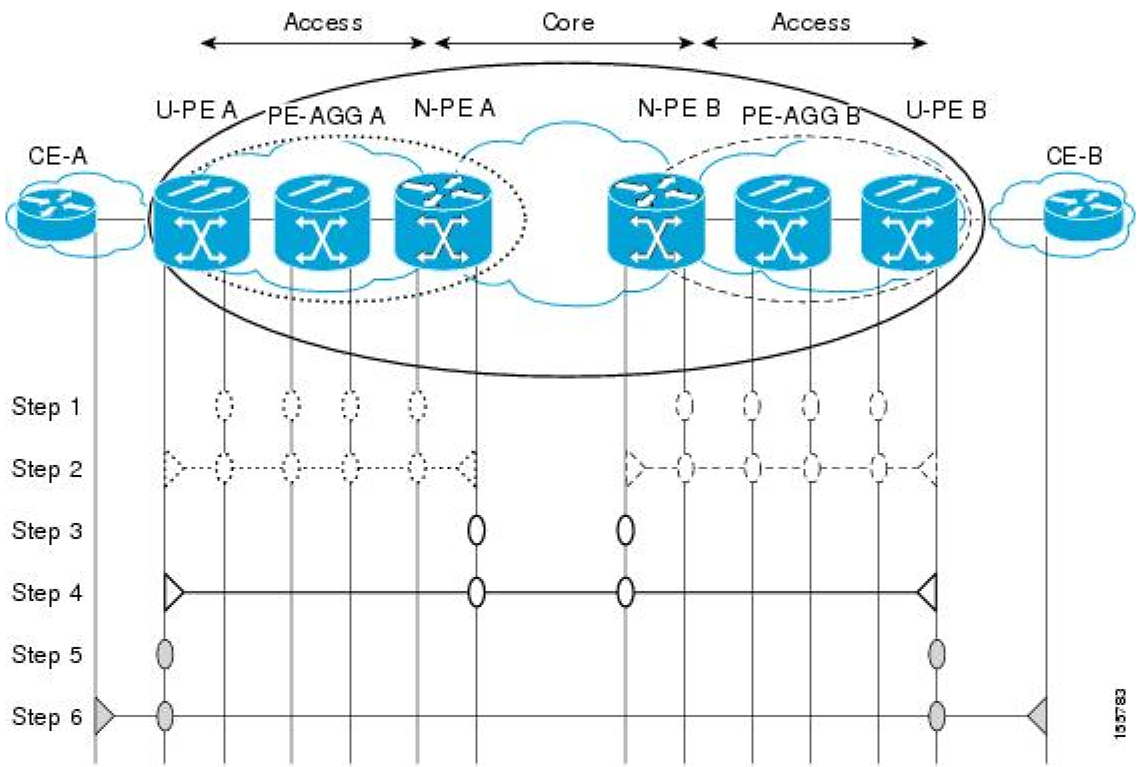
DETAILED STEPS

	Command or Action	Purpose
Step 1	Determine operator level MIPs.	Follow these steps: • Starting at lowest operator level domain, assign a MIP at every interface internal to the operator network to be visible to CFM. • Proceed to next higher operator level and assign MIPs. • Verify that every port that has a MIP at a lower level does not have maintenance points at a higher level. • Repeat steps a through d until all operator MIPs are determined.
Step 2	Determine operator level MEPs.	Follow these steps: • Starting at the lowest operator level domain, assign a MEP at every UNI that is part of a service instance. • Assign a MEP at the network to network interface (NNI) between operators, if there is more than one operator. • Proceed to next higher operator level and assign MEPs. • A port with a MIP at a lower level cannot have maintenance points at a higher level. A port with a MEP at a lower level should have either a MIP or MEP at a higher level.
Step 3	Determine service provider MIPs.	Follow these steps: • Starting at the lowest service provider level domain, assign service provider MIPs at the NNI between operators (if more than one). • Proceed to next higher service provider level and assign MIPs. • A port with a MIP at a lower level cannot have maintenance points at a higher level. A port with a MEP at a lower level should not have either a MIP or a MEP at a higher level.
Step 4	Determine service provider MEPs.	Follow these steps: • Starting at the lowest service provider level domain, assign a MEP at every UNI that is part of a service instance.

	Command or Action	Purpose
		• Proceed to next higher service provider level and assign MEPs. • A port with a MIP at a lower level cannot have maintenance points at a higher level. A port with a MEP at a lower level should have either a MIP or a MEP at a higher level.
Step 5	Determine customer MIPs.	Customer MIPs are allowed only on the UNIs at the uPEs if the service provider allows the customer to run CFM. Otherwise, the service provider can configure Cisco devices to block CFM frames. • Configure a MIP on every uPE, at the UNI port, in the customer maintenance domain. • Ensure the MIPs are at a maintenance level that is at least one higher than the highest level service provider domain.
Step 6	Determine customer MEPs.	Customer MEPs are on customer equipment. Assign an outward facing MEP within an outward domain at the appropriate customer level at the handoff between the service provider and the customer.

Examples

The figure below shows an example of a network with a service provider and two operators, A and B. Three domains are to be established to map to each operator and the service provider. In this example, for simplicity we assume that the network uses Ethernet transport end to end. CFM, however, can be used with other transports.



What to Do Next

After you have defined the Ethernet CFM domains, configure Ethernet CFM functionality by first provisioning the network and then provisioning service.

Configuring Ethernet CFM

Configuring Ethernet CFM consists of the following tasks:

Provisioning the Network

Provisioning the Network on the CE-A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**]
15. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**]
16. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.

	Command or Action	Purpose
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM continuity check events.
Step 15	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown mep-missing service-up`	Enables SNMP trap generation for Ethernet CFM continuity check events in relation to the cross-check operation between statically configured MEPS and those learned via CCMs.
Step 16	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Provisioning the Network on the U-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mip level** { *level* }
19. **exit**
20. **exit**
21. **snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**]
22. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**]
23. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.

	Command or Action	Purpose
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet4/2`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mip level** { *level* } **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.

	Command or Action	Purpose
Step 19	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.
Step 20	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 21	**snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 22	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown mep-missing service-up`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.
Step 23	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Provisioning the Network on the PE-AGG A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **interface** *type number*
12. **service instance** *id* **ethernet** [*evc-name*]
13. **encapsulation** *encapsulation-type*
14. **bridge-domain** *bridge-id*
15. **cfm mip level** *level*
16. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns the CLI to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/1`	Specifies an interface and enters interface configuration mode.

	Command or Action	Purpose
Step 12	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 13	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 14	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 15	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 16	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Provisioning the Network on the N-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **ethernet cfm global**
9. **ethernet cfm traceroute cache**
10. **ethernet cfm traceroute cache size** *entries*
11. **ethernet cfm traceroute cache hold-time** *minutes*
12. **interface** *type number*
13. **service instance** *id* **ethernet** [*evc-name*]
14. **encapsulation** *encapsulation-type*
15. **bridge-domain** *bridge-id*
16. **cfm mip level** *level*
17. **exit**
18. **exit**
19. **snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**]
20. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**]
21. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 9	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 10	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.

	Command or Action	Purpose
Step 11	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 12	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/0`	Specifies an interface and enters interface configuration mode.
Step 13	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 14	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 15	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 16	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 17	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.
Step 18	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 19	**snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 20	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown mep-missing service-up`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.
Step 21	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Provisioning the Network on the CE-B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**]
15. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**]
16. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.

	Command or Action	Purpose
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 15	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown mep-missing service-up`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.
Step 16	**end** **Example:** `Device(config)# end#`	Returns to privileged EXEC mode.

Provisioning the Network on the U-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mip level** *level*
19. **exit**
20. **exit**
21. **snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**]
22. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**]
23. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.

	Command or Action	Purpose
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet2/0`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 19	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.
Step 20	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 21	**snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 22	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown mep-missing service-up`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.
Step 23	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Provisioning the Network on the PE-AGG B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **interface** *type number*
12. **service instance** *id* **ethernet** [*evc-name*]
13. **encapsulation** *encapsulation-type*
14. **bridge-domain** *bridge-id*
15. **cfm mip level** *level*
16. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet1/1`	Specifies an interface and enters interface configuration mode.
Step 12	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 13	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 14	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 15	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 16	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning the Network on the N-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mip level** *level*
19. **exit**
20. **exit**
21. **snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**]
22. **snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**]
23. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.

	Command or Action	Purpose
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet1/2`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 19	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.
Step 20	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 21	**snmp-server enable traps ethernet cfm cc** [**mep-up**] [**mep-down**] [**config**] [**loop**] [**cross-connect**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm cc mep-up mep-down config loop cross-connect`	Enables SNMP trap generation for Ethernet CFM mep-up, mep-down, config, loop, and cross-connect events.
Step 22	**snmp-server enable traps ethernet cfm crosscheck** [**mep-unknown** | **mep-missing** | **service-up**] **Example:** `Device(config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown mep-missing service-up`	Enables SNMP trap generation for Ethernet CFM mep-unknown, mep-missing, and service-up continuity check events in relation to the cross-check operation between statically configured MEPs and those learned via CCMs.
Step 23	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Provisioning Service

Provisioning Service on the CE-A

Perform this task to set up service for Ethernet CFM. Optionally, when this task is completed, you may configure and enable the cross-check function. To perform this optional task, see “Configuring and Enabling Cross-Checking for an Inward Facing MEP on the U PE-A”.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mep domain** *domain-name* **mpid** *id*
19. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.

	Command or Action	Purpose
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface ethernet 0/3`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mep domain** *domain-name* **mpid** *id* **Example:** `Device(config-if-srv)# cfm mep domain L4 mpid 4001`	Configures the MEP domain and the ID.
Step 19	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning Service on the U-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mep domain** *domain-name* **mpid** *id*
19. **exit**
20. **exit**
21. **interface** *type number*
22. **service instance** *id* **ethernet** [*evc-name*]
23. **encapsulation** *encapsulation-type*
24. **bridge-domain** *bridge-id*
25. **cfm mip level** *level*
26. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.

	Command or Action	Purpose
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/2`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mep domain** *domain-name* **mpid** *id* **Example:** `Device(config-if-srv)# cfm mep domain L4 mpid 4001`	Configures the MEP domain and the ID.
Step 19	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.

	Command or Action	Purpose
Step 20	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 21	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/2`	Specifies an interface and enters interface configuration mode.
Step 22	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 23	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 24	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 25	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 26	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning Service on the PE-AGG A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **interface** *type number*
12. **service instance** *id* **ethernet** [*evc-name*]
13. **encapsulation** *encapsulation-type*
14. **bridge-domain** *bridge-id*
15. **cfm mip level** *level*
16. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/1`	Specifies an interface and enters interface configuration mode.
Step 12	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.

	Command or Action	Purpose
Step 13	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 14	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 15	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 16	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning Service on the N-PE A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mip level** *level*
19. **exit**
20. **exit**
21. **interface** *type number*
22. **service instance** *id* **ethernet** [*evc-name*]
23. **encapsulation** *encapsulation-type*
24. **bridge-domain** *bridge-id*
25. **cfm mep domain** *domain-name* **mpid** *id*
26. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.

	Command or Action	Purpose
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/0`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 19	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.

	Command or Action	Purpose
Step 20	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 21	**interface** *type number* **Example:** `Device(config-if)# interface gigabitethernet4/0`	Specifies an interface.
Step 22	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 23	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 24	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 25	**cfm mep domain** *domain-name* **mpid** *id* **Example:** `Device(config-if-srv)# cfm mep domain L4 mpid 4001`	Configures the MEP domain and the ID.
Step 26	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning Service on the CE-B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mep domain** *domain-name* **mpid** *id*
19. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.

	Command or Action	Purpose
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface ethernet 0/1`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mep domain** *domain-name* **mpid** *id* **Example:** `Device(config-if-srv)# cfm mep domain L4 mpid 4001`	Configures the MEP domain and the ID.
Step 19	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning Service on the U-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mip level** *level*
19. **exit**
20. **exit**
21. **interface** *type number*
22. **service instance** *id* **ethernet** [*evc-name*]
23. **encapsulation** *encapsulation-type*
24. **bridge-domain** *bridge-id*
25. **cfm mep domain** *domain-name* **mpid** *id*
26. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.

	Command or Action	Purpose
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet1/0`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 19	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.

	Command or Action	Purpose
Step 20	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 21	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet1/0`	Specifies an interface and enters interface configuration mode.
Step 22	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 23	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 24	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 25	**cfm mep domain** *domain-name* **mpid** *id* **Example:** `Device(config-if-srv)# cfm mep domain L4 mpid 4001`	Configures the MEP domain and the ID.
Step 26	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning Service on the PE-AGG B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **interface** *type number*
12. **service instance** *id* **ethernet** [*evc-name*]
13. **encapsulation** *encapsulation-type*
14. **bridge-domain** *bridge-id*
15. **cfm mip level** *level*
16. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 65`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.
Step 11	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/1`	Specifies an interface and enters interface configuration mode.
Step 12	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.

	Command or Action	Purpose
Step 13	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 14	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 15	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 16	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Provisioning Service on the N-PE B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**}
5. **continuity-check**
6. **continuity-check** [**interval** *cc-interval*]
7. **exit**
8. **mep archive-hold-time** *minutes*
9. **exit**
10. **ethernet cfm global**
11. **ethernet cfm traceroute cache**
12. **ethernet cfm traceroute cache size** *entries*
13. **ethernet cfm traceroute cache hold-time** *minutes*
14. **interface** *type number*
15. **service instance** *id* **ethernet** [*evc-name*]
16. **encapsulation** *encapsulation-type*
17. **bridge-domain** *bridge-id*
18. **cfm mip level** *level*
19. **exit**
20. **exit**
21. **interface** *type number*
22. **service instance** *id* **ethernet** [*evc-name*]
23. **encapsulation** *encapsulation-type*
24. **bridge-domain** *bridge-id*
25. **cfm mep domain** *domain-name* **mpid** *id*
26. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain Customer level 7`	Defines a CFM maintenance domain at a particular maintenance level and enters Ethernet CFM configuration mode.
Step 4	**service** {*short-ma-name* | **number** *MA-number* | **vlan-id** *primary-vlan-id* | **vpn-id** *vpn-id*} {**vlan** *vlan-id* | **port** | **evc** *evc-name*} **direction** {**up** | **down**} **Example:** `Device(config-ecfm)# service s41 evc 41 vlan 41`	Configures a maintenance association within a maintenance domain and enters Ethernet connectivity fault management (CFM) service configuration mode.
Step 5	**continuity-check** **Example:** `Device(config-ecfm-srv)# continuity-check`	Configures the transmission of continuity check messages (CCMs).
Step 6	**continuity-check** [**interval** *cc-interval*] **Example:** `Device(config-ecfm-srv)# continuity-check interval 10s`	Configures the per-service parameters and sets the interval at which CCMs are transmitted.
Step 7	**exit** **Example:** `Device(config-ecfm-srv)# exit`	Returns to Ethernet connectivity fault management configuration mode.
Step 8	**mep archive-hold-time** *minutes* **Example:** `Device(config-ecfm)# mep archive-hold-time 60`	Sets the amount of time that data from a missing MEP is kept in the continuity check database or that entries are held in the error database before they are purged.
Step 9	**exit** **Example:** `Device(config-ecfm)# exit`	Returns to global configuration mode.
Step 10	**ethernet cfm global** **Example:** `Device(config)# ethernet cfm global`	Enables CFM processing globally on the device.

	Command or Action	Purpose
Step 11	**ethernet cfm traceroute cache** **Example:** `Device(config)# ethernet cfm traceroute cache`	Enables caching of CFM data learned through traceroute messages.
Step 12	**ethernet cfm traceroute cache size** *entries* **Example:** `Device(config)# ethernet cfm traceroute cache size 200`	Sets the maximum size for the CFM traceroute cache table.
Step 13	**ethernet cfm traceroute cache hold-time** *minutes* **Example:** `Device(config)# ethernet cfm traceroute cache hold-time 60`	Sets the amount of time that CFM traceroute cache entries are retained.
Step 14	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet3/0`	Specifies an interface and enters interface configuration mode.
Step 15	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 16	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 17	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 18	**cfm mip level** *level* **Example:** `Device(config-if-srv)#cfm mip level 4`	Creates a MIP and sets the maintenance level number.
Step 19	**exit** **Example:** `Device(config-if-srv)# exit`	Returns to interface configuration mode.

	Command or Action	Purpose
Step 20	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 21	**interface** *type number* **Example:** `Device(config-if)# interface gigabitethernet4/0`	Specifies an interface.
Step 22	**service instance** *id* **ethernet** [*evc-name*] **Example:** `Device(config-if)# service instance 333 ethernet evc1`	Configures an Ethernet service instance on an interface and enters Ethernet service configuration mode.
Step 23	**encapsulation** *encapsulation-type* **Example:** `Device(config-if-srv)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 24	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Binds a service instance to a bridge domain instance.
Step 25	**cfm mep domain** *domain-name* **mpid** *id* **Example:** `Device(config-if-srv)# cfm mep domain L4 mpid 4001`	Configures the MEP domain and the ID.
Step 26	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.

Configuring and Enabling the Cross-Check Function

Configuring and Enabling Cross-Checking for an Inward Facing MEP on the U PE-A

Perform this task to configure and enable cross-checking for an inward facing MEP. This task requires you to configure and enable cross-checking on two devices. This task is optional.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*]
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [,*level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [,*vlan-id-vlan-id*]}

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM domain at a specified level and enters Ethernet CFM configuration mode.
Step 4	**mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*] **Example:** `Device(config-ether-cfm)# mep crosscheck mpid 402 vlan 100`	Statically defines a remote MEP on a specified VLAN within the domain.
Step 5	**exit** **Example:** `Device(config-ether-cfm)# exit#`	Returns to global configuration mode.
Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Device(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started

	Command or Action	Purpose
Step 7	**exit** **Example:** `Device(config)# exit`	Returns to privileged EXEC mode.
Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [,*level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [,*vlan-id-vlan-id*]} **Example:** `Device# ethernet cfm mep crosscheck enable level 4 vlan 100`	Enables cross-checking between remote MEPs in the domain and MEPs learned through CCMs.

Example

The following example configures cross-checking on an inward facing MEP (U-PE A):

```
U-PE A
ethernet cfm domain ServiceProvider level 4
mep crosscheck mpid 402 vlan 100
!
ethernet cfm mep crosscheck start-delay 60
```

The following example enables cross-checking on an inward facing MEP (U-PE A):

```
U-PE A
U-PEA# ethernet cfm mep crosscheck enable level 4 vlan 100
```

Configuring and Enabling Cross-Checking for an Inward Facing MEP on the U PE-B

Perform this task to configure and enable cross-checking for an inward facing MEP. This task requires you to configure and enable cross-checking on two devices. This task is optional.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id*
4. **mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*]
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [,*level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [,*vlan-id-vlan-id*]}

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain ServiceProvider level 4`	Defines a CFM domain at a specified level and enters Ethernet CFM configuration mode.
Step 4	**mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*] **Example:** `Device(config-ether-cfm)# mep crosscheck mpid 401 vlan 100`	Statically defines a remote MEP on a specified VLAN within the domain.
Step 5	**exit** **Example:** `Device(config-ether-cfm)# exit`	Returns to global configuration mode.
Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Device(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started.
Step 7	**exit** **Example:** `Device(config)# exit`	Returns to privileged EXEC mode.
Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [,*level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [,*vlan-id-vlan-id*]} **Example:** `Device# ethernet cfm mep crosscheck enable level 4 vlan 100`	Enables cross-checking between MEPs.

Example

The following example configures cross-checking on an inward facing MEP (U-PE B)

```
U-PE B
ethernet cfm domain ServiceProvider level 4
mep crosscheck mpid 401 vlan 100
!
ethernet cfm mep crosscheck start-delay 60
```

The following example enables cross-checking on an inward facing MEP (U-PE B)

```
U-PE B
U-PEB# ethernet cfm mep crosscheck enable level 4 vlan 100
```

Configuring and Enabling Cross-Checking for an Outward Facing MEP on the CE-A

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
4. **mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*]
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [,*level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [,*vlan-id-vlan-id*]}

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Device(config)# ethernet cfm domain Customer level 7 direction outward`	Defines a CFM domain at a specified level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 4	**mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*] **Example:** `Device(config-ether-cfm)# mep crosscheck mpid 702 vlan 100`	Statically defines a remote MEP with a specified ID, VLAN, and domain.
Step 5	**exit** **Example:** `Device(config-ether-cfm)# exit`	Returns to global configuration mode.
Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Device(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started.
Step 7	**exit** **Example:** `Device(config)# exit`	Returns to privileged EXEC mode.
Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [*,level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [*,vlan-id-vlan-id*]} **Example:** `Device# ethernet cfm mep crosscheck enable level 7 vlan 100`	Enables cross-checking between MEPs.

Configuring and Enabling Cross-Checking for an Outward Facing MEP on the CE-B

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
4. **mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*]
5. **exit**
6. **ethernet cfm mep crosscheck start-delay** *delay*
7. **exit**
8. **ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [*,level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [*,vlan-id-vlan-id*]}

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Device(config)# ethernet cfm domain Customer level 7 direction outward`	Defines an outward CFM domain at a specified level and enters Ethernet CFM configuration mode.
Step 4	**mep crosscheck mpid** *id* **vlan** *vlan-id* [**mac** *mac-address*] **Example:** `Device(config-ether-cfm)# mep crosscheck mpid 401 vlan 100`	Statically defines a remote MEP on a VLAN within a specified domain.
Step 5	**exit** **Example:** `Device(config-ether-cfm)# exit`	Returns to global configuration mode.
Step 6	**ethernet cfm mep crosscheck start-delay** *delay* **Example:** `Device(config)# ethernet cfm mep crosscheck start-delay 60`	Configures the maximum amount of time that the device waits for remote MEPs to come up before the cross-check operation is started.
Step 7	**exit** **Example:** `Device(config)# exit`	Returns to privileged EXEC mode.
Step 8	**ethernet cfm mep crosscheck** {**enable** | **disable**} **level** {*level-id* | *level-id-level-id* [,*level-id-level-id*]} **vlan** {*vlan-id* | **any** | *vlan-id-vlan-id* [,*vlan-id-vlan-id*]} **Example:** `Device# ethernet cfm mep crosscheck enable level 7 vlan 100`	Enables cross-checking between MEPs.

Configuring CFM over Bridge Domains

Perform this task to configure Ethernet CFM over bridge domains. This task is optional.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id* **direction outward**
4. **service** *csi-id* **evc** *evc-name*
5. **exit**
6. **ethernet cfm domain** *domain-name* **level** *level-id*
7. **exit**
8. **ethernet cfm domain** *domain-name* **level** *level-id*
9. **service** *csi-id* **evc** *evc-name*
10. **mep crosscheck mpid** *id* **evc** *evc-name* **mac** *mac-address*
11. **exit**
12. **ethernet evc** *evc-name*
13. **exit**
14. **interface** *type number*
15. **no ip address**
16. **service instance** *id* **ethernet** *evc-id*
17. **encapsulation dot1q** *vlan-id*
18. **bridge-domain** *bridge-id*
19. **cfm mep domain** *domain-name* **outward mpid** *mpid-value*
20. **end**
21. **configure terminal**
22. **interface** *type name*
23. **no ip address**
24. **ethernet cfm mip level** *level-id*
25. **service instance** *id* **ethernet** *evc-id*
26. **encapsulation dot1q** *vlan-id*
27. **bridge-domain** *bridge-id*
28. **cfm mep domain** *domain-name* **inward mpid** *mpid-value*
29. **end**
30. **configure terminal**
31. **ethernet cfm cc enable level** *level-id* **evc** *evc-name*
32. **ethernet cfm cc level any evc** *evc-name* **interval** *seconds* **loss-threshold** *num-msgs*
33. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* **direction outward** **Example:** `Device(config)# ethernet cfm domain CUSTOMER level 7 direction outward`	Defines a CFM maintenance domain at a particular level and enters Ethernet CFM configuration mode.
Step 4	**service** *csi-id* **evc** *evc-name* **Example:** `Device(config-ether-cfm)# service customer_100 evc evc_100`	Sets a universally unique ID for a CSI within a maintenance domain.
Step 5	**exit** **Example:** `Device(config-ether-cfm)# exit`	Returns to global configuration mode.
Step 6	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain MIP level 7`	Defines a CFM maintenance domain at a particular level and enters Ethernet CFM configuration mode.
Step 7	**exit** **Example:** `Device(config-ether-cfm)# exit`	Returns to global configuration mode.
Step 8	**ethernet cfm domain** *domain-name* **level** *level-id* **Example:** `Device(config)# ethernet cfm domain PROVIDER level 4`	Defines a CFM maintenance domain at a particular level and enters Ethernet CFM configuration mode.

	Command or Action	Purpose
Step 9	**service** *csi-id* **evc** *evc-name* **Example:** `Device(config-ether-cfm)# service provider_1 evc evc_100`	Sets a universally unique ID for a CSI within a maintenance domain.
Step 10	**mep crosscheck mpid** *id* **evc** *evc-name* **mac** *mac-address* **Example:** `Device(config-ether-cfm)# mep crosscheck mpid 200 evc evc_100 mac 1010.1010.1010`	Statically defines a remote MEP within a maintenance domain.
Step 11	**exit** **Example:** `Device(config-ether-cfm)# exit`	Returns to global configuration mode.
Step 12	**ethernet evc** *evc-name* **Example:** `Device(config)# ethernet evc evc_100`	Defines an EVC and enters EVC configuration mode.
Step 13	**exit** **Example:** `Device(config-evc)# exit`	Returns to global configuration mode.
Step 14	**interface** *type number* **Example:** `Device(config)# interface Ethernet 1/0`	Specifies an interface and enters interface configuration mode.
Step 15	**no ip address** **Example:** `Device(config-if)# no ip address`	Disables IP processing.
Step 16	**service instance** *id* **ethernet** *evc-id* **Example:** `Device(config-if)# service instance 100 ethernet evc_100`	Specifies an Ethernet service instance on an interface and enters service instance configuration mode.

	Command or Action	Purpose
Step 17	**encapsulation dot1q** *vlan-id* **Example:** `Device(config-if-srv)# encapsulation dot1q 100`	Defines the matching criteria to map 802.1Q frames on an ingress interface to the appropriate service instance.
Step 18	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Establishes a bridge domain.
Step 19	**cfm mep domain** *domain-name* **outward mpid** *mpid-value* **Example:** `Device(config-if-srv)# cfm mep domain CUSTOMER outward mpid 1001`	Configures a MEP for a domain.
Step 20	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.
Step 21	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 22	**interface** *type name* **Example:** `Device(config)# interface Ethernet 1/1`	Specifies an interface and enters interface configuration mode.
Step 23	**no ip address** **Example:** `Device(config-if)# no ip address`	Disables IP processing.
Step 24	**ethernet cfm mip level** *level-id* **Example:** `Device(config-if)# ethernet cfm mip level 7`	Provisions a MIP at a specified maintenance level on an interface.

	Command or Action	Purpose
Step 25	**service instance** *id* **ethernet** *evc-id* **Example:** `Device(config-if)# service instance 100 ethernet evc_100`	Configures an Ethernet service instance on an interface and enters service instance configuration mode.
Step 26	**encapsulation dot1q** *vlan-id* **Example:** `Device(config-if-srv)# encapsulation dot1q 100`	Defines the matching criteria to map 802.1Q frames on an ingress interface to the appropriate service instance.
Step 27	**bridge-domain** *bridge-id* **Example:** `Device(config-if-srv)# bridge-domain 100`	Establishes a bridge domain.
Step 28	**cfm mep domain** *domain-name* **inward mpid** *mpid-value* **Example:** `Device(config-if-srv)# cfm mep domain PROVIDER inward mpid 201`	Configures a MEP for a domain.
Step 29	**end** **Example:** `Device(config-if-srv)# end`	Returns to privileged EXEC mode.
Step 30	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 31	**ethernet cfm cc enable level** *level-id* **evc** *evc-name* **Example:** `Device(config)# ethernet cfm cc enable level 0-7 evc evc_100`	Globally enables transmission of CCMs.
Step 32	**ethernet cfm cc level any evc** *evc-name* **interval** *seconds* **loss-threshold** *num-msgs* **Example:** `Device(config)# ethernet cfm cc level any evc evc_100 interval 100 loss-threshold 2`	Sets the parameters for CCMs.

	Command or Action	Purpose
Step 33	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

What to Do Next

Note When configuring CFM over bridge domains where the bridge-domain ID matches the vlan ID service, you must configure the vlan service and the EVC service with the same service name. The bridge-domain is associated with the EVC service. The vlan and the bridge-domain represent the same broadcast domain.

Troubleshooting Tips

To verify and isolate a fault, start at the highest level maintenance domain and do the following:

- Check the device error status.
- When an error exists, perform a loopback test to confirm the error.
- Run a traceroute to the destination to isolate the fault.
- If the fault is identified, correct the fault.
- If the fault is not identified, go to the next lower maintenance domain and repeat these four steps at that maintenance domain level.
- Repeat the first four steps, as needed, to identify and correct the fault.

Configuring Ethernet OAM Interaction with CFM

For Ethernet OAM to function with CFM, you must configure an EVC and the OAM manager and associate the EVC with CFM. Additionally, you must use an inward facing MEP when you want interaction with the OAM manager.

Configuring the OAM Manager

Note If you configure, change, or remove a UNI service type, EVC, Ethernet service instance, or CE-VLAN configuration, all configurations are checked to ensure that UNI service types are matched with EVC configurations and Ethernet service instances are matched with CE-VLAN configurations. Configurations are rejected if the pairings do not match.

Perform this task to configure the OAM manager on a PE device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
4. **service** *csi-id* **vlan** *vlan-id*
5. **exit**
6. **ethernet evc** *evc-id*
7. **oam protocol** {**cfm svlan** *svlan-id* **domain** *domain-name* | **ldp**}
8. **exit**
9. Repeat Steps 3 through 8 to define other CFM domains that you want OAM manager to monitor.
10. **end**

DETAILED STEPS

	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	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Device(config)# ethernet cfm domain cstmr1 level 3`	Defines a CFM domain, sets the domain level, and enters Ethernet CFM configuration mode.
Step 4	**service** *csi-id* **vlan** *vlan-id* **Example:** `Device(config-ether-cfm)# service csi2 vlan 10`	Defines a universally unique customer service instance (CSI) and VLAN ID within the maintenance domain.
Step 5	**exit** **Example:** `Device(config-ether-cfm)# exit`	Returns to global configuration mode.

	Command or Action	Purpose
Step 6	**ethernet evc** *evc-id* **Example:** `Device(config)# ethernet evc 50`	Defines an EVC and enters EVC configuration mode.
Step 7	**oam protocol** {**cfm svlan** *svlan-id* **domain** *domain-name* | **ldp**} **Example:** `Device(config-evc)# oam protocol cfm svlan 10 domain cstmr1`	Configures the EVC OAM protocol.
Step 8	**exit** **Example:** `Device(config-evc)# exit`	Returns to global configuration mode.
Step 9	Repeat Steps 3 through 8 to define other CFM domains that you want OAM manager to monitor.	—
Step 10	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Enabling Ethernet OAM

The order in which the global and interface configuration commands are issued determines the configuration. The last command that is issued has precedence.

Perform this task to enable Ethernet OAM on a device or on an interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*]
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface ethernet 1/3`	Specifies an interface and enters interface configuration mode.
Step 4	**ethernet oam** [**max-rate** *oampdus* | **min-rate** *num-seconds*| **mode** {**active** | **passive**} | **timeout** *seconds*] **Example:** `Device(config-if)# ethernet oam max-rate 50`	Enables Ethernet OAM on an interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Configuration Examples for Configuring Ethernet CFM in a Service Provider Network

Example: Provisioning a Network

This configuration example shows only CFM-related commands. All commands that are required to set up the data path and configure the VLANs on the device are not shown. However, it should be noted that CFM traffic will not flow into or out of the device if the VLANs are not properly configured.

```
CE-A
!
ethernet cfm domain Customer level 7
```

```
!!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!!
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up

U-PE A
!
ethernet cfm domain Customer level 7
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
!
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet4/2
ethernet cfm mip level 1
!
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
PE-AGG A
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
!
ethernet cfm global
!
interface gigabitethernet3/1
ethernet cfm mip level 1
!
interface gigabitethernet4/1
ethernet cfm mip level 1
N-PE A
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
!
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet3/0
ethernet cfm mip level 1
!
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
U-PE B
!
ethernet cfm domain Customer level 7
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
!
ethernet cfm domain OperatorB level 2
mep archive-hold-time 65
```

```
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet2/0
ethernet cfm mip level 2
!
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
PE-AGG B
ethernet cfm domain OperatorB level 2
mep archive-hold-time 65
!
ethernet cfm global
!
interface gigabitethernet1/1
ethernet cfm mip level 2
!
interface gigabitethernet2/1
ethernet cfm mip level 2
N-PE B
!
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
!
ethernet cfm domain OperatorB level 2
mep archive-hold-time 65
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet1/2
ethernet cfm mip level 2
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
CE-B
!
ethernet cfm domain Customer level 7
!!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!!
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
!
snmp-server enable traps ethernet cfm cc mep-up mep-down cross-connect loop config
snmp-server enable traps ethernet cfm crosscheck mep-missing mep-unknown service-up
```

Example: Provisioning Service

This configuration example shows only CFM-related commands. All commands that are required to set up the data path and configure the VLANs on the device are not shown. However, it should be noted that CFM traffic will not flow into or out of the device if the VLANs are not properly configured.

```
CE-A
!
ethernet cfm domain Customer level 7
service Customer1 vlan 100
```

```
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet3/2
ethernet cfm mep level 7 direction outward domain Customer1 mpid 701 vlan 100
!
ethernet cfm cc enable level 7 vlan 100
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
```

U-PE A

```
!
ethernet cfm domain Customer level 7
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
service MetroCustomer1 vlan 100
!
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
service MetroCustomer1OpA vlan 100
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet3/2
ethernet cfm mip level 7
ethernet cfm mep level 4 mpid 401 vlan 100
ethernet cfm mep level 1 mpid 101 vlan 100
!
interface gigabitethernet4/2
ethernet cfm mip level 1
!
ethernet cfm cc enable level 4 vlan 100
ethernet cfm cc enable level 1 vlan 100
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
```

PE-AGG A

```
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
service MetroCustomer1OpA vlan 100
!
ethernet cfm global
!
interface gigabitethernet3/1
ethernet cfm mip level 1
!
interface gigabitethernet4/1
ethernet cfm mip level 1
```

N-PE A

```
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
service MetroCustomer1 vlan 100
!
ethernet cfm domain OperatorA level 1
mep archive-hold-time 65
service MetroCustomer1OpA vlan 100
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet3/0
ethernet cfm mip level 1
!
interface gigabitethernet4/0
ethernet cfm mip level 4
ethernet cfm mep level 1 mpid 102 vlan 100
!
```

```
ethernet cfm cc enable level 1 vlan 100
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
U-PE B
!
ethernet cfm domain Customer level 7
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
service MetroCustomer1 vlan 100
!
ethernet cfm domain OperatorB level 2
mep archive-hold-time 65
service MetroCustomer1OpB vlan 100
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet1/0
ethernet cfm mip level 7
ethernet cfm mep level 4 mpid 402 vlan 100
ethernet cfm mep level 2 mpid 201 vlan 100
!
interface gigabitethernet2/0
ethernet cfm mip level 2
!
ethernet cfm cc enable level 4 vlan 100
ethernet cfm cc enable level 2 vlan 100
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
PE-AGG B
ethernet cfm domain OperatorB level 2
mep archive-hold-time 65
service MetroCustomer1OpB vlan 100
!
ethernet cfm global
!
interface gigabitethernet1/1
ethernet cfm mip level 2
!
interface gigabitethernet2/1
ethernet cfm mip level 2
N-PE B
!
ethernet cfm domain ServiceProvider level 4
mep archive-hold-time 60
service MetroCustomer1 vlan 100
!
ethernet cfm domain OperatorB level 2
mep archive-hold-time 65
service MetroCustomer1OpB vlan 100
!
ethernet cfm global
ethernet cfm traceroute cache
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet1/2
ethernet cfm mip level 2
!
interface gigabitethernet2/2
ethernet cfm mip level 4
ethernet cfm mep level 2 mpid 202 vlan 100
!
ethernet cfm cc enable level 2 vlan 100
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
CE-B
!
ethernet cfm domain Customer level 7
service Customer1 vlan 100
!
ethernet cfm global
ethernet cfm traceroute cache
```

```
ethernet cfm traceroute cache size 200
ethernet cfm traceroute cache hold-time 60
!
interface gigabitethernet3/2
ethernet cfm mep level 7 direction outward domain Customer1 mpid 702 vlan 100
!
ethernet cfm cc enable level 7 vlan 100
ethernet cfm cc level any vlan any interval 20 loss-threshold 3
```

Glossary

CCM—continuity check message. A multicast CFM frame that a MEP transmits periodically to ensure continuity across the maintenance entities to which the transmitting MEP belongs, at the MA level on which the CCM is sent. No reply is sent in response to receiving a CCM.

EVC—Ethernet virtual connection. An association of two or more user-network interfaces.

fault alarm—An out-of-band signal, typically an SNMP notification, that notifies a system administrator of a connectivity failure.

inward-facing MEP—A MEP that resides in a bridge and transmits to and receives CFM messages from the direction of the bridge relay entity.

maintenance domain—The network or part of the network belonging to a single administration for which faults in connectivity are to be managed. The boundary of a maintenance domain is defined by a set of DSAPs, each of which may become a point of connectivity to a service instance.

maintenance domain name—The unique identifier of a domain that CFM is to protect against accidental concatenation of service instances.

MEP—maintenance endpoint. An actively managed CFM entity associated with a specific DSAP of a service instance, which can generate and receive CFM frames and track any responses. It is an endpoint of a single MA, and terminates a separate maintenance entity for each of the other MEPs in the same MA.

MEP CCDB—A database, maintained by every MEP, that maintains received information about other MEPs in the maintenance domain.

MIP—maintenance intermediate point. A CFM entity, associated with a specific pair of ISS SAPs or EISS Service Access Points, which reacts and responds to CFM frames. It is associated with a single maintenance association and is an intermediate point within one or more maintenance entities.

MIP CCDB—A database of information about the MEPs in the maintenance domain. The MIP CCDB can be maintained by a MIP.

MP—maintenance point. Either a MEP or a MIP.

MPID—maintenance endpoint identifier. A small integer, unique over a given MA, that identifies a specific MEP.

OAM—operations, administration, and maintenance. A term used by several standards bodies to describe protocols and procedures for operating, administrating, and maintaining networks. Examples are ATM OAM and IEEE Std. 802.3ah OAM.

operator—Entity that provides a service provider a single network of provider bridges or a single Layer 2 or Layer 3 backbone network. An operator may be identical to or a part of the same organization as the service provider. For purposes of IEEE P802.1ag, Draft Standard for Local and Metropolitan Area Networks, the operator and service provider are presumed to be separate organizations.

Terms such as “customer,” “service provider,” and “operator” reflect common business relationships among organizations and individuals that use equipment implemented in accordance with IEEE P802.1ag.

UNI—user-network interface. A common term for the connection point between an operator's bridge and customer equipment. A UNI often includes a C-VLAN-aware bridge component. The term UNI is used broadly in the IEEE P802.1ag standard when the purpose for various features of CFM are explained. UNI has no normative meaning.

CHAPTER 8

Using Link Layer Discovery Protocol in Multivendor Networks

Link Layer Discovery Protocol (LLDP), standardized by the IEEE as part of 802.1ab, enables standardized discovery of nodes, which in turn facilitates future applications of standard management tools such as Simple Network Management Protocol (SNMP) in multivendor networks. Using standard management tools makes physical topology information available and helps network administrators detect and correct network malfunctions and inconsistencies in configuration.

Media Endpoint Discovery (MED) is an LLDP enhancement that was formalized by the Telecommunications Industry Association (TIA) for voice over IP (VoIP) applications.

The Cisco implementation of LLDP is based on the IEEE 802.1ab standard. This document describes LLDP and LLDP-MED and how they are supported in Cisco software.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Using Link Layer Discovery Protocol in Multivendor Networks

- Type-Length-Value (TLV) types 0 through 127
- To support LLDP-MED, the following organizationally specific TLVs must be implemented:
  - Extended Power-via-Media Dependent Interface (MDI)
  - Inventory
  - LLDP-MED Capabilities
  - MAC/PHY Configuration Status
  - Network Policy
  - Port VLAN ID

Restrictions for Using Link Layer Discovery Protocol in Multivendor Networks

- Use of LLDP is limited to 802.1 media types such as Ethernet, Token Ring, and Fiber Distributed Data Interface (FDDI) networks.
- The maximum number of neighbor entries per chassis is limited on MED-capable network connectivity devices.

Information About Using Link Layer Discovery Protocol in Multivendor Networks

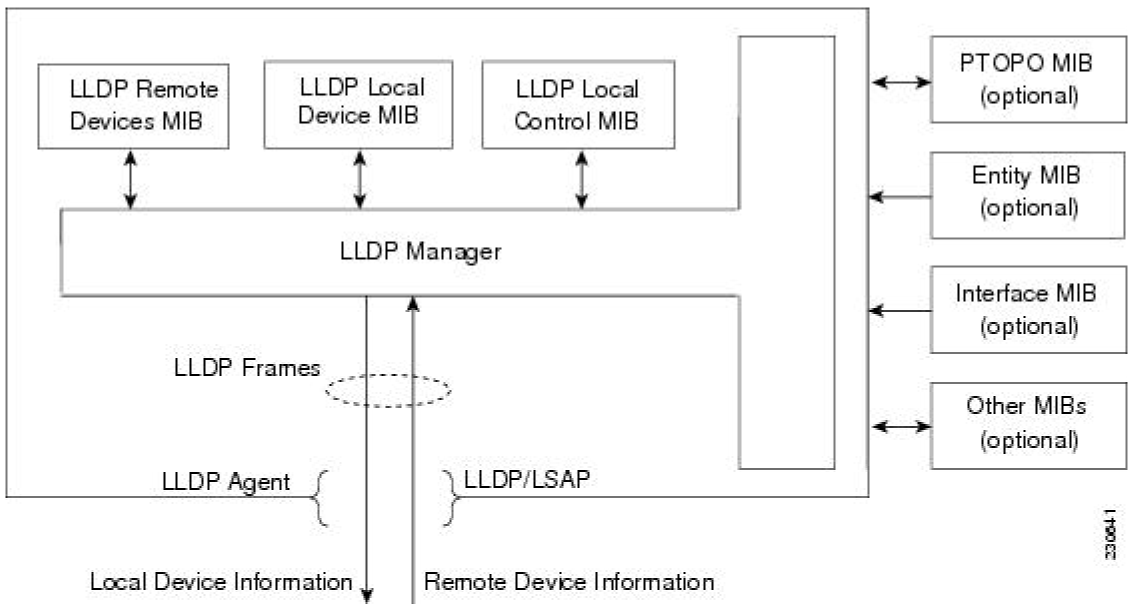
IEEE 802.1ab LLDP

IEEE 802.1ab Link Layer Discovery Protocol (LLDP) is an optional link layer protocol for network topology discovery in multivendor networks. Discovery information includes device identifiers, port identifiers, versions, and other details. As a protocol that aids network management, LLDP provides accurate network mapping, inventory data, and network troubleshooting information.

LLDP is unidirectional, operating only in an advertising mode. LLDP does not solicit information or monitor state changes between LLDP nodes. LLDP periodically sends advertisements to a constrained multicast address. Devices supporting LLDP can send information about themselves while they receive and record information about their neighbors. Additionally, devices can choose to turn off the send or receive functions independently. Advertisements are sent out and received on every active and enabled interface, allowing any device in a network to learn about all devices to which it is connected. Applications that use this information include network topology discovery, inventory management, emergency services, VLAN assignment, and inline power supply.

Note LLDP and Cisco Discovery Protocol can operate on the same interface.

The figure below shows a high-level view of LLDP operating in a network node.



When you configure LLDP or Cisco Discovery Protocol location information on a per-port basis, remote devices can send Cisco medianet location information to the switch. For more information, see the *Using Cisco Discovery Protocol module.*

LLDP-MED

LLDP-MED operates between several classes of network equipment such as IP phones, conference bridges, and network connectivity devices such as routers and switches. By default, a network connectivity device sends out only LLDP packets until it receives LLDP-MED packets from an endpoint device. The network device then sends out LLDP-MED packets until the remote device to which it is connected ceases to be LLDP-MED capable.

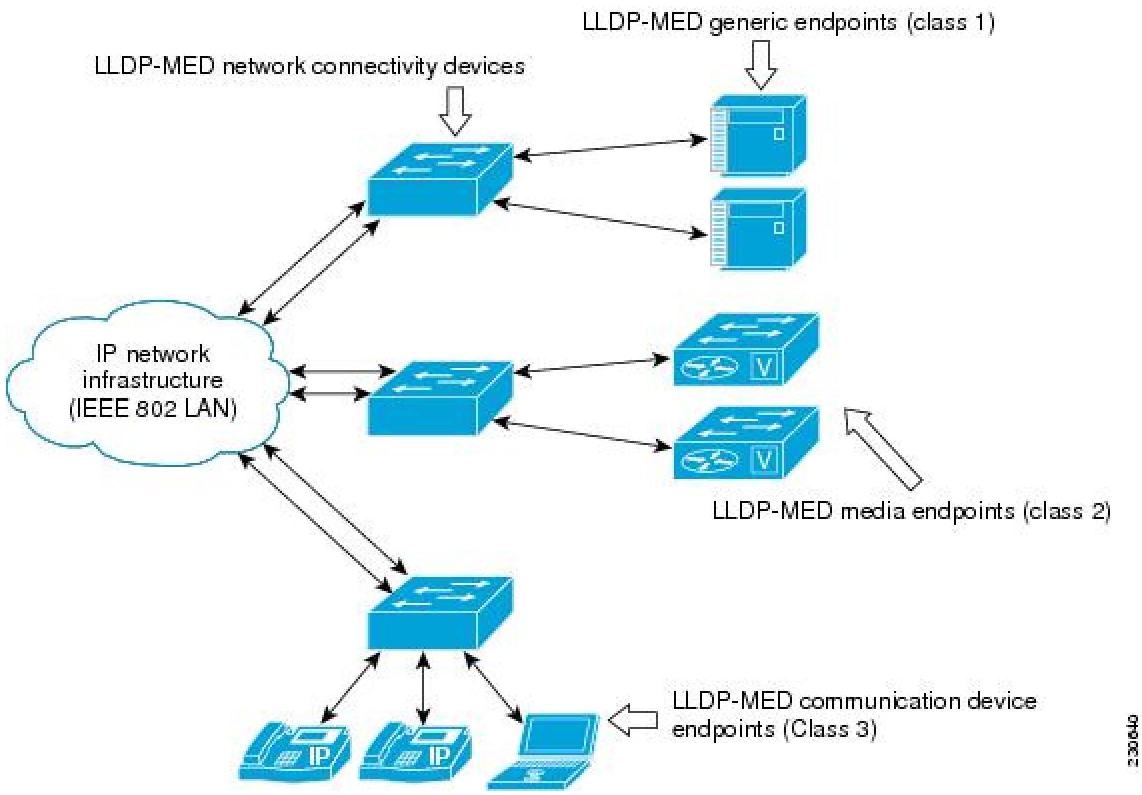
Classes of Endpoints

LLDP-MED network connectivity devices provide IEEE 802 network access to LLDP-MED endpoints. LLDP-MED supports the following three classes of endpoints:

- Generic (class 1)—Basic participant endpoints; for example, IP communications controllers.
- Media (class 2)—Endpoints that support media streams; for example, media gateways and conference bridges.

- Communication Device (class 3)—Endpoints that support IP communications end users; for example, IP phones and Softphone.

The figure below shows an LLDP-MED-enabled LAN.



Types of Discovery Supported

LLDP-MED provides support to discover the following types of information, which are crucial to efficient operation and management of endpoint devices and the network devices supporting them:

- **Capabilities** —Endpoints determine the types of capabilities that a connected device supports and which ones are enabled.
- **Inventory** —LLDP-MED support exchange of hardware, software, and firmware versions, among other inventory details.
- **LAN speed and duplex** —Devices discover mismatches in speed and duplex settings.
- **Location identification** —An endpoint, particularly a telephone, learns its location from a network device. This location information may be used for location-based applications on the telephone and is important when emergency calls are placed.
- **Network policy** —Network connectivity devices notify telephones about the VLANs they should use.
- **Power** —Network connectivity devices and endpoints exchange power information. LLDP-MED provides information about how much power a device needs and how a device is powered. LLDP-MED also determines the priority of the device for receiving power.

Benefits of LLDP-MED

- Follows an open standard
- Supports E-911 emergency service, which is aided by location management
- Provides fast start capability
- Supports interoperability between multivendor devices
- Supports inventory management (location, version, etc.)
- Provides MIB support
- Supports plug and play installation
- Provides several troubleshooting (duplex, speed, network policy) mechanisms

TLV Elements

Link Layer Discovery Protocol (LLDP) and LLDP-Media Endpoint Discovery (MED) use Type-Length-Values (TLVs) to exchange information between network and endpoint devices. TLV elements are embedded in communications protocol advertisements and used for encoding optional information. The size of the type and length fields is fixed at 2 bytes. The size of the value field is variable. The type is a numeric code that indicates the type of field that this part of the message represents, and the length is the size of the value field, in bytes. The value field contains the data for this part of the message.

LLDP-MED supports the following 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 switch, 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 signalling 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 switches and phones to convey power information, such as how the device is powered, power priority, and how much power the device needs. Supports advertisement of fractional wattage power requirements, endpoint power priority, and endpoint and network connectivity-device power status but does not provide for power negotiation between the endpoint and the network connectivity devices. When 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 switch 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 switch 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.

Note: A system power budget is the default power allocated to a device based on its device class. However, the total power that can be sourced from a switch is finite, and there will be some power budgeting done by the power module based on the number of ports already being served, total power that can be served, and how much new ports are requesting.

- Inventory management TLV—Allows an endpoint to send detailed inventory information about itself to the switch, 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 switch 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.

Benefits of LLDP

- Follows IEEE 802.1ab standard.
- Enables interoperability among multivendor devices.
- Facilitates troubleshooting of enterprise networks and uses standard network management tools.
- Provides extension for applications such as VoIP.

How to Configure Link Layer Discovery Protocol in Multivendor Networks

Enabling and Disabling LLDP Globally

LLDP is disabled globally by default. This section describes the tasks for enabling and disabling LLDP globally.

Enabling LLDP Globally

Perform this task to enable LLDP globally.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **lldp run**
4. **end**

DETAILED STEPS

	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 run** **Example:** `Device(config)# lldp run`	Enables LLDP globally.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Disabling LLDP Globally

Perform this task to disable LLDP globally.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no lldp run**
4. **end**

DETAILED STEPS

	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	**no lldp run** **Example:** `Device(config)# no lldp run`	Disables LLDP globally.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Disabling and Enabling LLDP on a Supported Interface

LLDP is enabled by default on all supported interfaces. This section describes the tasks for disabling and enabling LLDP on a supported interface.

Disabling LLDP on a Supported Interface

Perform this task to disable LLDP on a supported interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **no lldp** {**med-tlv-select** *tlv* | **receive** | **transmit**}
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface ethernet 0/1`	Specifies the interface type and number and enters interface configuration mode.
Step 4	**no lldp** {**med-tlv-select** *tlv* | **receive** | **transmit**} **Example:** `Device(config-if)# no lldp receive`	Disables an LLDP-MED TLV or LLDP packet reception on a supported interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Enabling LLDP on a Supported Interface

LLDP information can be transmitted and received only on an interface where LLDP is configured and enabled. Perform this task to enable LLDP.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **lldp** {**med-tlv-select** *tlv* | **receive** | **transmit**}
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface ethernet 0/1`	Specifies the interface type and number and enters interface configuration mode.
Step 4	**lldp** {**med-tlv-select** *tlv* | **receive** | **transmit**} **Example:** `Device(config-if)# lldp transmit`	Enables an LLDP-MED TLV or LLDP packet transmission on a supported interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Setting LLDP Packet Hold Time

Hold time is the duration that a receiving device should maintain LLDP neighbor information before aging it. Perform this task to define a hold time for an LLDP-enabled device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **lldp holdtime** *seconds*
4. **end**

DETAILED STEPS

	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 100`	Specifies the hold time.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Setting LLDP Packet Frequency

Perform this task to specify an interval at which the Cisco software sends LLDP updates to neighboring devices.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **lldp timer** *rate*
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Device> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**lldp timer** *rate* **Example:** `Device(config)# lldp timer 75`	Specifies the rate at which LLDP packets are sent every second.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Monitoring and Maintaining LLDP in Multivendor Networks

Perform this task to monitor and maintain LLDP in multivendor networks. This task is optional, and Steps 2 and 3 can be performed in any sequence.

SUMMARY STEPS

1. **enable**
2. **show lldp** [**entry** {***** | *word*} | **errors** | **interface** [**ethernet** *number*]| **neighbors** [**ethernet** *number*| **detail**]| **traffic**]
3. **clear lldp** {**counters** | **table**}
4. **end**

DETAILED STEPS

	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	**show lldp** [**entry** {***** | *word*} | **errors** | **interface** [**ethernet** *number*]| **neighbors** [**ethernet** *number*| **detail**]| **traffic**] **Example:** `Device# show lldp entry *`	Displays summarized and detailed LLDP information. **Note** When the **show lldp neighbors** command is issued, if the device ID has more than 20 characters, the ID is truncated to 20 characters in command output because of display constraints.
Step 3	**clear lldp** {**counters** | **table**} **Example:** `Device# clear lldp counters`	Resets LLDP traffic counters and tables to zero.
Step 4	**end** **Example:** `Device# end`	Returns to user EXEC mode.

Enabling and Disabling LLDP TLVs

LLDP TLV support is enabled by default if LLDP is enabled globally and locally on a supported interface. Specific TLVs, however, can be enabled and suppressed.

Enabling LLDP TLVs

Perform this task to enable an LLDP TLV on a supported interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **lldp tlv-select** *tlv*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Device> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface ethernet 0/1`	Specifies the interface type and number on which to enable LLDP-MED and enters interface configuration mode.
Step 4	**lldp tlv-select** *tlv* **Example:** `Device(config-if)# lldp tlv-select system-description`	Enables a specific LLDP TLV on a supported interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Disabling LLDP TLVs

Perform this task to disable an LLDP TLV on a supported interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **no lldp tlv-select** *tlv*
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface ethernet 0/1`	Specifies the interface type and number on which to disable LLDP-MED and enters interface configuration mode.
Step 4	**no lldp tlv-select** *tlv* **Example:** `Device(config-if)# no lldp tlv-select system-description`	Disables a specific LLDP TLV on a supported interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Enabling and Disabling LLDP-MED TLVs

LLDP-MED TLV support is enabled by default if LLDP is enabled globally and locally on a supported interface. Specific TLVs, however, can be enabled and suppressed.

Enabling LLDP-MED TLVs

Perform this task to enable a specific LLDP-MED TLV on a supported interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **lldp med-tlv-select** *tlv*
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface ethernet 0/1`	Specifies the interface type and number on which to enable LLDP-MED and enters interface configuration mode.
Step 4	**lldp med-tlv-select** *tlv* **Example:** `Device(config-if)# lldp med-tlv-select inventory-management`	Enables a specific LLDP-MED TLV on a supported interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Disabling LLDP-MED TLVs

Perform this task to disable a specific LLDP-MED TLV from a supported interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **no lldp med-tlv-select** *tlv*
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface ethernet 0/1`	Specifies the interface type and number on which to disable LLDP-MED and enters interface configuration mode.
Step 4	**no lldp med-tlv-select** *tlv* **Example:** `Device(config-if)# no lldp med-tlv-select inventory-management`	Disables a specific LLDP-MED TLV from a supported interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Configuration Examples for Link Layer Discovery Protocol in Multivendor Networks

Example Configuring LLDP on Two Devices

The following example shows how to configure LLDP timer, hold time, and TLVs on two devices in a network. In each case we assume that the Ethernet interfaces being configured are in the UP state.

```
! Configure LLDP on Device 1 with hold time, timer, and TLV options.

Device1> enable
Device1# configure terminal
Device1(config)# lldp run
Device1(config)# lldp holdtime 150
Device1(config)# lldp timer 15
Device1(config)# lldp tlv-select port-vlan
Device1(config)# lldp tlv-select mac-phy-cfg
Device1(config)# interface ethernet 0/0
Device1(config-if)# end
00:08:32: %SYS-5-CONFIG_I: Configured from console by console
! Show the updated running configuration. LLDP is enabled with hold time, timer, and TLV
options configured.

Device1# show running-config

Building configuration...
Current configuration : 1397 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Device1
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
clock timezone PST -8
ip subnet-zero
!
!
lldp timer 15
lldp holdtime 150
!


! Configure LLDP on Device 2 with hold time, timer, and TLV options.

Device2> enable
Device2# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Device2(config)# lldp run
Device2(config)# lldp holdtime 150
Device2(config)# lldp timer 15
Device2(config)# lldp tlv-select port-vlan
Device2(config)# lldp tlv-select mac-phy-cfg
Device2(config)# interface ethernet 0/0
Device2(config-if)# end
00:08:32: %SYS-5-CONFIG_I: Configured from console by console
```

```
! Show the updated running configuration on Device 2. LLDP is enabled with hold time, timer,
 and TLV options configured.

Device2# show running-config
Building configuration...
Current configuration : 1412 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname R2
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
clock timezone PST -8
ip subnet-zero
!
!
lldp timer 15
lldp holdtime 150
!


! After both devices are configured for LLDP, issue the show
 command from each device to view traffic and device information.

Device1# show lldp traffic
LLDP traffic statistics:
    Total frames out: 20
    Total entries aged: 0
    Total frames in: 15
    Total frames received in error: 0
    Total frames discarded: 0
    Total TLVs unrecognized: 0
Device1# show lldp neighbors
Capability codes:
    (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
    (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other
Device ID           Local Intf     Hold-time  Capability      Port ID
Device2             Et0/0          150        R               Et0/0
Total entries displayed: 1
Device2# show lldp traffic
LLDP traffic statistics:
    Total frames out: 15
    Total entries aged: 0
    Total frames in: 17
    Total frames received in error: 0
    Total frames discarded: 2
    Total TLVs unrecognized: 0
Device2# show lldp neighbors
Capability codes:
    (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
    (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other
Device ID           Local Intf     Hold-time  Capability      Port ID
Device1             Et0/0          150        R               Et0/0
Total entries displayed: 1
```

Additional References for Using Link Layer Discovery Protocol in Multivendor Networks

Related Documents

Related Topic	Document Title
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases
Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
LLDP	*Link Layer Discovery Protocol*
Per Port Location configurations	*Per Port Location Configuration*
Comparison of LLDP Media Endpoint Discovery (MED) and Cisco Discovery Protocol	*LLDP-MED and Cisco Discovery Protocol*

Standards and RFCs

Standards/RFCs	Title
IEEE 802.1ab	*Station and Media Access Control Connectivity Discovery*
RFC 2922	Physical Topology MIB

MIBs

MIB	MIBs Link
PTOPO MIB	To locate and download MIBs for selected platforms, Cisco software 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 and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Link Layer Discovery Protocol in Multivendor Networks

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 8: Feature Information for Using Link Layer Discovery Protocol in Multivendor Networks

Feature Name	Releases	Feature Information
IEEE 802.1ab LLDP (Link Layer Discovery Protocol)	Cisco IOS XE Release 3.8S Cisco IOS XE Release 3.9S	LLDP, standardized by the IEEE as part of 802.1ab, enables standardized discovery of nodes, which in turn facilitates future applications of standard management tools such as SNMP in multivendor networks. In Cisco IOS XE Release 3.9S, support was added for the Cisco ASR 903 Router. The following commands were introduced or modified: **clear lldp**, **lldp** and **show lldp**.

Feature Name	Releases	Feature Information
ANSI TIA-1057 LLDP-MED Support	15.2(3)T 12.2(33)SXH	MED is an LLDP enhancement that was formalized by the TIA for VoIP applications. The Cisco implementation of LLDP is based on the IEEE 802.1ab standard. The following commands were introduced or modified: **lldp** and **lldp** (interface).

CHAPTER 9

Per Port Location Configuration

The Per Port Location Configuration feature provides a mechanism for configuring the location attributes for specific ports. This feature provides the ability to configure Link Layer Discovery Protocol (LLDP) location information per port, overriding the global switch configuration. Thus, devices attached remotely to the switch can be given specific location information.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Per Port Location Configuration

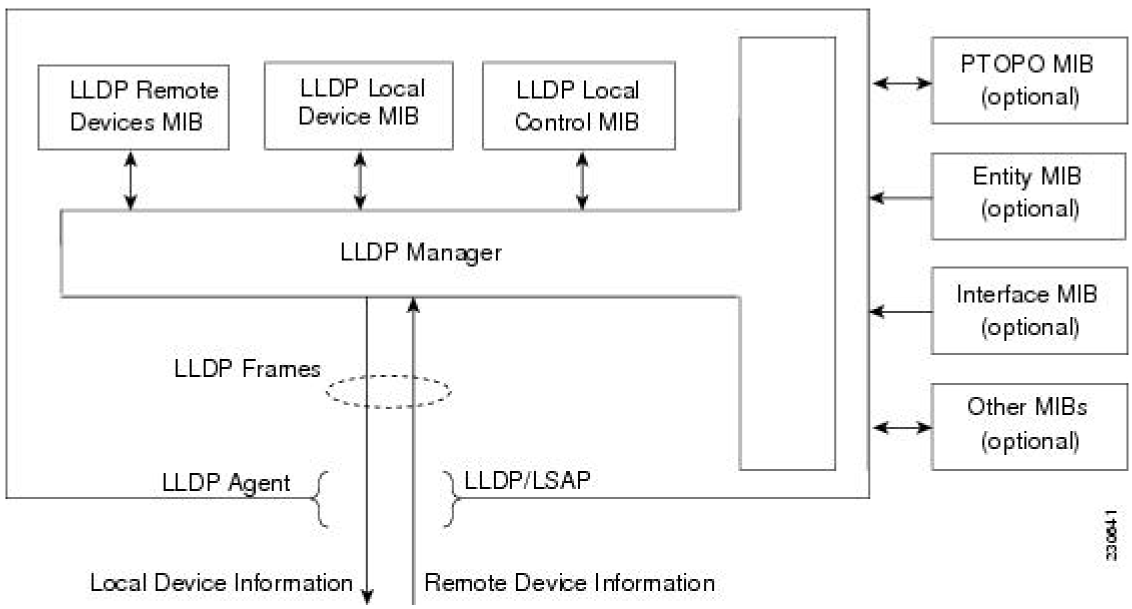
IEEE 802.1ab LLDP

IEEE 802.1ab Link Layer Discovery Protocol (LLDP) is an optional link layer protocol for network topology discovery in multivendor networks. Discovery information includes device identifiers, port identifiers, versions, and other details. As a protocol that aids network management, LLDP provides accurate network mapping, inventory data, and network troubleshooting information.

LLDP is unidirectional, operating only in an advertising mode. LLDP does not solicit information or monitor state changes between LLDP nodes. LLDP periodically sends advertisements to a constrained multicast address. Devices supporting LLDP can send information about themselves while they receive and record information about their neighbors. Additionally, devices can choose to turn off the send or receive functions independently. Advertisements are sent out and received on every active and enabled interface, allowing any device in a network to learn about all devices to which it is connected. Applications that use this information include network topology discovery, inventory management, emergency services, VLAN assignment, and inline power supply.

Note LLDP and Cisco Discovery Protocol can operate on the same interface.

The figure below shows a high-level view of LLDP operating in a network node.



When you configure LLDP or Cisco Discovery Protocol location information on a per-port basis, remote devices can send Cisco medianet location information to the switch. For more information, see the *Using Cisco Discovery Protocol module.*

How to Configure Per Port Location Configuration

Configuring Per Port Location Configuration

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **location** {**additional-location-information** *word* | **civic-location-id** *id* [**port-location**]| **elin-location-id** *id*}
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface fastethernet 0`	Specifies the interface on which you are configuring the location information, and enters interface configuration mode.
Step 4	**location** {**additional-location-information** *word* | **civic-location-id** *id* [**port-location**]| **elin-location-id** *id*} **Example:** `Device(config-if)# location civic-location-id 1 port-location`	Specifies location information for an interface, and enters civic location port configuration mode. • You can configure port-specific information in civic location port configuration mode.

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

Configuration Examples for Per Port Location Configuration

Configuring Per Port Location Configuration

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **location** {**additional-location-information** *word* | **civic-location-id** *id* [**port-location**]| **elin-location-id** *id*}
5. **end**

DETAILED STEPS

	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** *type number* **Example:** `Device(config)# interface fastethernet 0`	Specifies the interface on which you are configuring the location information, and enters interface configuration mode.

	Command or Action	Purpose
Step 4	**location** {**additional-location-information** *word* | **civic-location-id** *id* [**port-location**]| **elin-location-id** *id*} **Example:** `Device(config-if)# location civic-location-id 1 port-location`	Specifies location information for an interface, and enters civic location port configuration mode. • You can configure port-specific information in civic location port configuration mode.
Step 5	**end** **Example:** `Device(config-if-port)# end`	Returns to privileged EXEC mode.

Additional References for Using Link Layer Discovery Protocol in Multivendor Networks

Related Documents

Related Topic	Document Title
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases
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Description	Link
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Feature Information for Per Port Location Configuration

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Table 9: Feature Information for Per Port Location Configuration

Feature Name	Releases	Feature Information
Per Port Location Configuration	12.2(55)SE 15.1(1)SY	The Per Port Location Configuration feature provides a mechanism for configuring the location attributes for specific ports. In Cisco IOS Release 12.2(55)SE, this feature was introduced. In Cisco IOS Release 15.1(1)SY, this feature was integrated. The following commands were introduced or modified: **location**, **location** (interface), **location civic-location identifier**, **location civic-location-id**, **location custom-location identifier**, **location custom-location-id**, **location geo-location**, **identifier**, **location geo-location-id** , **location prefer**, **show location**, **show nmsp**.