Configuring Ethernet OAM on Cisco IOS XR Software

This module describes the configuration of Ethernet Operations, Administration, and Maintenance (OAM) on the Cisco XR 12000 Series Router.

Feature History for Configuring Ethernet OAM

Release	Modification
Release 4.0.0	Support for the following features was introduced: • Ethernet CFM on AToM core • Ethernet Link OAM

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Prerequisites for Configuring Ethernet OAM

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

Before configuring Ethernet OAM, confirm that at least one of the Gigabit Ethernet line cards supported on the router is installed:

- 8-Port Fast Ethernet SPA
- 2-Port Gigabit Ethernet SPA
- 5-Port Gigabit Ethernet SPA
- 8-Port Gigabit Ethernet SPA
- 10-Port Gigabit Ethernet SPA
- 1-Port 10-Gigabit Ethernet SPA

Restrictions for Configuring Ethernet OAM

The following functional areas of Ethernet OAM are not supported on the Cisco XR 12000 Series Router in Cisco IOS XR Release 4.0:

- Alarm Indication Signal (AIS)
- Ethernet Fault Detection (EFD)
- Remote Loopback
- Symbol period thresholds and window for link monitoring
- Unidirectional link-fault detection

Information About Configuring Ethernet OAM

To configure Ethernet OAM, you should understand the following concepts:

- Ethernet Link OAM, page 119
- Ethernet CFM, page 120

Ethernet Link OAM

Ethernet as a Metro Area Network (MAN) or a Wide Area Network (WAN) technology benefits greatly from the implementation of Operations, Administration and Maintenance (OAM) features. Ethernet link OAM features allow Service Providers to monitor the quality of the connections on a MAN or WAN. Service providers can monitor specific events, and take actions on events. Ethernet link OAM operates on a single, physical link and it can be configured to monitor either side or both sides of that link.

Ethernet link OAM can be configured in the following ways:

- A Link OAM profile can be configured, and this profile can be used to set the parameters for multiple interfaces.
- Link OAM can be configured directly on an interface.

  When an interface is also using a link OAM profile, specific parameters that are set in the profile can be overridden by configuring a different value directly on the interface.

An EOAM profile simplifies the process of configuring EOAM features on multiple interfaces. An Ethernet OAM profile, and all of its features, can be referenced by other interfaces, allowing other interfaces to inherit the features of that Ethernet OAM profile.

Individual Ethernet link OAM features can be configured on individual interfaces without being part of a profile. In these cases, the individually configured features always override the features in the profile.

The preferred method of configuring custom EOAM settings is to create an EOAM profile in Ethernet configuration mode and then attach it to an individual interface or to multiple interfaces.

The following standard Ethernet Link OAM features are supported on the router:

- Neighbor Discovery, page 119
- Link Monitoring, page 120
- MIB Retrieval, page 120
- Miswiring Detection (Cisco-Proprietary), page 120
- SNMP Traps, page 120

Neighbor Discovery

Neighbor discovery enables each end of a link to learn the OAM capabilities of the other end and establish an OAM peer relationship. Each end also can require that the peer have certain capabilities before it will establish a session. You can configure certain actions to be taken if there is a capabilities conflict or if a discovery process times out, using the **action capabilities-conflict** or **action discovery-timeout** commands.

Link Monitoring

Link monitoring enables an OAM peer to monitor faults that cause the quality of a link to deteriorate over time. When link monitoring is enabled, an OAM peer can be configured to take action when the configured thresholds are exceeded.

MIB Retrieval

MIB retrieval enables an OAM peer on one side of an interface to get the MIB variables from the remote side of the link. The MIB variables that are retrieved from the remote OAM peer are READ ONLY.

Miswiring Detection (Cisco-Proprietary)

Miswiring Detection is a Cisco-proprietary feature that uses the 32-bit vendor field in every Information OAMPDU to identify potential miswiring cases.

SNMP Traps

SNMP traps can be enabled or disabled on an Ethernet OAM interface.

Ethernet CFM

Ethernet Connectivity Fault Management (CFM) is a service-level OAM protocol that provides tools for monitoring and troubleshooting end-to-end Ethernet services per VLAN. This includes proactive connectivity monitoring, fault verification, and fault isolation. CFM uses standard Ethernet frames and can be run on any physical media that is capable of transporting Ethernet service frames. Unlike most other Ethernet protocols which are restricted to a single physical link, CFM frames can transmit across the entire end-to-end Ethernet network.

CFM is defined in two standards:

- IEEE 802.1ag—Defines the core features of the CFM protocol.
- ITU-T Y.1731—Redefines, but maintains compatibility with the features of IEEE 802.1ag, and defines some additional features.

Ethernet CFM on the Cisco XR 12000 Series Router supports the following functions of ITU-T Y.1731:

- ETH-CC, ETH-RDI, ETH-LB, ETH-LT—These are equivalent to the corresponding features defined in IEEE 802.1ag.

Note The Linktrace responder procedures defined in IEEE 802.1ag are used rather than the procedures defined in Y.1731; however, these are interoperable.

To understand how the CFM maintenance model works, you need to understand the following concepts and features:

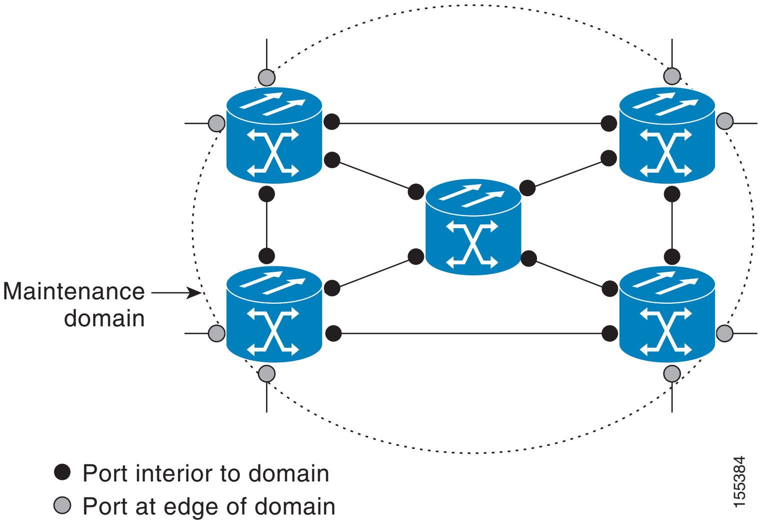
- Maintenance Domains, page 121
- Services, page 123
- Maintenance Points, page 123
- CFM Protocol Messages, page 126

- MEP Cross-Check, page 132
- Configurable Logging, page 132

Maintenance Domains

A *maintenance domain* describes 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 interfaces internal to it and at its boundary, as shown in Figure 1.

Figure 1 CFM Maintenance Domain



A maintenance domain is defined by the bridge ports that are provisioned within it. Domains are assigned maintenance levels, in the range of 0 to 7, by the administrator. The level of the domain is useful in defining the hierarchical relationships of multiple domains.

CFM maintenance domains allow different organizations to use CFM in the same network, but independently. For example, consider a service provider who offers a service to a customer, and to provide that service, they use two other operators in segments of the network. In this environment, CFM can be used in the following ways:

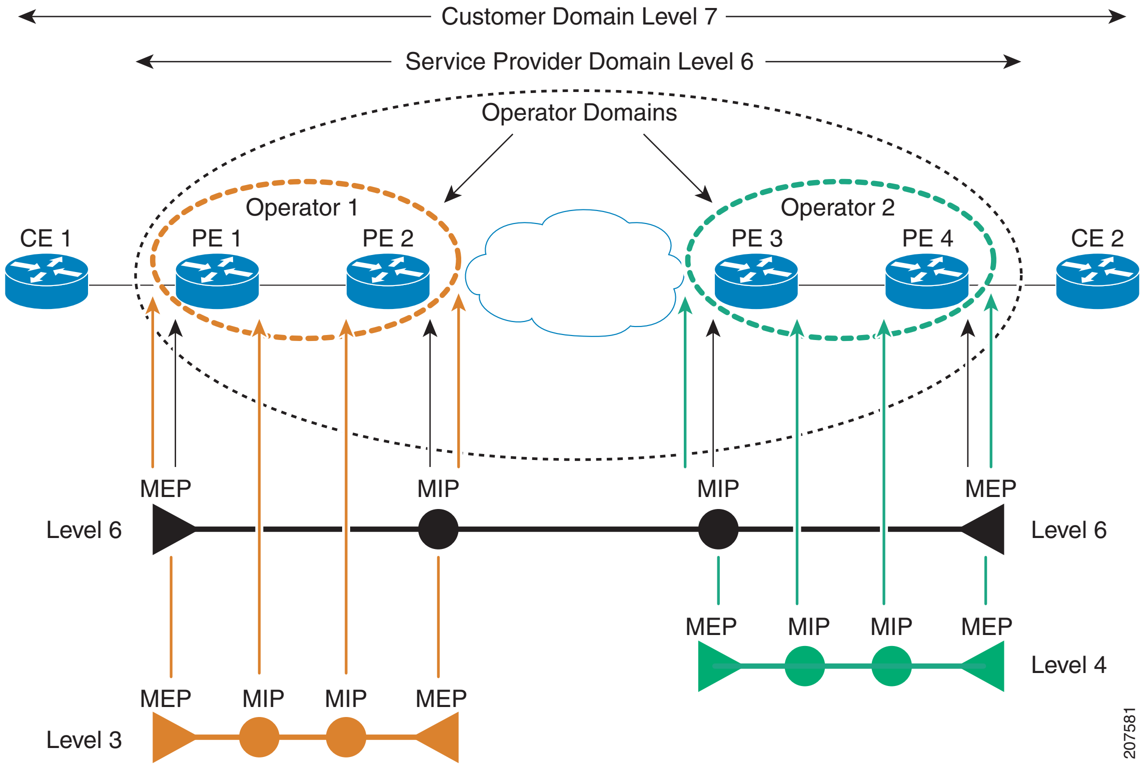
- The customer can use CFM between their CE devices, to verify and manage connectivity across the whole network.
- The service provider can use CFM between their PE devices, to verify and manage the services they are providing.
- Each operator can use CFM within their operator network, to verify and manage connectivity within their network.

Each organization uses a different CFM maintenance domain.

Figure 2 shows an example of the different levels of maintenance domains in a network.

Note In CFM diagrams, the conventions are that triangles represent MEPs, pointing in the direction that the MEP sends CFM frames, and circles represent MIPs. For more information about MEPs and MIPs, see the "Maintenance Points" section on page 123.

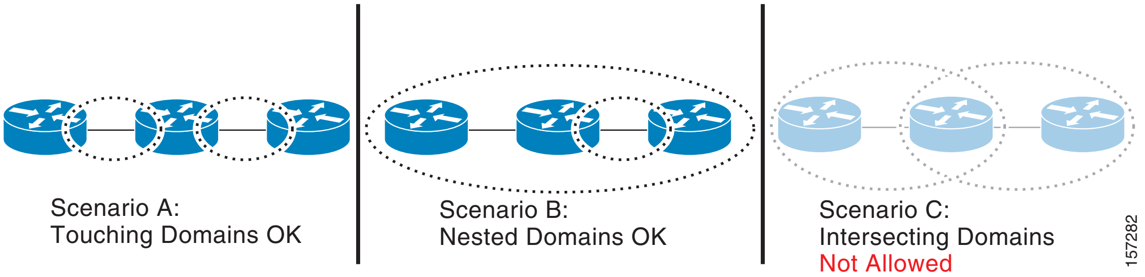
Figure 2 Different CFM Maintenance Domains Across a Network



To ensure that the CFM frames for each domain do not interfere with each other, each domain is assigned a maintenance level, between 0 and 7. Where domains are nested, as in this example, the encompassing domain must have a higher level than the domain it encloses. In this case, the domain levels must be negotiated between the organizations involved. The maintenance level is carried in all CFM frames that relate to that domain.

CFM maintenance domains may touch or nest, but cannot intersect. Figure 3 illustrates the supported structure for touching and nested domains, and the unsupported intersection of domains.

Figure 3 Supported CFM Maintenance Domain Structure



Services

A CFM service allows an organization to partition its CFM maintenance domain, according to the connectivity within the network. For example, if the network is divided into a number of virtual LANs (VLANs), a CFM service is created for each of these. CFM can then operate independently in each service. It is important that the CFM services match the network topology, so that CFM frames relating to one service cannot be received in a different service. For example, a service provider may use a separate CFM service for each of their customers, to verify and manage connectivity between that customer's end points.

A CFM service is always associated with the maintenance domain that it operates within, and therefore with that domain's maintenance level. All CFM frames relating to the service carry the maintenance level of the corresponding domain.

Note CFM Services are referred to as *Maintenance Associations* in IEEE 802.1ag and as *Maintenance Entity Groups* in ITU-T Y.1731.

Maintenance Points

A CFM *Maintenance Point* (MP) is an instance of a particular CFM service on a specific interface. CFM only operates on an interface if there is a CFM maintenance point on the interface; otherwise, CFM frames are forwarded transparently through the interface.

A maintenance point is always associated with a particular CFM service, and therefore with a particular maintenance domain at a particular level. Maintenance points generally only process CFM frames at the same level as their associated maintenance domain. Frames in the higher or lower maintenance levels are forwarded transparently. This helps enforce the maintenance domain hierarchy described in the "Maintenance Domains" section on page 121, and ensures that CFM frames for a particular domain cannot leak out beyond the boundary of the domain.

There are two types of MP:

- Maintenance End Points (MEPs)—Created at the edge of the domain. Maintenance end points (MEPs) are members of a particular service within a domain and are responsible for sourcing and sinking CFM frames. They periodically transmit continuity check messages and receive similar messages from other MEPs within their domain. They also transmit traceroute and loopback messages at the request of the administrator. MEPs are responsible for confining CFM messages within the domain.

- Maintenance Intermediate Points (MIPs)—Created in the middle of the domain. MIPs allow CFM frames to be forwarded at either lower, higher, or their own maintenance levels.

MIP Creation

Unlike MEPs, MIPs are not explicitly configured on each interface. MIPs are created automatically according to the algorithm specified in the CFM 802.1ag standard. The algorithm, in brief, operates as follows for each interface:

- The cross-connect for the interface is found, and all services associated with that cross-connect are considered for MIP auto-creation.
- The level of the highest-level MEP on the interface is found. From among the services considered above, the service in the domain with the lowest level that is higher than the highest MEP level is selected. If there are no MEPs on the interface, the service in the domain with the lowest level is selected.
- The MIP auto-creation configuration (**mip auto-create** command) for the selected service is examined to determine whether a MIP should be created.

Note Configuring a MIP auto-creation policy for a service does not guarantee that a MIP will automatically be created for that service. The policy is only considered if that service is selected by the algorithm first.

MEP and CFM Processing Overview

The boundary of a domain is an interface, rather than a bridge or host. Therefore, MEPs can be sub-divided into two categories:

- Down MEPs—Send CFM frames from the interface where they are configured, and process CFM frames received on that interface.
- Up MEPs—Send frames into the bridge relay function, as if they had been received on the interface where the MEP is configured. They process CFM frames that have been received on other interfaces, and have been switched through the bridge relay function as if they are going to be sent out of the interface where the MEP is configured.

Note The terms *Down MEP* and *Up MEP* are defined in the IEEE 802.1ag and ITU-T Y.1731 standards, and refer to the direction that CFM frames are sent from the MEP. The terms should not be confused with the operational status of the MEP.

Figure 4 illustrates the monitored areas for Down and Up MEPs.

Figure 4 Monitored Areas for Down and Up MEPs

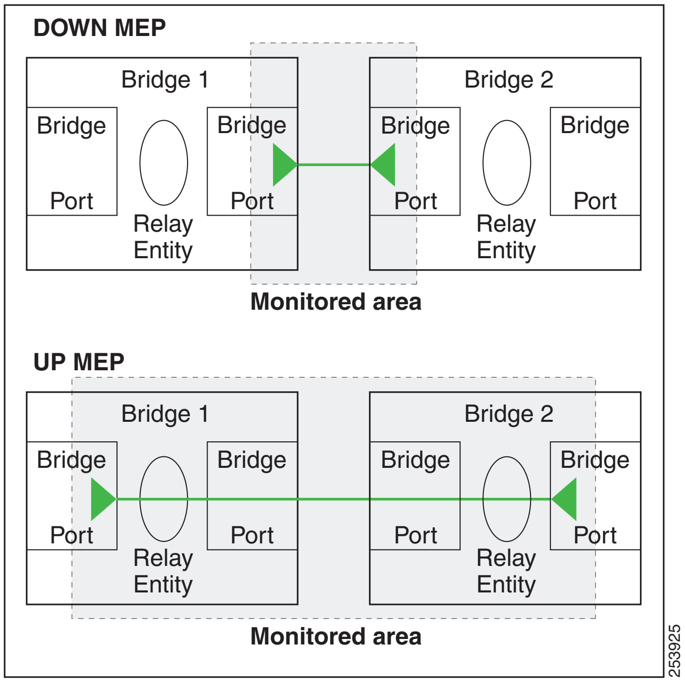
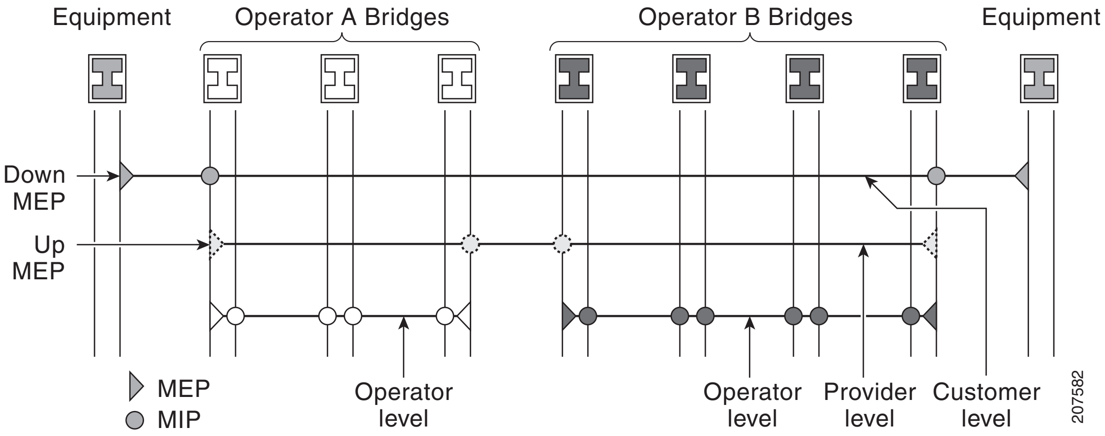


Figure 5 shows maintenance points at different levels. Because domains are allowed to nest but not intersect (see Figure 3), a MEP at a low level always corresponds with a MEP or MIP at a higher level. In addition, only a single MIP is allowed on any interface—this is generally created in the lowest domain that exists at the interface and that does not have a MEP.

Figure 5 CFM Maintenance Points at Different Levels



MIPs and Up MEPs can only exist on switched (Layer 2) interfaces, because they send and receive frames from the bridge relay function. Down MEPs can be created on switched (Layer 2) or routed (Layer 3) interfaces.

MEPs continue to operate normally if the interface they are created on is blocked by the Spanning Tree Protocol (STP); that is, CFM frames at the level of the MEP continue to be sent and received, according to the direction of the MEP. MEPs never allow CFM frames at the level of the MEP to be forwarded, so the STP block is maintained.

MIPs also continue to receive CFM frames at their level if the interface is STP blocked, and can respond to any received frames. However, MIPs do not allow CFM frames at the level of the MIP to be forwarded if the interface is blocked.

Note A separate set of CFM maintenance levels is created every time a VLAN tag is pushed onto the frame. Therefore, if CFM frames are received on an interface which pushes an additional tag, so as to “tunnel” the frames over part of the network, the CFM frames will not be processed by any MPs within the tunnel, even if they are at the same level. For example, if a CFM MP is created on an interface with an encapsulation that matches a single VLAN tag, any CFM frames that are received at the interface that have two VLAN tags will be forwarded transparently, regardless of the CFM level.

CFM Protocol Messages

The CFM protocol consists of a number of different message types, with different purposes. All CFM messages use the CFM EtherType, and carry the CFM maintenance level for the domain to which they apply.

This section describes the following CFM messages:

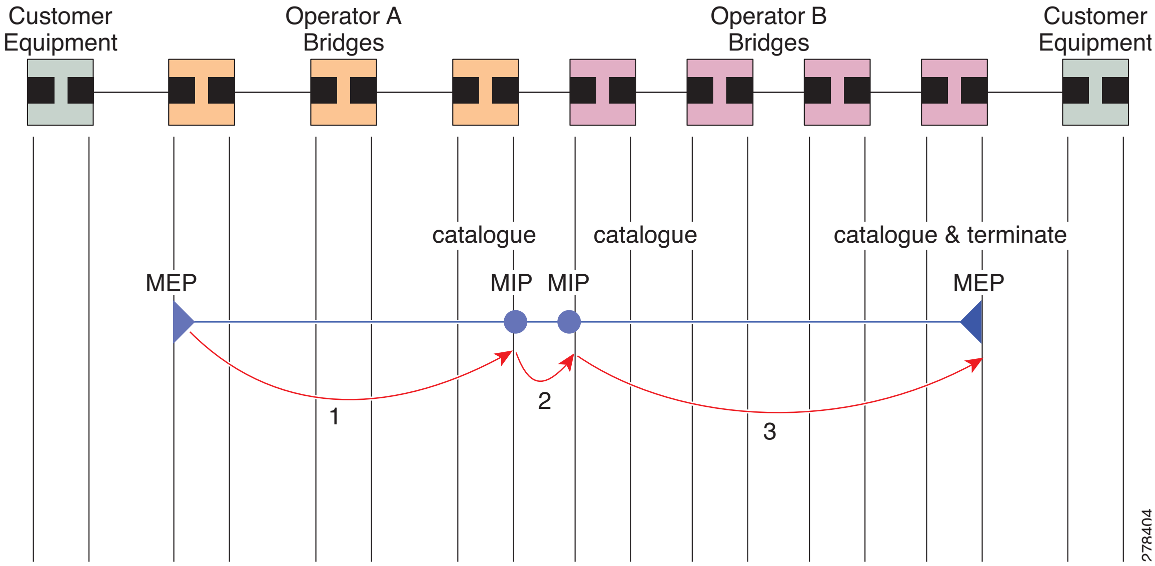
- Continuity Check (IEEE 802.1ag and ITU-T Y.1731), page 126
- Loopback (IEEE 802.1ag and ITU-T Y.1731), page 128
- Linktrace (IEEE 802.1ag and ITU-T Y.1731), page 129
- Exploratory Linktrace (Cisco), page 131

Continuity Check (IEEE 802.1ag and ITU-T Y.1731)

Continuity Check Messages (CCMs) are “heartbeat” messages exchanged periodically between all the MEPs in a service. Each MEP sends out multicast CCMs, and receives CCMs from all the other MEPs in the service—these are referred to as *peer MEPs*. This allows each MEP to discover its peer MEPs, and to verify that there is connectivity between them.

MIPs also receive CCMs. MIPs use the information to build a MAC learning database that is used when responding to Linktrace. For more information about Linktrace, see the “Linktrace (IEEE 802.1ag and ITU-T Y.1731)” section on page 129.

Figure 6 Continuity Check Message Flow



All the MEPs in a service must transmit CCMs at the same interval. IEEE 802.1ag defines 7 possible intervals that can be used:

- 3.3ms
- 10ms
- 100ms
- 1s
- 10s
- 1 minute
- 10 minutes

A MEP detects a loss of connectivity with one of its peer MEPs when some number of CCMs have been missed. This occurs when sufficient time has passed during which a certain number of CCMs were expected, given the CCM interval. This number is called the *loss threshold*, and is usually set to 3.

CCM messages carry a variety of information that allows different defects to be detected in the service. This information includes:

- A configured identifier for the domain of the transmitting MEP. This is referred to as the Maintenance Domain Identifier (MDID).
- A configured identifier for the service of the transmitting MEP. This is referred to as the Short MA Name (SMAN). Together, the MDID and the SMAN make up the Maintenance Association Identifier (MAID). The MAID must be configured identically on every MEP in the service.
- A configured numeric identifier for the MEP (the MEP ID). Each MEP in the service must be configured with a different MEP ID.
- A sequence number.
- A Remote Defect Indication (RDI). Each MEP includes this in the CCMs it is sending, if it has detected a defect relating to the CCMs it is receiving. This notifies all the MEPs in the service that a defect has been detected somewhere in the service.
- The interval at which CCMs are being transmitted.

- The status of the interface where the MEP is operating—for example, whether the interface is up, down, STP blocked, and so on.

Note The status of the interface (up/down) should not be confused with the direction of any MEPs on the interface (Up MEPs/Down MEPs).

The following defects can be detected from received CCMs:

- Interval mismatch—The CCM interval in the received CCM does not match the interval that the MEP is sending CCMs.
- Level mismatch—A MEP has received a CCM carrying a lower maintenance level than the MEPs own level.
- Loop—A CCM is received with the source MAC address equal to the MAC address of the interface where the MEP is operating.
- Configuration error—A CCM is received with the same MEP ID as the MEP ID configured for the receiving MEP.
- Cross-connect—A CCM is received with an MAID that does not match the locally configured MAID. This generally indicates a VLAN misconfiguration within the network, such that CCMs from one service are leaking into a different service.
- Peer interface down—A CCM is received that indicates the interface on the peer is down.
- Remote defect indication—A CCM is received carrying a remote defect indication.

Note This defect does not cause the MEP to include a remote defect indication in the CCMs that it is sending.

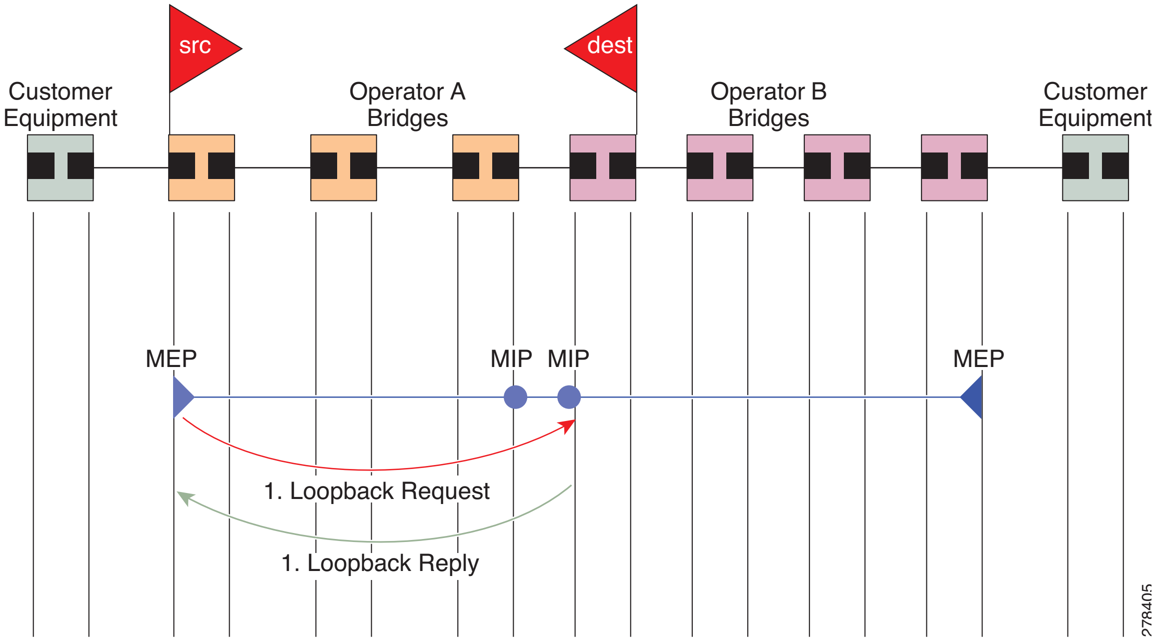
Out-of-sequence CCMs can also be detected by monitoring the sequence number in the received CCMs from each peer MEP. However, this is not considered a CCM defect.

Loopback (IEEE 802.1ag and ITU-T Y.1731)

Loopback Messages (LBM) and Loopback Replies (LBR) are used to verify connectivity between a local MEP and a particular remote MP. At the request of the administrator, a local MEP sends unicast LBMs to the remote MP. On receiving each LBM, the target maintenance point sends an LBR back to the originating MEP. Loopback indicates whether the destination is reachable or not—it does not allow hop-by-hop discovery of the path. It is similar in concept to an ICMP Echo (ping). Since loopback messages are destined for unicast addresses, they are forwarded like normal data traffic, while observing the maintenance levels. At each device that the loopback reaches, if the outgoing interface is known (in the bridge's forwarding database), then the frame is sent out on that interface. If the outgoing interface is not known, then the message is flooded on all interfaces.

Figure 7 shows an example of CFM loopback message flow between a MEP and MIP.

Figure 7 Loopback Messages



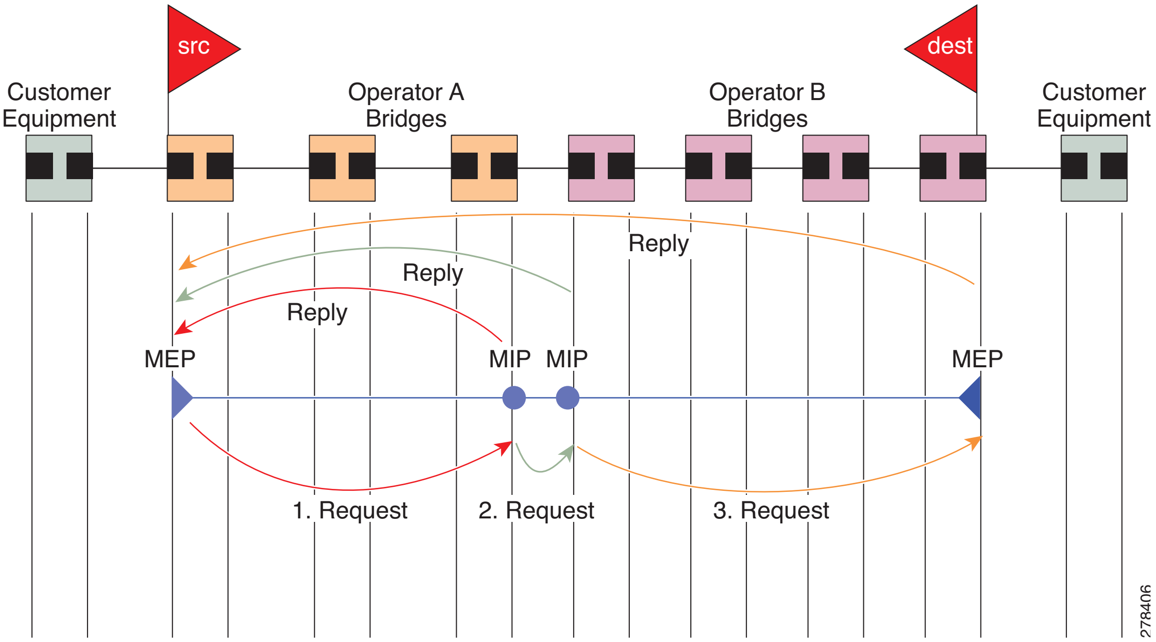
Loopback messages can be padded with user-specified data. This allows data corruption to be detected in the network. They also carry a sequence number which allows for out-of-order frames to be detected.

Linktrace (IEEE 802.1ag and ITU-T Y.1731)

Linktrace Messages (LTM) and Linktrace Replies (LTR) are used to track the path (hop-by-hop) to a unicast destination MAC address. At the request of the operator, a local MEP sends an LTM. Each hop where there is a maintenance point sends an LTR back to the originating MEP. This allows the administrator to discover connectivity data about the path. It is similar in concept to IP traceroute, although the mechanism is different. In IP traceroute, successive probes are sent, whereas CFM Linktrace uses a single LTM which is forwarded by each MP in the path. LTMs are multicast, and carry the unicast target MAC address as data within the frame. They are intercepted at each hop where there is a maintenance point, and either retransmitted or dropped to discover the unicast path to the target MAC address.

Figure 8 shows an example of CFM linktrace message flow between MEPs and MIPs.

Figure 8 Linktrace Message Flow



The linktrace mechanism is designed to provide useful information even after a network failure. This allows it to be used to locate failures, for example after a loss of continuity is detected. To achieve this, each MP maintains a CCM Learning Database. This maps the source MAC address for each received CCM to the interface through which the CCM was received. It is similar to a typical bridge MAC learning database, except that it is based only on CCMs and it times out much more slowly—on the order of days rather than minutes.

Note In IEEE 802.1ag, the CCM Learning Database is referred to as the MIP CCM Database. However, it applies to both MIPs and MEPs.

In IEEE 802.1ag, when an MP receives an LTM message, it determines whether to send a reply using the following steps:

1. The target MAC address in the LTM is looked up in the bridge MAC learning table. If the MAC address is known, and therefore the egress interface is known, then an LTR is sent.
2. If the MAC address is not found in the bridge MAC learning table, then it is looked up in the CCM learning database. If it is found, then an LTR is sent.
3. If the MAC address is not found, then no LTR is sent (and the LTM is not forwarded).

If the target MAC has never been seen previously in the network, the linktrace operation will not produce any results.

Note IEEE 802.1ag and ITU-T Y.1731 define slightly different linktrace mechanisms. In particular, the use of the CCM learning database and the algorithm described above for responding to LTM messages are specific to IEEE 802.1ag. IEEE 802.1ag also specifies additional information that can be included in LTRs. Regardless of the differences, the two mechanisms are interoperable.

Exploratory Linktrace (Cisco)

Exploratory Linktrace is a Cisco extension to the standard linktrace mechanism described above. It has two primary purposes:

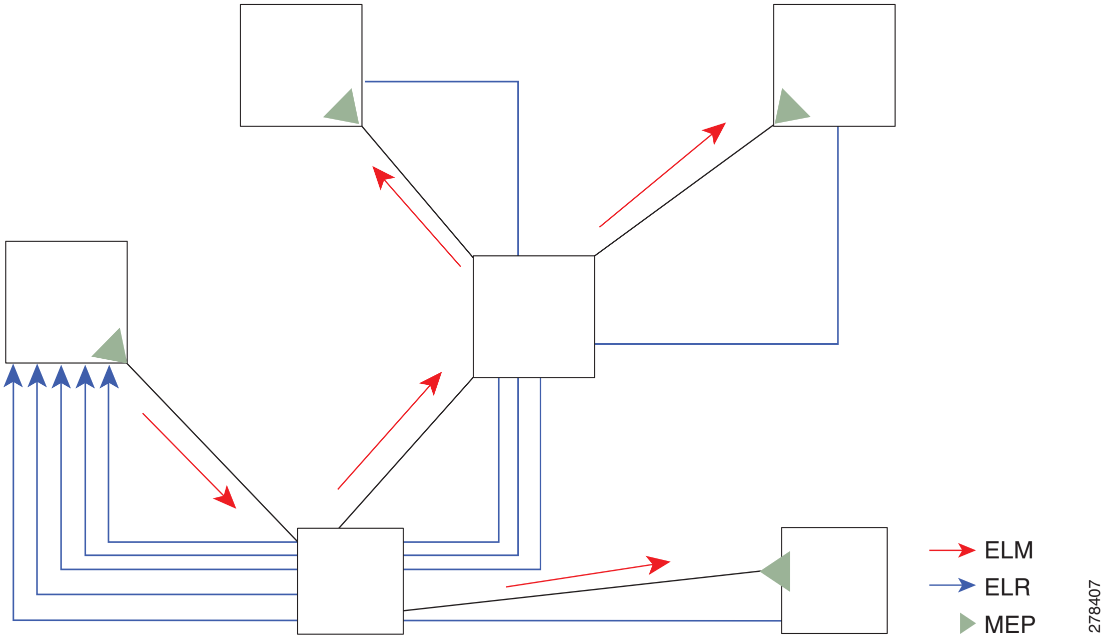
- Provide a mechanism to locate faults in cases where standard linktrace does not work, such as when a MAC address has never been seen previously in the network. For example, if a new MEP has been provisioned but is not working, standard linktrace does not help isolate a problem because no frames will ever have been received from the new MEP. Exploratory Linktrace overcomes this problem.
- Provide a mechanism to map the complete active network topology from a single node. This can only be done currently by examining the topology (for example, the STP blocking state) on each node in the network individually, and manually combining this information to create the overall active topology map. Exploratory linktrace allows this to be done automatically from a single node.

Exploratory Linktrace is implemented using the Vendor Specific Message (VSM) and Vendor Specific Reply (VSR) frames defined in ITU-T Y.1731. These allow vendor-specific extensions to be implemented without degrading interoperability. Exploratory Linktrace can safely be deployed in a network that includes other CFM implementations because those implementations will simply ignore the Exploratory Linktrace messages.

Exploratory Linktrace is initiated at the request of the administrator, and results in the local MEP sending a multicast Exploratory Linktrace message. Each MP in the network that receives the message sends an Exploratory Linktrace reply. MIPs that receive the message also forward it on. The initiating MEP uses all the replies to create a tree of the overall network topology.

Figure 9 show an example of the Exploratory Linktrace message flow between MEPs.

Figure 9 Exploratory Linktrace Messages and Replies



To avoid overloading the originating MEP with replies in a large network, responding MPs delay sending their replies for a random amount of time, and that time increases as the size of the network increases.

In a large network, there will be a corresponding large number of replies and the resulting topology map will be equally large. If only a part of the network is of interest, for example, because a problem has already been narrowed down to a small area, then the Exploratory Linktrace can be “directed” to start at a particular MP. Replies will thus only be received from MPs beyond that point in the network. The replies are still sent back to the originating MEP.

MEP Cross-Check

MEP cross-check supports configuration of a set of expected peer MEPs so that errors can be detected when any of the known MEPs are missing, or if any additional peer MEPs are detected that are not in the expected group.

The set of expected MEP IDs in the service is user-defined. Optionally, the corresponding MAC addresses can also be specified. CFM monitors the set of peer MEPs from which CCMs are being received. If no CCMs are ever received from one of the specified expected peer MEPs, or if a loss of continuity is detected, then a cross-check “missing” defect is detected. Similarly, if CCMs are received from a matching MEP ID but with the wrong source MAC address, a cross-check “missing” defect is detected. If CCMs are subsequently received that match the expected MEP ID, and if specified, the expected MAC address, then the defect is cleared.

Note While loss of continuity can be detected for any peer MEP, it is only treated as a defect condition if cross-check is configured.

If cross-check is configured and CCMs are received from a peer MEP with a MEP ID that is not expected, this is detected as a cross-check “unexpected” condition. However, this is not treated as a defect condition.

Configurable Logging

CFM supports logging of various conditions to syslog. Logging can be enabled independently for each service, and when the following conditions occur:

- New peer MEPs are detected, or loss of continuity with a peer MEP occurs.
- Changes to the CCM defect conditions are detected.
- Cross-check “missing” or “unexpected” conditions are detected.

How to Configure Ethernet OAM

This section provides the following configuration procedures:

- Configuring Ethernet Link OAM, page 133
- Configuring Ethernet CFM, page 141

Configuring Ethernet Link OAM

Custom EOAM settings can be configured and shared on multiple interfaces by creating an EOAM profile in Ethernet configuration mode and then attaching the profile to individual interfaces. The profile configuration does not take effect until the profile is attached to an interface. After an EOAM profile is attached to an interface, individual EOAM features can be configured separately on the interface to override the profile settings when desired.

This section describes how to configure an EOAM profile and attach it to an interface in the following procedures:

- Configuring an Ethernet OAM Profile, page 133
- Attaching an Ethernet OAM Profile to an Interface, page 138
- Configuring Ethernet OAM at an Interface and Overriding the Profile Configuration, page 139
- Verifying the Ethernet OAM Configuration, page 140

Configuring an Ethernet OAM Profile

Perform the following steps to configure an Ethernet OAM profile.

SUMMARY STEPS

1. **configure**
2. **ethernet oam profile** *profile-name*
3. **link-monitor**
4. **frame window** *window*
5. **frame threshold low** *threshold*
6. **frame-period window** *window*
7. **frame-period threshold low** *threshold*
8. **frame-seconds window** *window*
9. **frame-seconds threshold low** *threshold*
10. **exit**
11. **mib-retrieval**
12. **connection timeout** *seconds*
13. **hello-interval** {**100ms** | **1s**}
14. **mode** {**active** | **passive**}
15. **require-remote mode** {**active** | **passive**}

16. **require-remote link-monitoring**
17. **require-remote mib-retrieval**
18. **action capabilities-conflict** {**disable** | **error-disable-interface**}
19. **action critical-event** {**disable** | **error-disable-interface**}
20. **action discovery-timeout** {**disable** | **error-disable-interface** }
21. **action dying-gasp** {**disable** | **error-disable-interface**}
22. **action high-threshold** {**error-disable-interface** | **log**}
23. **action remote-loopback disable**
24. **action session-down** {**disable** | **error-disable-interface**}
25. **action session-up disable**
26. **action uni-directional link-fault** {**disable** | **error-disable-interface**}
27. **action wiring-conflict** {**disable** | **log**}
28. **commit**
29. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/0/CPU0:router# configure terminal`	Enters global configuration mode.
Step 2	**ethernet oam profile** *profile-name* **Example:** `RP/0/0/CPU0:router(config)# ethernet oam profile Profile_1`	Creates a new Ethernet Operations, Administration and Maintenance (OAM) profile and enters Ethernet OAM configuration mode.
Step 3	**link-monitor** **Example:** `RP/0/0/CPU0:router(config-eoam)# link-monitor`	Enters the Ethernet OAM link monitor configuration mode.
Step 4	**frame window** *window* **Example:** `RP/0/0/CPU0:router(config-eoam-lm)# frame window 60`	(Optional) Configures the frame window size (in milliseconds) of an OAM frame error event. The range is 1000 to 60000. The default value is 1000.
Step 5	**frame threshold low** *threshold* **high** *threshold* **Example:** `RP/0/0/CPU0:router(config-eoam-lm)# frame threshold low 10000000 high 60000000`	(Optional) Configures the thresholds (in symbols) that triggers an Ethernet OAM frame error event. The high threshold is optional and is configurable only in conjunction with the low threshold. The range is 0 to 60000000. The default low threshold is 1.

	Command or Action	Purpose
Step 6	**frame-period window** *window* **Example:** `RP/0/0/CPU0:router(config-eoam-lm)# frame-period window 60000`	(Optional) Configures the window size (in milliseconds) for an Ethernet OAM frame-period error event. The range is 100 to 60000. The default value is 1000.
Step 7	**frame-period threshold low** *threshold* **high** *threshold* `RP/0/0/CPU0:router(config-eoam-lm)# frame-period threshold low 100 high 1000000`	(Optional) Configures the thresholds (in frames) that trigger an Ethernet OAM frame-period error event. The high threshold is optional and is configurable only in conjunction with the low threshold. The range is 0 to 1000000. The default low threshold is 60000.
Step 8	**frame-seconds window** *window* **Example:** `RP/0/0/CPU0:router(config-eoam-lm)# frame-seconds window 900000`	(Optional) Configures the window size (in milliseconds) for the OAM frame-seconds error event. The range is 10000 to 900000. The default value is 6000.
Step 9	**frame-seconds threshold low** *threshold* **high** *threshold* **Example:** `RP/0/0/CPU0:router(config-eoam-lm)# frame-seconds threshold 3 threshold 900`	(Optional) Configures the thresholds (in seconds) that trigger a frame-seconds error event. The high threshold value can be configured only in conjunction with the low threshold value. The range is 1 to 900 The default value is 1.
Step 10	**exit** **Example:** `RP/0//CPU0:router(config-eoam-lm)# exit`	Exits back to Ethernet OAM mode.
Step 11	**mib-retrieval** **Example:** `RP/0/0/CPU0:router(config-eoam)# mib-retrieval`	Enables MIB retrieval in an Ethernet OAM profile or on an Ethernet OAM interface.
Step 12	**connection timeout** *seconds* **Example:** `RP/0/0/CPU0:router(config-eoam)# connection timeout 30`	Configures the timeout value (in seconds) for an Ethernet OAM session. The range is 2 to 30. The default value is 5.

Step 13	**hello-interval** {**100ms**|**1s**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# hello-interval 100ms`
		Configures the time interval between hello packets for an Ethernet OAM session. The default is 1 second (**1s**).

Step 14	**mode** {**active**|**passive**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# mode passive`
		Configures the Ethernet OAM mode. The default is active.

	Command or Action	Purpose

Step 15	**require-remote mode** {**active**|**passive**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# require-remote mode active`
		Requires that active mode or passive mode is configured on the remote end before the OAM session becomes active.

Step 16	**require-remote link-monitoring** **Example:** `RP/0/0/CPU0:router(config-eoam)# require-remote link-monitoring`	Requires that link-monitoring is configured on the remote end before the OAM session becomes active.
Step 17	**require-remote mib-retrieval** **Example:** `RP/0/0/CPU0:router(config-eoam)# require-remote mib-retrieval`	Requires that MIB-retrieval is configured on the remote end before the OAM session becomes active.

Step 18	**action capabilities-conflict** {**disable** | **error-disable-interface**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action capabilities-conflict error-disable-interface`
		Specifies the action that is taken on an interface when a capabilities-conflict event occurs. The default action is to create a syslog entry.
		Note If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs.

Step 19	**action critical-event** {**disable** | **error-disable-interface**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action critical-event error-disable-interface`
		Specifies the action that is taken on an interface when a critical-event notification is received from the remote Ethernet OAM peer. The default action is to create a syslog entry.
		Note If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs.

Step 20	**action discovery-timeout** {**disable** | **error-disable-interface**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action discovery-timeout error-disable-interface`
		Specifies the action that is taken on an interface when a connection timeout occurs. The default action is to create a syslog entry.
		Note If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs.

Step 21	**action dying-gasp** {**disable** | **error-disable-interface**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action dying-gasp error-disable-interface`
		Specifies the action that is taken on an interface when a dying-gasp notification is received from the remote Ethernet OAM peer. The default action is to create a syslog entry.
		Note If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs.

	Command or Action	Purpose

Step 22	**`action high-threshold`** {**`error-disable-interface`** | **`log`**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action high-threshold error-disable-interface`
		Specifies the action that is taken on an interface when a high threshold is exceeded. The default is to take no action when a high threshold is exceeded.
		Note If you change the default, the **disable** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and take no action at the interface when the event occurs.

Step 23	**`action remote-loopback disable`**
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action remote-loopback disable`
		Specifies that no action is taken on an interface when a remote-loopback event occurs. The default action is to create a syslog entry.
		Note If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs.

Step 24	**`action session-down`** {**`disable`** | **`error-disable-interface`**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action session-down error-disable-interface`
		Specifies the action that is taken on an interface when an Ethernet OAM session goes down.
		Note If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs.

Step 25	**`action session-up disable`**
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action session-up disable`
		Specifies that no action is taken on an interface when an Ethernet OAM session is established. The default action is to create a syslog entry.
		Note If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs.

Step 26	**`action uni-directional link-fault`** {**`disable`** | **`error-disable-interface`**}	Specifies the action that is taken on an interface when a link-fault notification is received from the remote Ethernet OAM peer. The default action is to create a syslog entry. **Note** If you change the default, the **log** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and log the event for the interface when it occurs. **Note**

Step 27	**`action wiring-conflict`** {**`disable`** | **`log`**}
	Example:
	`RP/0/0/CPU0:router(config-eoam)# action wiring-conflict log`
		Specifies the action that is taken on an interface when a wiring-conflict event occurs. The default is to put the interface into error-disable state.
		Note If you change the default, the **error-disable-interface** keyword option is available in Interface Ethernet OAM configuration mode to override the profile setting and put the interface into error-disable state when the event occurs.

	Command or Action	Purpose

Step 28	**`commit`**
	Example:
	`RP/0/0/CPU0:router(config-if)# commit`
		Saves the configuration changes to the running configuration file and remains within the configuration session.

Step 29	**`end`**
	Example:
	`RP/0/0/CPU0:router(config-if)# end`
		Ends the configuration session and exits to the EXEC mode.

Attaching an Ethernet OAM Profile to an Interface

Perform the following steps to attach an Ethernet OAM profile to an interface:

SUMMARY STEPS

1. **configure**
2. **interface** [**FastEthernet** | **GigabitEthernet** | **TenGigE**] *interface-path-id*
3. **ethernet oam**
4. **profile** *profile-name*
5. **commit**
6. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`configure`**
	Example:
	`RP/0/0/CPU0:router# configure terminal`
		Enters global configuration mode.

Step 2	**`interface`** [**`FastEthernet`** | **`GigabitEthernet`** | **`TenGigE`**] *`interface-path-id`*
	Example:
	`RP/0/0/CPU0:router(config)# interface TenGigE 0/1/0/0`
		Enters interface configuration mode and specifies the Ethernet interface name and notation *rack/slot/module/port*.
		Note The example indicates an 8-port 10-Gigabit Ethernet interface in modular services card slot 1.

Step 3	**`ethernet oam`**
	Example:
	`RP/0/0/CPU0:router(config-if)# ethernet oam`
		Enables Ethernet OAM and enters interface Ethernet OAM configuration mode.

Step 4	**`profile`** *`profile-name`*
	Example:
	`RP/0/0/CPU0:router(config-if-eoam)# profile Profile_1`
		Attaches the specified Ethernet OAM profile (*profile-name*), and all of its configuration, to the interface.

	Command or Action	Purpose

Step 5	`commit`
	Example:
	`RP/0/0/CPU0:router(config-if)# commit`
		Saves the configuration changes to the running configuration file and remains within the configuration session.

Step 6	`end`
	Example:
	`RP/0/0/CPU0:router(config-if)# end`
		Ends the configuration session and exits to the EXEC mode.

Configuring Ethernet OAM at an Interface and Overriding the Profile Configuration

Using an EOAM profile is an efficient way of configuring multiple interfaces with a common EOAM configuration. However, if you want to use a profile but also change the behavior of certain functions for a particular interface, then you can override the profile configuration. To override certain profile settings that are applied to an interface, you can configure that command in interface Ethernet OAM configuration mode to change the behavior for that interface.

In some cases, only certain keyword options are available in interface Ethernet OAM configuration due to the default settings for the command. For example, without any configuration of the **action** commands, several forms of the command have a default behavior of creating a syslog entry when a profile is created and applied to an interface. Therefore, the **log** keyword is not available in Ethernet OAM configuration for these commands in the profile because it is the default behavior. However, the **log** keyword is available in Interface Ethernet OAM configuration if the default is changed in the profile configuration so you can retain the action of creating a syslog entry for a particular interface.

To see all of the default Ethernet OAM configuration settings, see the "Verifying the Ethernet OAM Configuration" section on page 140.

To configure Ethernet OAM settings at an interface and override the profile configuration, perform the following steps:

SUMMARY STEPS

1. **configure**
2. **interface** [**FastEthernet** | **GigabitEthernet** | **TenGigE**] *interface-path-id*
3. **ethernet oam**
4. *interface-Ethernet-OAM-command*
5. **commit**
6. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`configure`**
	Example:
	`RP/0/0/CPU0:router# configure terminal`
		Enters global configuration mode.

Step 2	**`interface`** `[`**`FastEthernet`** `|` **`GigabitEthernet`** `|` **`TenGigE`**`]` *`interface-path-id`*
	Example:
	`RP/0/0/CPU0:router(config)# interface TenGigE 0/1/0/0`
		Enters interface configuration mode and specifies the Ethernet interface name and notation *rack/slot/module/port*.
		Note The example indicates an 8-port 10-Gigabit Ethernet interface in modular services card slot 1.

Step 3	**`ethernet oam`**
	Example:
	`RP/0/0/CPU0:router(config-if)# ethernet oam`
		Enables Ethernet OAM and enters interface Ethernet OAM configuration mode.

Step 4	*`interface-Ethernet-OAM-command`*
	Example:
	`RP/0/0/CPU0:router(config-if-eoam)# action capabilities-conflict error-disable-interface`
		Configures a setting for an Ethernet OAM configuration command and overrides the setting for the profile configuration, where *interface-Ethernet-OAM-command* is one of the supported commands on the platform in interface Ethernet OAM configuration mode.

Step 5	**`commit`**
	Example:
	`RP/0/0/CPU0:router(config-if)# commit`
		Saves the configuration changes to the running configuration file and remains within the configuration session.

Step 6	**`end`**
	Example:
	`RP/0/0/CPU0:router(config-if)# end`
		Ends the configuration session and exits to the EXEC mode.

Verifying the Ethernet OAM Configuration

Use the **show ethernet oam configuration** command to display the values for the Ethernet OAM configuration for a particular interface, or for all interfaces. The following example shows the default values for Ethernet OAM settings:

Note Some of these settings are not supported on certain platforms, but the defaults are still reported. On the Cisco XR 12000 Series Router, the following areas are unsupported:

- Remote loopback
- Symbol period window
- Symbol period thresholds
- Uni-directional link-fault detection

```
RP/0/0/CPU0:router# show ethernet oam configuration
Thu Aug  5 22:07:06.870 DST
GigabitEthernet0/4/0/0:
  Hello interval:                                              1s
  Link monitoring enabled:                                      Y
  Remote loopback enabled:                                      N
  Mib retrieval enabled:                                        N
  Uni-directional link-fault detection enabled:                 N
  Configured mode:                                         Active
  Connection timeout:                                           5
  Symbol period window:                                         0
  Symbol period low threshold:                                  1
  Symbol period high threshold:                              None
  Frame window:                                              1000
  Frame low threshold:                                          1
  Frame high threshold:                                      None
  Frame period window:                                       1000
  Frame period low threshold:                                   1
  Frame period high threshold:                               None
  Frame seconds window:                                     60000
  Frame seconds low threshold:                                  1
  Frame seconds high threshold:                              None
  High threshold action:                                     None
  Link fault action:                                          Log
  Dying gasp action:                                          Log
  Critical event action:                                      Log
  Discovery timeout action:                                   Log
  Capabilities conflict action:                               Log
  Wiring conflict action:                           Error-Disable
  Session up action:                                          Log
  Session down action:                                        Log
  Remote loopback action:                                     Log
  Require remote mode:                                     Ignore
  Require remote MIB retrieval:                                 N
  Require remote loopback support:                              N
  Require remote link monitoring:                               N
```

Configuring Ethernet CFM

To configure Ethernet CFM, perform the following tasks:

- Configuring a CFM Maintenance Domain, page 142
- Configuring Services for a CFM Maintenance Domain, page 143
- Enabling and Configuring Continuity Check for a CFM Service, page 145 (optional)
- Configuring Automatic MIP Creation for a CFM Service, page 147 (optional)
- Configuring Cross-Check on a MEP for a CFM Service, page 149 (optional)
- Configuring Other Options for a CFM Service, page 151 (optional)
- Configuring CFM MEPs, page 153
- Verifying the CFM Configuration, page 155
- Troubleshooting Tips, page 155

Configuring a CFM Maintenance Domain

To configure a CFM maintenance domain, perform the following steps:

SUMMARY STEPS

1. **config**
2. **ethernet cfm**
3. **domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]]
4. **traceroute cache hold-time** *minutes* **size** *entries*
5. **end**
   or
   commit

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`config`**
	Example:
	`RP/0/0/CPU0:router# config`
		Enters global configuration mode.

Step 2	**`ethernet cfm`**
	Example:
	`RP/0/0/CPU0:router(config)# ethernet cfm`
		Enters Ethernet Connectivity Fault Management (CFM) configuration mode.

Step 3	**domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]] **Example:** `RP/0/0/CPU0:router(config-cfm)# domain Domain_One level 1 id string D1`	Creates and names a container for all domain configurations and enters CFM domain configuration mode. The level must be specified. The **id** is the maintenance domain identifier (MDID) and is used as the first part of the maintenance association identifier (MAID) in CFM frames. If the MDID is not specified, the domain name is used as the MDID by default.

	Command or Action	Purpose
Step 4	**traceroute cache hold-time** *minutes* **size** *entries* **Example:** `RP/0/0/CPU0:router(config-cfm)# traceroute cache hold-time 1 size 3000`	(Optional) Sets the maximum limit of traceroute cache entries or the maximum time limit to hold the traceroute cache entries. The default is 100 minutes and 100 entries.
Step 5	**end** or **commit** **Example:** `RP/0/0/CPU0:router(config-cfm-dmn)# commit`	Saves configuration changes. • When you use the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:` – Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. – Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. – Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring Services for a CFM Maintenance Domain

You can configure up to 32000 CFM services for a maintenance domain.

Restrictions

When you configure services for a CFM maintenance domain, consider the following restrictions:

- VPLS configuration (L2VPN bridge groups and bridge-domains) is supported with CFM down MEPs only.
- Up MEPs and MIPs are not supported on Virtual Private Wire Service (VPWS) cross-connects over Layer 2 Tunneling Protocol Version 3 (L2TPv3). The configuration is accepted, but CFM will not operate correctly. Only VPWS cross-connects over an Any-Transport over MPLS (AToM) core are supported.
- Policy-Based Tunnel Selection (PBTS) in the core network is not supported.

To configure services for a CFM maintenance domain, perform the following steps:

SUMMARY STEPS

1. **config**
2. **ethernet cfm**
3. **domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]]

4. **service** *service-name* {**down-meps | xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [vlan-id *id-number*] | [**string** *text*] | [**number** *number*] | [**vpn-id** *oui vpnid*]]
5. **end**
   or
   commit

DETAILED STEPS

	Command or Action	Purpose
Step 1	**config** **Example:** `RP/0/0/CPU0:router# config`	Enters global configuration mode.
Step 2	**ethernet cfm** **Example:** `RP/0/0/CPU0:router(config)# ethernet cfm`	Enters Ethernet CFM configuration mode.
Step 3	**domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]] **Example:** `RP/0/0/CPU0:router(config-cfm)# domain Domain_One level 1 id string D1`	Creates and names a container for all domain configurations at a specified maintenance level, and enters CFM domain configuration mode. The **id** is the maintenance domain identifier (MDID) and is used as the first part of the maintenance association identifier (MAID) in CFM frames. If the MDID is not specified, the domain name is used as the MDID by default.

	Command or Action	Purpose
Step 4	**service** *service-name* {**down-meps** | **xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [**vlan-id** *id-number*]|[**string** *text*]|[**number** *number*]|[**vpn-id** *oui vpnid*]] **Example:** `RP/0/0/CPU0:router(config-cfm-dmn)# service Bridge_Service bridge group BD1 bridge-domain B1`	Configures and associates a service with the domain and enters CFM domain service configuration mode. You can specify that the service is used only for down MEPs, or associate the service with an xconnect where MIPs and up MEPs will be created. The **id** sets the short MA name.
Step 5	**end** or **commit** **Example:** `RP/0/0/CPU0:router(config-cfm-dmn-svc)# commit`	Saves configuration changes. • When you use the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:` – Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. – Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. – Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Enabling and Configuring Continuity Check for a CFM Service

The Cisco XR 12000 Series Router supports Continuity Check as defined in the IEEE 802.1ag specification, and supports CCMs intervals of 100 ms and longer. The overall packet rates for CCM messages are up to 2000 CCMs-per-second sent, and up to 2000 CCMs-per-second received, per card.

To configure Continuity Check for a CFM service, complete the following steps:

SUMMARY STEPS

1. **config**
2. **ethernet cfm**
3. **domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]]
4. **service** *service-name* {**down-meps** | **xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [vlan-id *id-number*] | [**string** *text*] | [**number** *number*] | [**vpn-id** *oui vpnid*]]
5. **continuity-check interval** *time* [**loss-threshold** *threshold*]
6. **continuity-check archive hold-time** *minutes*
7. **continuity-check loss auto-traceroute**

8. **end**
   or
   commit

DETAILED STEPS

	Command or Action	Purpose
Step 1	**config** **Example:** `RP/0/0/CPU0:router# config`	Enters global configuration mode.
Step 2	**ethernet cfm** **Example:** `RP/0/0/CPU0:router(config)# ethernet cfm`	Enters Ethernet Connectivity Fault Management (CFM) configuration mode.
Step 3	**domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]] **Example:** `RP/0/0/CPU0:router(config-cfm)# domain Domain_One level 1 id string D1`	Creates and names a container for all domain configurations and enters the CFM domain configuration mode. The level must be specified. The **id** is the maintenance domain identifier (MDID) and is used as the first part of the maintenance association identifier (MAID) in CFM frames. If the MDID is not specified, the domain name is used as the MDID by default.
Step 4	**service** *service-name* {**down-meps | xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [**vlan-id** *id-number*]|[**string** *text*]|[**number** *number*]|[**vpn-id** *oui vpnid*]] **Example:** `RP/0/0/CPU0:router(config-cfm-dmn)# service Bridge_Service bridge group BD1 bridge-domain B1`	Configures and associates a service with the domain and enters CFM domain service configuration mode. You can specify that the service is used only for down MEPs, or associate the service with an xconnect where MIPs and up MEPs will be created. The **id** sets the short MA name.
Step 5	**continuity-check interval** *time* [**loss-threshold** *threshold*] **Example:** `RP/0/0/CPU0:router(config-cfm-dmn-svc)# continuity-check interval 100m loss-threshold 10`	(Optional) Enables Continuity Check and specifies the time interval at which CCMs are transmitted or to set the threshold limit for when a MEP is declared down.
Step 6	**continuity-check archive hold-time** *minutes* **Example:** `RP/0/0/CPU0:router(config-cfm-dmn-svc)# continuity-check archive hold-time 100`	(Optional) Configures how long information about peer MEPs is stored after they have timed out.

	Command or Action	Purpose

Step 7	**`continuity-check loss auto-traceroute`**
	Example:
	`RP/0/0/CPU0:router(config-cfm-dmn-svc)# continuity-check loss auto-traceroute`
		(Optional) Configures automatic triggering of a traceroute when a MEP is declared down.

Step 8	**`end`**
	or
	`commit`
	Example:
	`RP/0/0/CPU0:router(config-cfm-dmn-svc)# commit`
		Saves configuration changes.
		• When you use the **end** command, the system prompts you to commit changes:
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)?`
		`[cancel]:`
		– Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		– Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		– Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring Automatic MIP Creation for a CFM Service

For more information about the algorithm for creating MIPs, see the "MIP Creation" section on page 124.

To configure automatic MIP creation for a CFM service, complete the following steps:

SUMMARY STEPS

1. **config**
2. **ethernet cfm**
3. **domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]]
4. **service** *service-name* {**down-meps | xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [vlan-id *id-number*] | [**string** *text*] | [**number** *number*] | [**vpn-id** *oui vpnid*]]
5. **mip auto-create {all | lower-mep-only}**
6. **end**
   or
   commit

DETAILED STEPS

	Command or Action	Purpose
Step 1	**config** **Example:** `RP/0/0/CPU0:router# config`	Enters global configuration mode.
Step 2	**ethernet cfm** **Example:** `RP/0/0/CPU0:router# ethernet cfm`	Enters the Ethernet Connectivity Fault Management (CFM) configuration mode.
Step 3	**domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]] **Example:** `RP/0/0/CPU0:router(config-cfm)# domain Domain_One level 1 id string D1`	Creates and names a container for all domain configurations and enters the CFM domain configuration mode. The level must be specified. The **id** is the maintenance domain identifier (MDID) and is used as the first part of the maintenance association identifier (MAID) in CFM frames. If the MDID is not specified, the domain name is used as the MDID by default.
Step 4	**service** *service-name* {**down-meps | xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [**vlan-id** *id-number*]|[**string** *text*]|[**number** *number*]|[**vpn-id** *oui vpnid*]] **Example:** `RP/0/0/CPU0:router(config-cfm-dmn)# service Bridge_Service bridge group BD1 bridge-domain B1`	Configures and associates a service with the domain and enters CFM domain service configuration mode. You can specify that the service is used only for down MEPs, or associate the service with an xconnect where MIPs and up MEPs will be created. The **id** sets the short MA name.

	Command or Action	Purpose

Step 5	`mip auto-create {all | lower-mep-only}`
	Example:
	`RP/0/0/CPU0:router(config-cfm-dmn-svc)# mip auto-create all`
		(Optional) Enables the automatic creation of MIPs in an xconnect.

Step 6	`end`
	or
	`commit`
	Example:
	`RP/0/0/CPU0:router(config-cfm-dmn-svc)# commit`
		Saves configuration changes.
		• When you use the **end** command, the system prompts you to commit changes:
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`
		– Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		– Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		– Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring Cross-Check on a MEP for a CFM Service

To configure cross-check on a MEP for a CFM service and specify the expected set of MEPs, complete the following steps:

SUMMARY STEPS

1. **config**
2. **ethernet cfm**
3. **domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]]
4. **service** *service-name* {**down-meps | xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [vlan-id *id-number*] | [**string** *text*] | [**number** *number*] | [**vpn-id** *oui vpnid*]]
5. **mep crosscheck**
6. **mep-id** *mep-id-number* [**mac-address** *mac-address*]
7. **end**
   or
   commit

DETAILED STEPS

	Command or Action	Purpose
Step 1	**config** **Example:** `RP/0/0/CPU0:router# config`	Enters global configuration mode.
Step 2	**ethernet cfm** **Example:** `RP/0//CPU0:router# ethernet cfm`	Enters the Ethernet Connectivity Fault Management (CFM) configuration mode.
Step 3	**domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]] **Example:** `RP/0/0/CPU0:router(config-cfm)# domain Domain_One level 1 id string D1`	Creates and names a container for all domain configurations and enters the CFM domain configuration mode. The level must be specified. The **id** is the maintenance domain identifier (MDID) and is used as the first part of the maintenance association identifier (MAID) in CFM frames. If the MDID is not specified, the domain name is used as the MDID by default.
Step 4	**service** *service-name* {**down-meps | xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [**vlan-id** *id-number*]|[**string** *text*]|[**number** *number*]|[**vpn-id** *oui vpnid*]] **Example:** `RP/0/0/CPU0:router(config-cfm-dmn)# service Bridge_Service bridge group BD1 bridge-domain B1`	Configures and associates a service with the domain and enters CFM domain service configuration mode. You can specify that the service is used only for down MEPs, or associate the service with an xconnect where MIPs and up MEPs will be created. The **id** sets the short MA name.
Step 5	**mep crosscheck** **Example:** `RP/0/0/CPU0:router(config-cfm-dmn-svc)# mep crosscheck mep-id 10`	Enters CFM MEP crosscheck configuration mode.

	Command or Action	Purpose

Step 6	**`mep-id`** *`mep-id-number`* `[`**`mac-address`** *`mac-address`*`]`
	Example:
	`RP/0/0/CPU0:router(config-cfm-xcheck)# mep-id 10`
		Enables cross-check on a MEP.
		Note Repeat this command for every MEP that you want included in the expected set of MEPs for cross-check.

Step 7	**`end`**
	or
	`commit`
	Example:
	`RP/0/0/CPU0:router(config-cfm-xcheck)# commit`
		Saves configuration changes.
		• When you use the **end** command, the system prompts you to commit changes:
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`
		– Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		– Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		– Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring Other Options for a CFM Service

To configure other options for a CFM service, complete the following steps:

SUMMARY STEPS

1. **config**
2. **ethernet cfm**
3. **domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]]
4. **service** *service-name* {**down-meps | xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [vlan-id *id-number*] | [**string** *text*] | [**number** *number*] | [**vpn-id** *oui vpnid*]]
5. **maximum meps** *number*
6. **log** {**ais | continuity-check errors | continuity-check mep changes | crosscheck errors | efd**}
7. **end**
   or
   commit

DETAILED STEPS

	Command or Action	Purpose
Step 1	**config** **Example:** RP/0/0/CPU0:router# config	Enters global configuration mode.
Step 2	**ethernet cfm** **Example:** RP/0/0/CPU0:router# ethernet cfm	Enters the Ethernet Connectivity Fault Management (CFM) configuration mode.
Step 3	**domain** *domain-name* **level** *level-value* [**id** [**null**] [**dns** *DNS-name*] [**mac** *H.H.H*] [**string** *string*]] **Example:** RP/0/0/CPU0:router(config-cfm)# domain Domain_One level 1 id string D1	Creates and names a container for all domain configurations and enters the CFM domain configuration mode. The level must be specified. The **id** is the maintenance domain identifier (MDID) and is used as the first part of the maintenance association identifier (MAID) in CFM frames. If the MDID is not specified, the domain name is used as the MDID by default.
Step 4	**service** *service-name* {**down-meps** | **xconnect group** *xconnect-group-name* **p2p** *xconnect-name*}[**id** [**vlan-id** *id-number*]| **string** *text*]| **number** *number*]|[**vpn-id** *oui vpnid*]] **Example:** RP/0/0/CPU0:router(config-cfm-dmn)# service Bridge_Service bridge group BD1 bridge-domain B1	Configures and associates a service with the domain and enters CFM domain service configuration mode. You can specify that the service is used only for down MEPs, or associate the service with an xconnect where MIPs and up MEPs will be created. The **id** sets the short MA name.
Step 5	**maximum-meps** *number* **Example:** RP/0/0/CPU0:router(config-cfm-dmn-svc)# maximum-meps 1000	(Optional) Configures the maximum number (2 to 8190) of MEPs across the network, which limits the number of peer MEPs recorded in the database.

	Command or Action	Purpose

Step 6	**log** {**ais**|**continuity-check errors**|**continuity-check mep changes**|**crosscheck errors**|**efd**}
	Example:
	`RP/0/0/CPU0:router(config-cfm-dmn-svc)# log continuity-check errors`
		(Optional) Enables logging of certain types of events.

Step 7	**end** or **commit** **Example:** `RP/0/0/CPU0:router(config-cfm-dmn-svc)# commit`	Saves configuration changes. • When you use the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:` – Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. – Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. – Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring CFM MEPs

When you configure CFM MEPs, consider the following guidelines:

- Up to 16 MEPs are supported per interface (8 up MEPs and 8 down MEPs) or up to 15 MPs (7 up MEPs, 7 down MEPs, and 1 MIP).
- Up to 2000 maintenance points are supported per card.
- Up to 3000 maintenance points are supported per system.
- CFM maintenance points can be created on the following interface types:
  - Attachment circuit (AC) Layer 2 interfaces and Layer 3 interfaces.
  - Up MEPs can be configured on an AC interface, receiving messages to and from a pseudowire.
  - Down MEPs can be configured on an AC or L3 interface, receiving and sending messages to and from an Ethernet interface.
  - L3 interfaces can only support down MEPs.
  - MIPs are only supported on an AC interface.
  - Both up and down MEPs (and MIPs) can be configured on the same interface. They can be at the same or different levels.

Restrictions

When you configure MEPs, consider the following restrictions:

- Up MEPs are not supported on Layer 3 interfaces.
- MEPs are not supported on Layer 2 bundle interfaces or bundle member interfaces.
- Up MEPs and MIPs are not supported on Virtual Private Wire Service (VPWS) cross-connects over Layer 2 Tunneling Protocol Version 3 (L2TPv3). Only VPWS cross-connects over an Any-Transport over MPLS (AToM) core are supported.

SUMMARY STEPS

1. **config**
2. **ethernet cfm**
3. **mep domain** *domain-name* **service** *service-name* **mep-id** *id-number*
4. **cos** *cos*
5. **end**
   or
   commit

DETAILED STEPS

	Command or Action	Purpose
Step 1	**config** **Example:** `RP/0/0/CPU0:router# config`	Enters global configuration mode.
Step 2	**ethernet cfm** **Example:** `RP/0/0/CPU0:router(config-if)# ethernet cfm`	Enters interface Ethernet CFM configuration mode.
Step 3	**mep domain** *domain-name* **service** *service-name* **mep-id** *id-number* **Example:** `RP/0/0/CPU0:router(config-if-cfm)# mep domain Dm1 service Sv1 mep-id 1`	Creates a maintenance end point (MEP) on an interface and enters interface CFM MEP configuration mode.

	Command or Action	Purpose
Step 4	**cos** *cos* **Example:** `RP/0/0/CPU0:router(config-if-cfm-mep)# cos 7`	(Optional) Configures the class of service (CoS) (from 0 to 7) for all CFM packets generated by the MEP on an interface. If not configured, the CoS is inherited from the Ethernet interface.
Step 5	**end** or **commit** **Example:** `RP/0/0/CPU0:router(config-if-cfm-mep)# commit`	Saves configuration changes. • When you use the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:` – Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. – Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. – Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Verifying the CFM Configuration

To verify the CFM configuration, use one or more of the following commands:

Command	Purpose
show ethernet cfm configuration-errors [**domain** *domain-name*] [**interface** *interface-path-id*]	Displays information about errors that are preventing configured CFM operations from becoming active, as well as any warnings that have occurred.
show ethernet cfm local maintenance-points domain *name* [**service** *name*] | **interface** *type interface-path-id*] [**mep** | **mip**]	Displays a list of local maintenance points.

Troubleshooting Tips

To troubleshoot problems within the CFM network, perform the following steps:

Step 1 To verify connectivity to a problematic MEP, use the **ping ethernet cfm** command as shown in the following example:

```
RP/0/0/CPU0:router# ping ethernet cfm domain D1 service S1 mep-id 16 source
interface GigabitEthernet 0/0/0/0
```

```
Type escape sequence to abort.
Sending 5 CFM Loopbacks, timeout is 2 seconds -
Domain foo (level 2), Service foo
Source: MEP ID 1, interface GigabitEthernet0/0/0/0
Target: 0001.0002.0003 (MEP ID 16):
  Running (5s) ...
Success rate is 60.0 percent (3/5), round-trip min/avg/max = 1251/1349/1402 ms
Out-of-sequence: 0.0 percent (0/3)
Bad data: 0.0 percent (0/3)
Received packet rate: 1.4 pps
```

Step 2 If the results of the **ping ethernet cfm** command show a problem with connectivity to the peer MEP, use the **traceroute ethernet cfm** command to help further isolate the location of the problem as shown in the following example:

```
RP/0/0/CPU0:router# traceroute ethernet cfm domain D1 service S1 mep-id 16 source
interface gigabitethernet 0/0/0/0

Traceroutes in domain D1 (level 4), service S1
Source: MEP-ID 1, interface GigabitEthernet0/0/0/0
================================================================================
Traceroute at 2009-05-18 12:09:10 to 0001.0203.0402,
TTL 64, Trans ID 2:

Hop Hostname/Last             Ingress MAC/name       Egress MAC/Name        Relay
--- ------------------------ ---------------------- ---------------------- -----
  1 ios                       0001.0203.0400 [Down]                         FDB
      0000-0001.0203.0400     Gi0/0/0/0
  2 abc                                              0001.0203.0401 [Ok]    FDB
      ios                                            Not present
  3 bcd                       0001.0203.0402 [Ok]                           Hit
      abc                     GigE0/0
Replies dropped: 0
```

If the target was a MEP, verify that the last hop shows "Hit" in the Relay field to confirm connectivity to the peer MEP.

If the Relay field contains "MPDB" for any of the hops, then the target MAC address was not found in the bridge MAC learning table at that hop, and the result is relying on CCM learning. This result can occur under normal conditions, but it can also indicate a problem. If you used the **ping ethernet cfm** command before using the **traceroute ethernet cfm** command, then the MAC address should have been learned. If "MPDB" is appearing in that case, then this indicates a problem at that point in the network.

-

Configuration Examples for Ethernet OAM

This section provides the following configuration examples:

- Configuration Examples for EOAM Interfaces, page 157
- Configuration Examples for Ethernet CFM, page 159

Configuration Examples for EOAM Interfaces

This section provides the following configuration examples:

- Configuring an Ethernet OAM Profile Globally: Example, page 157
- Configuring Ethernet OAM Features on an Individual Interface: Example, page 157
- Configuring Ethernet OAM Features to Override the Profile on an Individual Interface: Example, page 158
- Clearing Ethernet OAM Statistics on an Interface: Example, page 158
- Enabling SNMP Server Traps on a Router: Example, page 158

Configuring an Ethernet OAM Profile Globally: Example

The following example shows how to configure an Ethernet OAM profile globally:

```
configure terminal
 ethernet oam profile Profile_1
  link-monitor
   frame window 60
   frame threshold low 10000000 high 60000000
   frame-period window 60000
   frame-period threshold low 100 high 12000000
   frame-seconds window 900000
   frame-seconds threshold 3 threshold 900
   exit
  mib-retrieval
  connection timeout 30
  require-remote mode active
  require-remote link-monitoring
  require-remote mib-retrieval
  action dying-gasp error-disable-interface
  action critical-event error-disable-interface
  action discovery-timeout error-disable-interface
  action session-down error-disable-interface
  action capabilities-conflict error-disable-interface
  action wiring-conflict error-disable-interface
  action remote-loopback error-disable-interface
  commit
```

Configuring Ethernet OAM Features on an Individual Interface: Example

The following example shows how to configure Ethernet OAM features on an individual interface:

```
configure terminal
 interface TenGigE 0/1/0/0
  ethernet oam
   link-monitor
    frame window 60
    frame threshold low 10000000 high 60000000
    frame-period window 60000
    frame-period threshold low 100 high 12000000
    frame-seconds window 900000
    frame-seconds threshold 3 threshold 900
    exit
   mib-retrieval
   connection timeout 30
   require-remote mode active
   require-remote link-monitoring
   require-remote mib-retrieval
   action link-fault  error-disable-interface
   action dying-gasp error-disable-interface
   action critical-event error-disable-interface
   action discovery-timeout error-disable-interface
   action session-down error-disable-interface
   action capabilities-conflict error-disable-interface
   action wiring-conflict error-disable-interface
   action remote-loopback error-disable-interface
   commit
```

Configuring Ethernet OAM Features to Override the Profile on an Individual Interface: Example

The following example shows the configuration of Ethernet OAM features in a profile followed by an override of that configuration on an interface:

```
configure terminal
 ethernet oam profile Profile_1
  mode passive
  action dying-gasp disable
  action critical-event disable
  action discovery-timeout disable
  action session-up disable
  action session-down disable
  action capabilities-conflict disable
  action wiring-conflict disable
  action remote-loopback disable
  action uni-directional link-fault error-disable-interface
  commit

configure terminal
 interface TenGigE 0/1/0/0
  ethernet oam
   profile Profile_1
    mode active
    action dying-gasp log
    action critical-event log
    action discovery-timeout log
    action session-up log
    action session-down log
    action capabilities-conflict log
    action wiring-conflict log
    action remote-loopback log
    action uni-directional link-fault log
    uni-directional link-fault detection
    commit
```

Clearing Ethernet OAM Statistics on an Interface: Example

The following example shows how to clear Ethernet OAM statistics on an interface:

```
RP/0/RP0/CPU0:router# clear ethernet oam statistics interface gigabitethernet 0/1/5/1
```

Enabling SNMP Server Traps on a Router: Example

The following example shows how to enable SNMP server traps on a router:

```
configure terminal
  ethernet oam profile Profile_1
  snmp-server traps ethernet oam events
```

Configuration Examples for Ethernet CFM

This section includes the following examples:

- Ethernet CFM Domain Configuration: Example, page 159
- Ethernet CFM Service Configuration: Example, page 159
- Continuity Check for an Ethernet CFM Service Configuration: Example, page 159
- MIP Creation for an Ethernet CFM Service Configuration: Example, page 159
- Cross-check for an Ethernet CFM Service Configuration: Example, page 159
- Other Ethernet CFM Service Parameter Configuration: Example, page 160
- MEP Configuration: Example, page 160
- Ethernet CFM Show Command: Examples, page 160

Ethernet CFM Domain Configuration: Example

This example shows how to configure a basic domain for Ethernet CFM:

```
config
 ethernet cfm
  traceroute cache hold-time 1 size 3000
  domain Domain_One level 1 id string D1
  commit
```

Ethernet CFM Service Configuration: Example

The following example shows how to create a service for an Ethernet CFM domain:

```
  service Cross_Connect_1 xconnect group XG1 p2p X1
  commit
```

Continuity Check for an Ethernet CFM Service Configuration: Example

The following example shows how to configure continuity-check options for an Ethernet CFM service:

```
   continuity-check archive hold-time 100
   continuity-check loss auto-traceroute
   continuity-check interval 100ms loss-threshold 10
   commit
```

MIP Creation for an Ethernet CFM Service Configuration: Example

The following example shows how to enable MIP auto-creation for an Ethernet CFM service:

```
   mip auto-create all
   commit
```

Cross-check for an Ethernet CFM Service Configuration: Example

The following example shows how to configure cross-check for MEPs in an Ethernet CFM service:

```
   mep crosscheck
    mep-id 10
    mep-id 20
```

```
commit
```

Other Ethernet CFM Service Parameter Configuration: Example

The following example shows how to configure other Ethernet CFM service options:

```
  maximum-meps 4000
  log continuity-check errors
  commit
  exit
 exit
exit
```

MEP Configuration: Example

The following example shows how to configure a MEP for Ethernet CFM on an interface:

```
interface gigabitethernet 0/1/0/1
 ethernet cfm
 mep domain Dm1 service Sv1 mep-id 1
 commit
```

Ethernet CFM Show Command: Examples

The following examples show how to verify the configuration of Ethernet Connectivity Fault Management (CFM):

Example 1

The following example shows how to display all the maintenance points that have been created on an interface:

```
RP/0/0/CPU0:router# show ethernet cfm local maintenance-points

Domain/Level         Service             Interface         Type   ID   MAC
-------------------- ------------------- ----------------- ------ ---- --------
fig/5                bay                 Gi0/10/0/12.23456 Dn MEP    2 44:55:66
fig/5                bay                 Gi0/0/1/0.1       MIP         55:66:77
fred/3               barney              Gi0/1/0/0.1       Up MEP    5 66:77:88!
```

Example 2

The following example shows how to display all the CFM configuration errors on all domains:

```
RP/0/0/CPU0:router# show ethernet cfm configuration-errors

Domain fig (level 5), Service bay
 * An Up MEP is configured for this domain on interface GigabitEthernet0/1/2/3.234 and an
Up MEP is also configured for domain blort, which is at the same level (5).
 * A MEP is configured on interface GigabitEthernet0/3/2/1.1 for this domain/service,
which has CC interval 100ms, but the lowest interval supported on that interface is 1s
```

Example 3

The following example shows how to display operational state for local maintenance end points (MEPs):

```
RP/0/0/CPU0:router# show ethernet cfm local meps

 A - AIS received                I - Wrong interval
 R - Remote Defect received      V - Wrong Level
 L - Loop (our MAC received)     T - Timed out (archived)
 C - Config (our ID received)    M - Missing (cross-check)
 X - Cross-connect (wrong MAID)  U - Unexpected (cross-check)
 P - Peer port down

Domain foo (level 6), Service bar
   ID Interface (State)        Dir MEPs/Err RD Defects AIS
----- ------------------------ --- -------- -- ------- ---
  100 Gi1/1/0/1.234 (Up)       Up     0/0   N  A

Domain fred (level 5), Service barney
   ID Interface (State)        Dir MEPs/Err RD Defects AIS
----- ------------------------ --- -------- -- ------- ---
    2 Gi0/1/0/0.234 (Up)       Up     3/2   Y  RPC
```

Example 4

The following example shows how to display operational state of other maintenance end points (MEPs) detected by a local MEP:

```
RP/0/0/CPU0:router# show ethernet cfm peer meps

Flags:
 > - Ok                            I - Wrong interval
 R - Remote Defect received        V - Wrong level
 L - Loop (our MAC received)       T - Timed out
 C - Config (our ID received)      M - Missing (cross-check)
 X - Cross-connect (wrong MAID)    U - Unexpected (cross-check)

Domain fred (level 7), Service barney
Up MEP on GigabitEthernet0/1/0/0.234, MEP-ID 2
================================================================================
St    ID MAC address    Port    Up/Downtime   CcmRcvd SeqErr   RDI Error
-- ----- -------------- ------- ----------- --------- ------ ----- -----
 >     1 0011.2233.4455 Up      00:00:01         1234      0     0     0
R>     4 4455.6677.8899 Up      1d 03:04         3456      0   234     0
L      2 1122.3344.5566 Up      3w 1d 6h         3254      0     0  3254
C      2 7788.9900.1122 Test    00:13            2345      6    20  2345
X      3 2233.4455.6677 Up      00:23              30      0     0    30
I      3 3344.5566.7788 Down    00:34           12345      0   300  1234
V      3 8899.0011.2233 Blocked 00:35              45      0     0    45
 T     5 5566.7788.9900         00:56              20      0     0     0
M      6                                            0      0     0     0
U>     7 6677.8899.0011 Up      00:02             456      0     0     0

Domain fred (level 7), Service fig
Down MEP on GigabitEthernet0/10/0/12.123, MEP-ID 3
================================================================================
St    ID MAC address    Port    Up/Downtime  CcmRcvd SeqErr   RDI Error
-- ----- -------------- ------- ----------- -------- ------ ----- -----
 >     1 9900.1122.3344 Up      03:45           4321      0     0     0
```

Example 5

The following example shows how to display operational state of other maintenance end points (MEPs) detected by a local MEP with details:

```
RP/0/0/CPU0:router# show ethernet cfm peer meps detail
Domain dom3 (level 5), Service ser3
Down MEP on GigabitEthernet0/0/0/0 MEP-ID 1
================================================================================
Peer MEP-ID 10, MAC 0001.0203.0403
   CFM state: Wrong level, for 00:01:34
   Port state: Up
   CCM defects detected:    V - Wrong Level
   CCMs received: 5
```

```
     Out-of-sequence:             0
     Remote Defect received:      5
     Wrong Level:                 0
     Cross-connect (wrong MAID):  0
     Wrong Interval:              5
     Loop (our MAC received):     0
     Config (our ID received):    0
Last CCM received 00:00:06 ago:
     Level: 4, Version: 0, Interval: 1min
     Sequence number: 5, MEP-ID: 10
     MAID: String: dom3, String: ser3
     Port status: Up, Interface status: Up


Domain dom4 (level 2), Service ser4
Down MEP on GigabitEthernet0/0/0/0 MEP-ID 1
================================================================================
Peer MEP-ID 20, MAC 0001.0203.0402
   CFM state: Ok, for 00:00:04
   Port state: Up
   CCMs received: 7
     Out-of-sequence:             1
     Remote Defect received:      0
     Wrong Level:                 0
     Cross-connect (wrong MAID):  0
     Wrong Interval:              0
     Loop (our MAC received):     0
     Config (our ID received):    0
Last CCM received 00:00:04 ago:
     Level: 2, Version: 0, Interval: 10s
     Sequence number: 1, MEP-ID: 20
     MAID: String: dom4, String: ser4
     Chassis ID: Local: ios; Management address: 'Not specified'
     Port status: Up, Interface status: Up

Peer MEP-ID 21, MAC 0001.0203.0403
   CFM state: Ok, for 00:00:05
   Port state: Up
   CCMs received: 6
     Out-of-sequence:             0
     Remote Defect received:      0
     Wrong Level:                 0
     Cross-connect (wrong MAID):  0
     Wrong Interval:              0
     Loop (our MAC received):     0
     Config (our ID received):    0
Last CCM received 00:00:05 ago:
     Level: 2, Version: 0, Interval: 10s
     Sequence number: 1, MEP-ID: 21
     MAID: String: dom4, String: ser4
     Port status: Up, Interface status: Up
```

Where to Go Next

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

For information about modifying Ethernet management interfaces for the shelf controller (SC), route processor (RP), and distributed RP, see the *Advanced Configuration and Modification of the Management Ethernet Interface on the Cisco ASR 9000 Series RouterCisco IOS XR Software* module later in this document.

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

Additional References

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

Related Documents

Related Topic	Document Title
Cisco IOS XR master command reference	*Cisco IOS XR Master Commands List*
Cisco IOS XR interface configuration commands	*Cisco IOS XR Interface and Hardware Component Command Reference*
Information about user groups and task IDs	*Cisco IOS XR Interface and Hardware Component Command Reference*

Standards

Standards	Title
IEEE 802.1ag	*Connectivity Fault Management*
ITU-T Y.1731	*OAM Functions and Mechansims for Ethernet Based Networks*

MIBs

MIBs	MIBs Link
IEEE8021-CFM-MIB	To locate and download MIBs for selected platforms using Cisco IOS XR Software, use the Cisco MIB Locator found at the following URL: http://cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

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

Technical Assistance

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