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ADTRAN

Configuration Guide

# Ethernet OAM CFM in AOS

This guide describes the functionality of Ethernet operation, administration, and management (OAM) connectivity fault management (CFM) in ADTRAN Operating System (AOS) products. The guide provides an overview of Ethernet OAM technology, Ethernet OAM CFM technology, and the use of this technology in AOS. It also covers the specifics of configuring the different OAM CFM features in AOS products. Configuration is described using the command line interface (CLI), and includes configuration examples, a command summary, and Ethernet OAM CFM troubleshooting.

This guide consists of the following sections:

# Ethernet OAM Overview

Large Ethernet networks often involve different operators that must work together to provide end-to-end network services to enterprise customers. Ethernet OAM is a compilation of protocols designed to aid in the maintenance of these networks. Ethernet networks have traditionally been used as local area networks (LANs), and are usually maintained using Layer 3 IP protocols, such as Simple Network Management Protocol (SNMP), Internet Control Message Protocol (ICMP) echo, and IP traceroute. Ethernet OAM, however, operates on a much larger scale and on the data link layer (DLL), or Layer 2, of the Open Systems Interconnection (OSI) layered communication model. The feature also enables network administrators to monitor the health of Ethernet connections even through multiple Ethernet segments separated by Layer 2 devices (switches or bridges). Ethernet OAM provides scalable services, such as multi-point rather than point-to-point services, a per-customer or per-service maintenance model, and the ability to maintain Layer 2 networks without implementing additional IP infrastructures. Ethernet OAM protocols provide network administrators, whether they are service providers, operators, or enterprise customers, with a method of maintaining and managing Ethernet networks over wide area networks (WANs) and through multiple network domains, allowing Ethernet to become a carrier-grade service option.

## Types of Ethernet OAM

Ethernet OAM can be divided into two types: Link OAM and Service OAM. Each type provides a different capability for network management.

Link OAM operates over a single point-to-point Ethernet link, and is concerned only with a single provided link. Link OAM can be used to monitor a link for critical events, test a link, and discover unidirectional links. The Metro-Ethernet Forum (MEF) describes the functionality of Link OAM in MEF 17, and classifies it in a transport OAM category along with Asynchronous Transfer Mode (ATM), Multiprotocol Label Switching (MPLS), and other OAM technologies concerned with the link they provide. Link OAM is also defined in IEEE 802.3ah and Clause 57 of IEEE 802.3.

Service OAM, on the other hand, operates over the entire end-to-end Ethernet service instance, providing maintenance and monitoring within multiple network domains and different domain levels. Unlike Link OAM, which provides monitoring of a single Ethernet link, Service OAM allows for the monitoring multiple links over multiple network domains. Service OAM is also defined in MEF 17.

One type of Service OAM is connectivity fault management (CFM). CFM is described in IEEE 802.1ag, and is concerned with fault detection, notification, verification, and isolation. CFM operates using mechanisms like Ethernet keepalive, ping, and traceroute.

  

### Ethernet OAM in the Network

To understand the functionality of Ethernet OAM, you must understand the role the service plays in the network. Figure 1 describes the placement of both Link and Service OAM as it fits into the end-to-end Ethernet service instance.

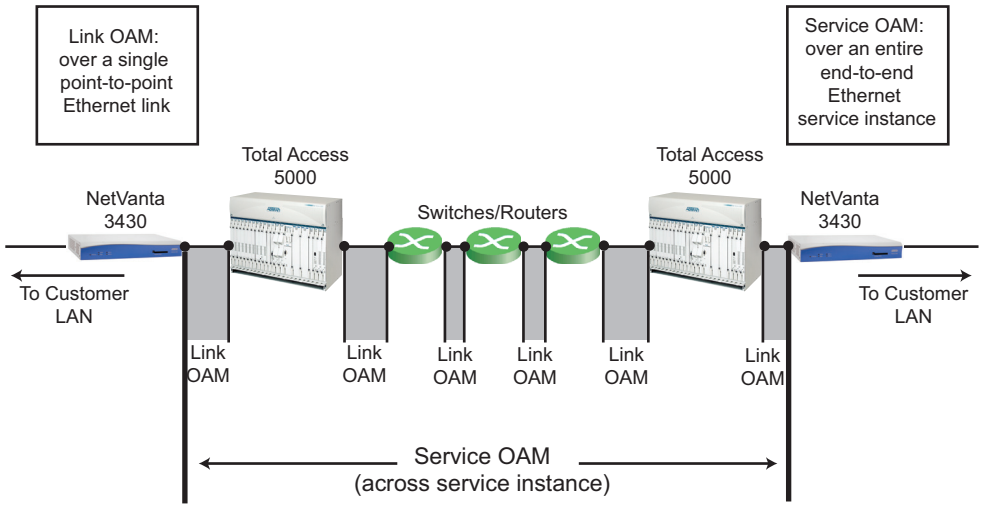


**Figure 1. Ethernet OAM in the End-to-End Ethernet Service Instance**

Note the multiple network domains (service provider, operator, and enterprise customer) and the multiple network layers that are covered in the Ethernet OAM maintenance umbrella. There is a hierarchical relationship between domains and levels, as well as between different points along the service instance. These relationships are described in detail in the following section.

## Ethernet OAM CFM Overview

Ethernet OAM CFM is specifically concerned with detecting faults over an Ethernet service instance, through multiple maintenance domains, allowing each service instance to be managed individually. Each service instance is typically designated by a virtual local area network (VLAN) tag on the user-to-network Interface (UNI), allowing the identification of individual service instances along the service domain. Using a system of messages and notifications within the service domain, CFM can discover Ethernet service instance connection paths, locate and verify faults in the connection, isolate any discovered faults, give notification of discovered faults, and assist in fault recovery. These messages and notifications are used to test and communicate with various devices within the service instance, devices that often operate in different network domains.

To understand how CFM works, you must first become familiar with the four major players in the CFM structure: maintenance domains (MDs), MD levels, maintenance intermediate points (MIPs), and maintenance end points (MEPs).

## Maintenance Domains

MDs are administrator domains created for the purpose of managing a network. The domains are defined by designating which switches and routers are to be included in the domain. This designation is usually done by the service provider or operator, with the enterprise customer using routers at the end of the MD as the UNIs. Figure 2 describes how different MDs might appear over a service instance.

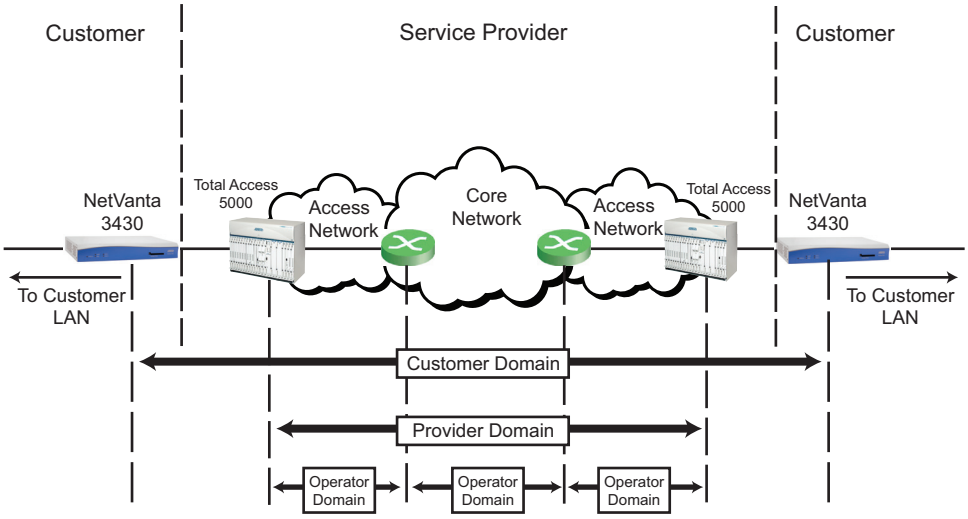


**Figure 2. Maintenance Domains Over a Service Instance**

MDs are nested, meaning operator domains fit into service provider domains, and service provider domains fit into customer/subscriber domains. These domains do not overlap, but are terminated by designated end devices or intermediate devices that act as end devices to terminate the domain. The domain nesting hierarchy is described in Figure 3.

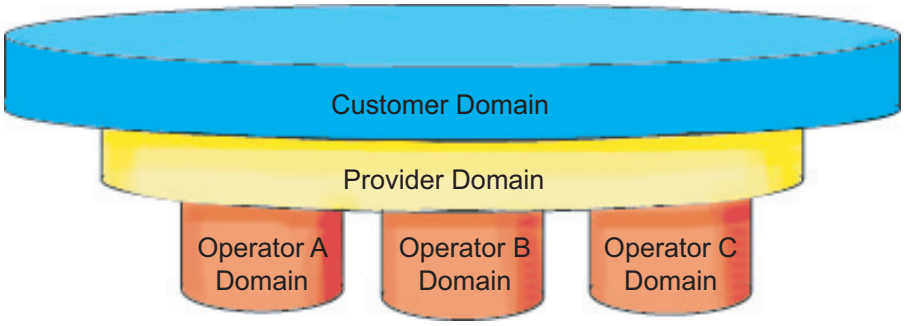


**Figure 3. Hierarchy of Nested Maintenance Domains**

## Maintenance Domain Levels

As described in the previous section, each MD is nested in a hierarchy, which creates different MD levels. Each level is specific to the maintenance domain, as each level is made up of a different MD along the service instance. For example, the service provider's maintenance domain is at a different level than the operator's MD. These levels are created by the beginning and termination of MDs using MIPs and MEPs. The MEPs of one domain can become MIPs of a higher level domain. Figure 4 describes this activity.

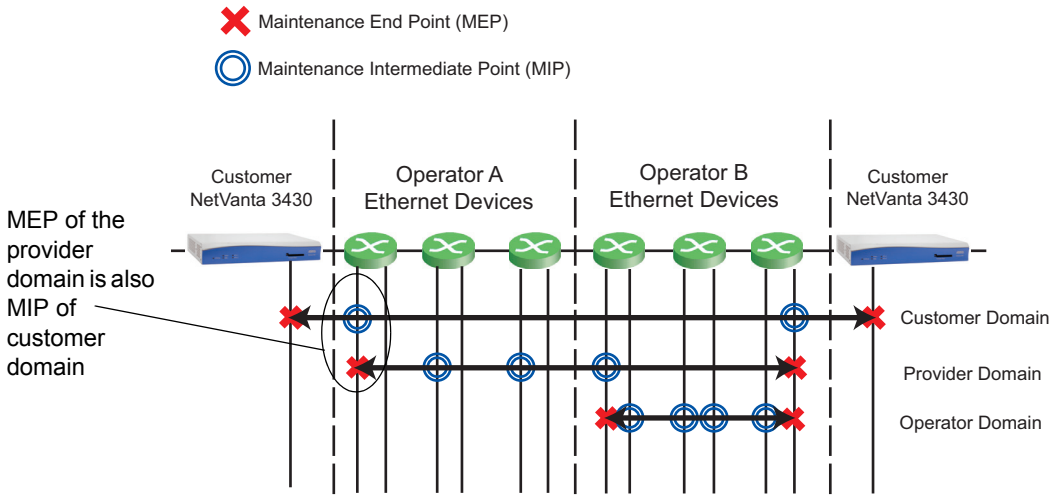


**Figure 4. Maintenance Domain Levels Based on Maintenance Domains**

These different levels allow customers, service providers, and operators to discover faults and isolate them within their MD level, without having to share network information with each other.

## Maintenance Intermediate Points and Maintenance End Points

MIPs are maintenance points within the MD, and MEPs are maintenance points that terminate the domain. Maintenance points are any port of a bridge.

Typically, an MIP is some type of Layer 2 switch, that forwards Layer 2 packets through domains. These packets can be forwarded up towards higher level MDs, or down towards lower level MDs, arriving at the alternate domain's MEP, or the packets can be forwarded to another MIP on the same domain. Therefore, MIPs can operate as MEPs for one domain while also operating as MIPs for higher level domains.

MEPs, on the other hand, terminate Layer 2 traffic. Typically, an MEP is a router that converts Layer 2 traffic into its Layer 3 interface, but MEPs can also be switches that terminate CFM functionality on interfaces that face the provider, or that have independent interfaces for sending Layer 2 traffic. MEPs can only send traffic to other MEPs with MD levels less than or equal to its own.

The relationship of MIPs, MEPs, and Layer traffic is described in Figure 5. In this figure, the Layer 2 and Layer 3 traffic is described according to the MIP and MEP relationship shown in Figure 4.

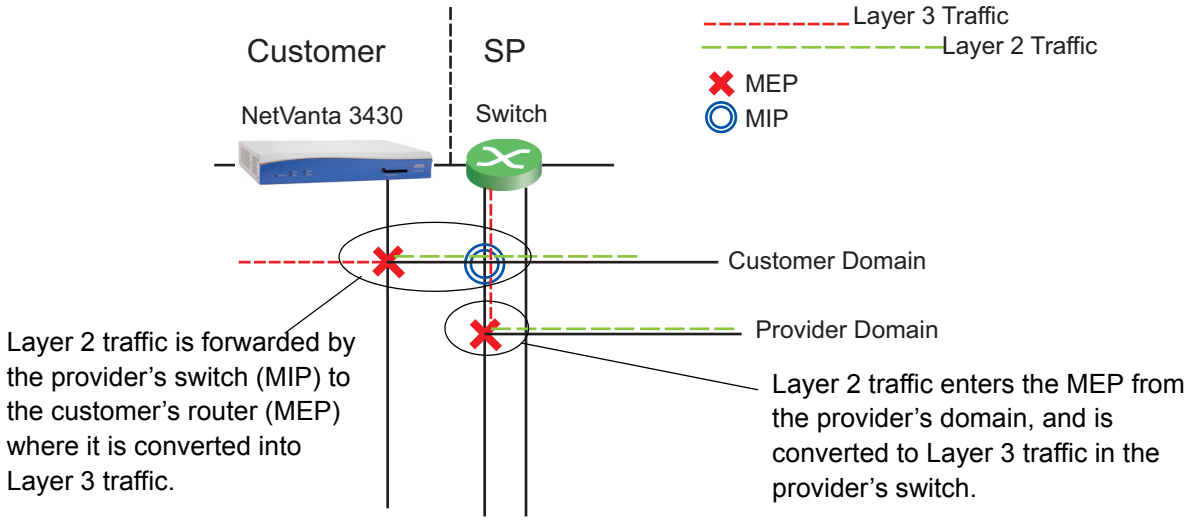


**Figure 5. Relationship of MIPs, MEPs, and Layer Traffic**

## How does Ethernet OAM CFM work?

Ethernet OAM CFM operates by sending messages through MEPs and MIPs on the MDs through the entire service instance. There are three types of CFM messages: continuity check messages (CCM), path trace messages, and loopback messages.

### CCM Messages

CCM messages are *keepalive* multi-cast messages. These messages are issued periodically by MEPs, and help to detect loss of service connectivity among MEPs, discover other MEPs within a domain, and allow MIPs to discover MEPs. CCM messages are the messages that are used for fault detection, as well as fault notification. When these messages are sent from MEP to MEP, MEP receivers can use them to detect loss of connectivity, as well as unintended connectivity, and discover a fault. CCMs are also used by an MEP to notify another MEP that it has detected or is experiencing a fault.

### Path Trace Messages

Path trace messages are multi-cast linktrace messages, stemming from the Ethernet traceroute utility, which are used to discover MIPs along a path to a targeted MEP. These messages are sent by an MEP at the request of an administrator, and used to track the path in a hop-by-hop method. This functionality is similar to the Internet Control Message Protocol (ICMP) traceroute function. These messages help to locate MIPs, as well as to determine which part of a path is experiencing a detected fault.

### Loopback Messages

Loopback messages are sent by an MEP at the request of an administrator to verify connectivity to a particular MIP or MEP. These messages are generated using an Ethernet ping utility, and indicate whether a destination is reachable or not. Their functionality is very similar to that of ICMP echo probes. These messages can also aid in determining which portion of a path is experiencing a fault.

# Ethernet OAM CFM in AOS

Now that you have an understanding of Ethernet OAM CFM parts and functionality, you need to become familiar with the way CFM functions in AOS products. CFM design in AOS products focuses specifically on MEPs that use Layer 3 interfaces facing into the carrier network. The AOS design provides the following capabilities: support for MEPs that are facing towards the lower levels of the MD level hierarchy, CCMs to detect and indicate failures, Ethernet ping utilities to test reachability and verify faults, and Ethernet traceroute utilities to discover paths and isolate faults. The following section describes CFM design specific to the organization and hierarchy of CFM in AOS devices, the function of MEPs within AOS devices, and AOS's method of handling fault alarms and notification.

## AOS CFM Organization and Hierarchy

As previously stated, CFM operation in AOS products focuses on enterprise devices, functioning as MEPs, that face the carrier network. If you keep in mind that each endpoint is a port, or interface, on a device, and that each service instance is designated by a VLAN tag on an interface, it makes sense that each AOS device organizes MEPs by MDs, MAs, interfaces, and MEPs.

In each AOS device operating as an endpoint, there are eight MD levels supported. It is important to note that MEPs only direct traffic to other endpoints at a lower or equal MD level. Interfaces serving as MEPs can either be on a VLAN, or not.

Each VLAN on each interface, or each non-VLAN interface, supports eight MEPs with each MEP operating at a different domain level. Each VLAN also creates a maintenance association (MA) for each domain level. MAs are sets of MEPs on the same domain level that have the same maintenance association identifier (MAID). The MAID is a configured identifier, unique to the domain, that protects against the accidental concatenation of service instances.

It is important to understand how VLANs and VLAN IDs (VIDs) affect the CFM MEP configuration. Each interface, or part of the AOS device, that provides a set of VIDs that are specific or locally significant to that interface, are called components. Components are described in CFM configuration by a component ID. This component ID identifies specific components within an MA.

  

The AOS device operating as an MEP is described in Figure 6.

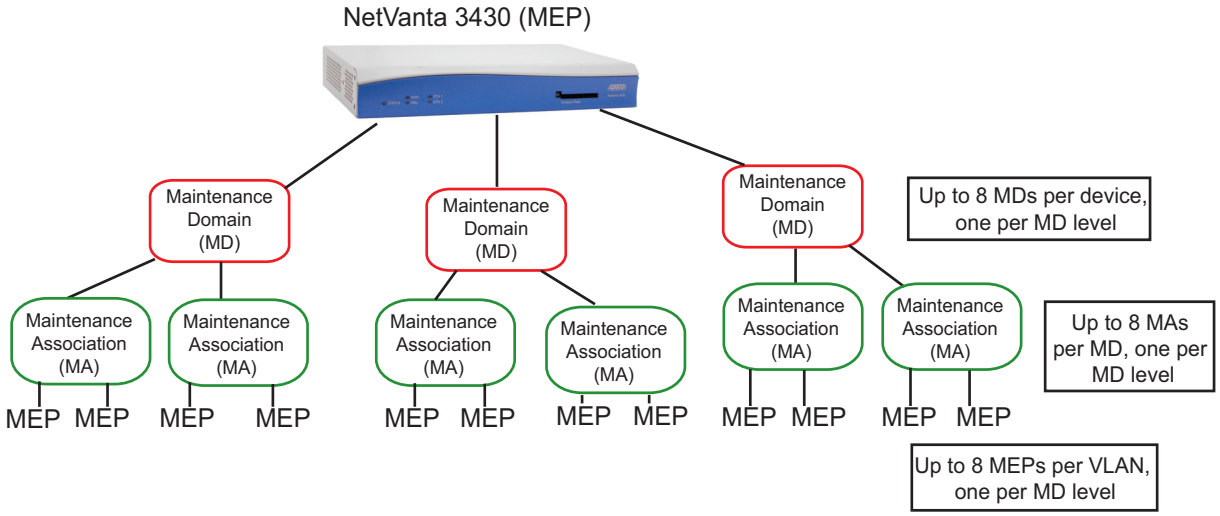


**Figure 6. AOS Device and MEPs**

## MEP Function in AOS Devices

Each MEP is capable of sending and receiving CFM messages, whether CCMs, linktrace, or Ethernet ping messages. AOS devices do not send AIS messages, but rather use the AOS event system or SNMP for alarms and notifications. All other CFM messages can be sent from an AOS device interface as tagged or untagged VLAN frames. When MEPs are configured on an interface, the VLAN context of the interface determines how CFM messages are tagged when transmitted from that interface. The messages are tagged the same way user packets are tagged from a particular interface. For example, packets sent from a Layer 3 interface are untagged, but packets sent from a Layer 3 interface with an 802.1Q subinterface have tagged packets unless the subinterface is the native VLAN (in which case, they are untagged). Any CFM messages that are not processed or discarded by an MEP are ignored.

Each CCM received by an MEP is stored in a CCM database specific to each MEP. This database is used to reference MEP IDs (unique numerical values given to each MEP) and allows each MEP to determine if it is receiving CCMs from expected MEPs, as well as to detect any unexpected MEPs in the network. The CCM database also allows MEPs to compare their database with their list of configured remote MEPs. Remote MEPs are MEPs that are not part of the same MD. The comparison between received CCMs and a list of MEPs that should be sending CCMs, signals the MEP to generate an alarm whenever any mismatches are discovered.

## Alarms and Notifications

The main purpose of Ethernet OAM CFM is to detect faults and provide fault detection notification. In AOS, devices do not send alarm indication signal (AIS) messages, but rather use the AOS event system or SNMP for fault notification and fault alarms. Faults, or defects, are different than fault alarms. Alarms are generated only when specific defects meet configured alarm thresholds on each MEP. In the case that an alarm is generated, notification occurs through the AOS event system at priority 1 (error) and also through the SNMP subsystem (if enabled). When alarms are cleared, it is reported to the event system at priority 3 (notice).

  

In accordance with IEEE 802.1ag, there are five defect conditions defined for Ethernet OAM CFM. These five conditions are ordered in priority. The alarm threshold, configurable per MEP, determines the lowest defect condition that is allowed to generate an alarm. Alarm thresholds vary from the lowest, where any defect can create an alarm, to the highest (highest priority defect + 1), which allows no alarms. Alarms are generated only if the defect condition meets the minimum alarm threshold, and an alarm at that level or higher is not currently activated.

Defect conditions are described in detail in *Ethernet OAM CFM Defect Conditions* on page 24.

## Hardware and Software Requirements and Limitations

The Ethernet OAM CFM feature is available on AOS data products as outlined in the ADTRAN knowledge base article, article number 2272, *Product Feature Matrix*. This matrix is available online at http://kb.adtran.com.

AOS Ethernet OAM CFM is only designed to support enterprise-side MEPs.

Each AOS device supports the creation of eight MDs, one at each level.

Each VLAN on AOS device ports supports eight MEPs, one at each MD level.

Each non-VLAN AOS device ports supports eight MEPs, one at each MD level.

Each MEP on an AOS device sends traffic only to other MEPs or MIPs at a lower MD level.

## Configuring Ethernet OAM CFM

Ethernet OAM CFM is configurable using the AOS CLI. To configure Ethernet OAM CFM MEPs on an AOS device, you will need to do the following:

1. Enable Ethernet OAM CFM.
2. Configure the maintenance domain.
3. Configure the maintenance association.
4. Configure the interface.

### Enabling Ethernet OAM CFM

Ethernet OAM CFM is enabled on the AOS device using the **ethernet cfm** command from the Global Configuration mode. The **no** form of this command disables Ethernet OAM CFM functionality. To enable CFM, enter the command as follows:

(config)**#ethernet cfm**

Warning messages must also be enabled on the AOS device. Warning messages are generated when remote MEP defects are noticed. To enable Ethernet OAM CFM warning messages, enter the **ethernet cfm log-changes** command from the Global Configuration mode prompt as follows:

(config)**#ethernet cfm log-changes**

The **no** form of this command disables warning message generation, and causes the information to appear in generic debug messages. Warning messages are disabled by default.

  

## Configuring the Maintenance Domain

The maintenance domain for each MEP must be configured. In order to configure the MD, you will need to do the following:

1. Enable/create the MD and enter the MD Configuration mode.
2. Specify the MEP database entry hold time.

### Create the MD

An MD is created, enabled, and entered for configuration using the **ethernet cfm domain [**<*name*> **| none] level** <*level*> command. This command creates and enables the MD, as well as specifies the MD's name (using the <*name*> parameter) and the MD's level (using the **level** <*level*> parameter). The **no** form of this command deletes the specified MD and removes any MAs and MEPs defined with the domain.

The domain and association names serve two purposes. One is to provide a text label used in the device configuration to identify a particular domain and association, and the other is to construct a MAID. The MAID is included in CFM CCMs and identifies the MA to which the transmitting MEP belongs. The MAID also allows MEPs receiving CCMs to detect CFM error conditions.

The <*name*> parameter is a character string consisting of any combination of ASCII characters 32 through 127. If ASCII character 32 (space) is used, the name must be enclosed in quotation marks. The character string must be between **1** and **42** characters. If the **none** parameter is used, the domain name is not included in the MAID and serves only as a text label in the device configuration. By default, a character string is used.

The **level** <*level*> parameter refers to the maintenance level of all maintenance points that are members of this maintenance domain. The level range is **0** to **7**. By default, no maintenance domain exists.

*Because each MEP supported on an AOS device port or interface must be at a different MD level, each MEP on a particular port or interface will have to be configured on a separate MD.*

To create and enable an MD, as well as enter its configuration mode, enter the command from the Global Configuration mode prompt as follows:

```
(config)#ethernet cfm domain domain1 level 6
(config-ecfm-domain)#
```

### Specify MEP Database Entry Hold Time

Each MEP that is created is associated with a particular MD. The MDs maintain an MEP database of remote MEPs, listing all configured and associated remote MEPs within the system. When a remote MEP fails, it can be removed from this database after a specified amount of time. The **remote-mep hold-time** <*minutes*> command allows you to specify how long an entry in the MEP database is retained after it has entered the failed state. When the remote MEP entry is purged, any errors logged related to the remote MEP are also purged. The **hold-time** range is **1** to **65535** minutes, with a default value of **100** minutes. The **no** form of this command returns the hold time to the default value.

  

To specify the remote MEP database entry hold time, enter the command from the MD Configuration mode as follows:

```
(config-ecfm-domain)#remote-mep hold-time 20
(config-ecfm-domain)#
```

The Ethernet OAM CFM MD is now configured.

## Configuring the Maintenance Association

Once the MD is configured, an MA must be configured to organize the components, create a MAID, and enable the transmissions of CCMs. To create and configure an MA, you must do the following:

1. Enable/create the MA.
2. Specify the MA network settings.
3. Specify the MA component settings.

### Create the MA

An MA is created, enabled, and entered for configuration using the **association** <*name*> command from the MD Configuration mode prompt. This command also specifies the MA's name and helps to create the MAID in a similar fashion to the MD configuration command. Enter the command as follows from the MD Configuration mode prompt:

```
(config-ecfm-domain1)#association association1
(config-ecfm-assoc)#
```

The <*name*> parameter follows the naming convention of the MD, and is a character string consisting of any combination of ASCII characters 32 through 127. If ASCII character 32 (space) is used, the name must be enclosed in quotation marks. The character string must be between **1** and **42** characters.

  

## Specify the MA Network Settings

Once you have created the MA and entered its configuration mode, you will need to specify the MA's network settings. These settings define the common MA network properties for the entire association. To configure the MA, you can configure the following:

- CCM interval
- Remote MEP list
- MEP validation

### Configure the CCM Interval

You will need to set the CCM interval for MEPs in this association using the **ccm interval [100ms | 1s | 10s | 1m | 10m]**. The CCM interval refers to how often the MEPs in this association will send CCMs. Intervals are specified by 100 milliseconds, 1 second, 10 seconds, 1 minute, or 10 minutes. Default value is **1**s. Using the **no** form of this command returns the CCM interval for all MEPs in this association to the default value. Enter the command from the MA Configuration mode as follows:

```
(config-ecfm-assoc)#ccm interval 100ms
(config-ecfm-assoc)#
```

### Configure the MA's Remote MEP List

You will also need to populate the MA's remote MEP list using the **remote-mep** <*mep-id*> command. This list is for MEPs that are remote, or MEPs that are not on this device, but that communicate with other MEPs in the same MA. Local MEPs, or those on the same device, are automatically listed.

The <*mep-id*> parameter refers to a unique numerical value given to each MEP. MEP ID range is **1** to **8191**. Each MEP ID is stored and can be compared to the MEP's CCM database learned by listening to CCMs from other MEPs in the network. This allows each MEP to determine if it is receiving CCMs from expected MEPs, as well as detect any unexpected MEPs in the network.

The **no** form of this command removes the remote MEP entry from the list. To add a remote MEP to this MA's list, enter the command from the MA Configuration mode as follows:

```
(config-ecfm-assoc)#remote-mep 1000
(config-ecfm-assoc)#
```


*You will need to repeat this command as many times as necessary to populate the MA's remote MEP list with all of the remote MEPs communicating with this MA.*

### Configure MEP Validation

You can optionally specify whether or not MEPs will use a comparison between their CCM database (received CCMs) and their list of configured remote MEPs (that should be sending CCMs) to generate an alarm when a mismatch is discovered. By default, each MEP validates their MEP list, and all CCMs received must correspond to preconfigured remote MEPs in the MA.

  

Disabling validation, using the **no mep-validation [start-delay** <*delay*>**]** command, or changing the time the MEP waits before validating CCMs, can be useful when creating a domain association or when troubleshooting. Disabling validation in these circumstances prevents unnecessary alarms and warnings. For example, if you wish to allow the unit to dynamically learn its remote MEPs rather than manually entering them, disabling validation allows you to do that without generating unnecessary alarms.

The **start-delay** <*delay*> parameter controls the time (in seconds) that the MEP will wait before enforcing MEP validation. The timer starts when the CFM subsystem is initialized, when MEP validation is enabled, or when the MEP CCM database is cleared. The delay range is **1** to **65535** seconds. The default delay **30** seconds.

To disable MEP validation, enter the command from the MA Configuration mode as follows:

```
(config-ecfm-assoc)#no mep-validation
(config-ecfm-assoc)#
```

To enable MEP validation, with a greater delay interval than the default value, enter the command as follows:

```
(config-ecfm-assoc)#mep-validation start-delay 1000
(config-ecfm-assoc)#
```

### Specify the MA Component Settings

Components must be added to each MA. Components available are limited by platform, and accessible components can be discovered by entering the **component** command followed by a **?** at the MA Configuration mode prompt. To discover available components, enter the command as follows:

```
(config-ecfm-assoc)#component ?
ethernet              -Fast L3 ethernet component
```

To add a component to the MA, and establish a set of one or more VLANs to be treated as a fixed group within this component, use the **component** <*component*> **vlan [none |** <*vlan id*>**]** command. This command also assigns these VLANs to be protected by this association on this component, and enters the component configuration mode. The <*component*> parameter is the component that will be added to the association. Components are specified in the format <*component type [slot/port]*>. For example, for an Ethernet component, use **eth 0/1**. The **vlan [none |** <*vlan id*>**]** parameters specify that this MA component is not attached to a VLAN (**none**) or that the component has a VLAN ID protected by the MA on this component (<*vlan id*>). VLAN IDs are values ranging from **1** to **4094**.


*The first VLAN ID in the list is the primary VLAN ID for the entry being created.*

Enter the command as follows from the MA Configuration mode prompt:

```
(config-ecfm-assoc)#component ethernet 0/1 vlan 5
(config-ecfm-ma-comp)#
```

  

The **no** form of this command removes the component definition from the association. By default, no component is defined.

*At least one component must be defined in any maintenance association.*

You can optionally enable MEPs in this association to send sender ID type length values (TLVs) in packets using the **mp-sender-id [none | chassis-id | management-id]** command. You can specify that no sender IDs are sent, that the chassis ID is sent, and/or that the management address is sent. These TLVs are included in CCMs and used in fault detection. Using the **no** form of this command reverts to the sender ID setting of the parent association (default value). To specify that MEPs in this association send sender ID TLVs, and what type they send, enter the command from the Component Configuration mode as follows:

```
(config-ecfm-ma-comp)#mp-sender-id chassis-id
(config-ecfm-ma-comp)#
```

The Ethernet OAM CFM MA is now configured.

## Configuring the Interface

Interfaces can also be configured for Ethernet OAM CFM. Because Ethernet OAM operates as a function of the media access control (MAC) layer of the OSI, the interface type plays a large role in determining Ethernet OAM CFM role within the AOS device. Interfaces can be configured to support downstream OAM CFM at the interface level and to enable and configure MEPs. To configure an interface for Ethernet OAM CFM, you will need to do the following:

1. Specify an interface.
2. Enable Ethernet OAM CFM on an interface.
3. Create an MEP and enter MEP configuration.
4. Enable the MEP.
5. Configure the MEP.

### Specify an Interface

To specify an interface for configuring Ethernet OAM CFM, enter the **interface** command from the Global Configuration mode. Specify an interface in the format *<interface type [slot/port |slot/port.subinterface id]>*. For example, for an Ethernet subinterface, use **eth 0/1.1**. For a list of appropriate interfaces, enter **interface ?** at the prompt. To specify an interface for Ethernet OAM CFM, enter the command as follows:

```
(config)#interface eth 0/1
(config-eth 0/1)#
```

  

### Enable Ethernet OAM CFM on the Interface

Ethernet OAM CFM is enabled on the interface using the **ethernet-cfm down** command. This command enables downstream Ethernet OAM CFM at the interface level. The **no** form of this command disables downstream Ethernet OAM CFM at the interface level. Any existing CFM configuration is retained when the **no** form is used, but no frames are sent or received and no resources are consumed by CFM. By default, Ethernet OAM CFM is **disabled** at the interface level.

To enable Ethernet OAM CFM at the interface level, enter the command as follows from the Interface Configuration mode:

```
(config-eth 0/1)#ethernet-cfm down
(config-eth 0/1)#
```

### Create an MEP and Enter MEP Configuration

An MEP is created on the interface using the **ethernet-cfm mep [**<*domain name*> **| none]** <*association name*> <*mep id*> **down** command. This command associates the MEP created on the interface with a specific domain (<*domain name*>) or with no domain (**none**), with an association (<*association name*>), and with a specific MEP ID (<*mep id*>). The domain name is the domain created to which this MEP belongs, as is the association name. The MEP ID is the unique numerical value given to the MEP to identify the MEP in the CCM database and MA list. The MEP ID range is **1** to **8191**.

The **down** parameter defines the direction of the MEP. A down MEP faces outward from the interface on which it is configured. Ethernet OAM CFM end devices only support down MEPs.

To create an MEP and enter the MEP's configuration, enter the command as follows:

```
(config-eth 0/1)#ethernet-cfm mep domain1 association1 1000 down
(config-eth 0/1-mep)#
```


*If this command is applied to an interface that conveys a single VLAN ID, such as a Layer 3 Ethernet subinterface, the MEP is created on the VLAN ID of that subinterface. On such an interface, the MEP cannot be created at the main interface. For interfaces that have no subinterfaces, the MEP is created and associated with no VLAN.*

*The domain and association must already be defined before using this command.*

The **no** form of this command deletes the MEP and releases all its resources.

### Enable the MEP

The MEP is enabled using the **mep-enabled** command. By default, all MEPs are **disabled**. Using the **no** form of this command halts all associated MEP functionality for this MEP. Frames are not sent or received by this MEP, but all other properties of the MEP are retained.

To enable an MEP enter the command as follows from the MEP Configuration mode prompt:

```
(config-eth 0/1-mep)#mep-enabled
(config-eth 0/1-mep)#
```

  

### Configure the MEP

In configuring the MEP, you will enable CCMs, specify the priority for CFM frames and linktrace messages transmitted by the MEP, and set the MEP alarms.

To enable the MEP to transmit CCMs, enter the **ccm-enabled** command from the MEP Configuration mode prompt. The **no** form of this command disables CCM transmissions by this MEP, although the MEP can still process received CCMs. CCM transmissions are disabled by default. To enable CCM transmissions, enter the command as follows:

```
(config-eth 0/1-mep)#ccm-enabled
(config-eth 0/1-mep)#
```

To specify the priority for CFM frames and linktrace messages transmitted by the MEP, enter the **priority** <*value*> command from the MEP Configuration mode prompt. This command sets the 802.1p priority for these frames. The **no** form of this command sets the priority to the default value of **7**. The valid range of priority values is **0** to **7**. To specify the priority for these messages, enter the command as follows:

```
(config-eth 0/1-mep)#priority 3
(config-eth 0/1-mep)#
```

*Priority only applies if the interface supports VLAN tags and the message will be sent with a tag.*

To set the MEP alarm timers, enter the **alarm-timers** <*alarm time*> <*reset time*> command from the MEP Configuration mode prompt. These timers determine how long a defect condition must exist before being eligible as an alarm, and how long defect conditions must be absent before a new alarm may be triggered. The **no** form of this command sets the timers to their default values. The <*alarm time*> parameter is the time (in milliseconds) that a defect condition must be present before it is eligible to be reported as an alarm. The range for alarm time is **2500** ms to **10000** ms, with a default value of **2500** ms. The <*reset time*> parameter is the time (in milliseconds) that defects must be absent before alarms are reset such that a new alarm can be triggered. The range for reset time is **2500** ms to **10000** ms, with a default value of **10000** ms. To specify the alarm timers, enter the command as follows:

```
(config-eth 0/1-mep)#alarm-timers 3000 6000
(config-eth 0/1-mep)#
```

*Timer values are stored in 1/1000 of a second. Therefore, entering the command as follows stores the timer values as **2510** and **10230**:*

(config-eth 0/1-mep)**#alarm timers 2514 10239**

  

To set the MEP alarm priority levels, enter the **alarm-priority-level [errorccm | macstatus | none | rdi-ccm | remoteccm | xconccm]** command from the MEP Configuration mode prompt. These priority levels specify the lowest level priority condition that generates an alarm on this MEP. By default, alarms are generated at priority level **1**. Each priority parameter, its root cause, and its importance is described in the table *Ethernet OAM CFM Defect Conditions* on page 24. Using the **no** form of this command returns the priority level to the default value. To change the MEP's alarm priority level, for example to level **5** or higher, enter the command as follows:

```
(config-eth 0/1-mep)#alarm-priority-level xconccm
(config-eth 0/1-mep)#
```

The alarm notifications can also be sent using SNMP. To enable SNMP notification, rather than using the AOS event priority system, enter the **snmp-trap fault alarm** command from the MEP Configuration mode prompt as follows:

```
(config-eth 0/1-mep)#snmp-trap fault alarm
(config-eth 0/1-mep)#
```

The MEP is now configured.

  

# Using Ethernet OAM CFM in AOS

Ethernet OAM CFM provides the ability to detect and isolate faults within an Ethernet service instance. In AOS, Ethernet OAM CFM is used to discover these faults by using Ethernet ping and traceroute utilities. Notification of defect types and alarms are used to describe what types of problems have been discovered. The following sections cover Ethernet OAM CFM utilities in AOS.

## Ethernet Ping

Ethernet ping uses Ethernet CFM loopback protocols (as described in IEEE 802.1ag) to test the accessibility of the specified MEP. It operates in a similar fashion to ICMP ping utilities, except that it uses Ethernet OAM loopback messages rather than ICMP echo messages. Ethernet OAM loopback messages operate on Layer 2, rather than Layer 3, as do ICMP ping messages. Using the Ethernet ping utility through Ethernet OAM CFM indicates whether or not a destination is accessible, and aids in discovering connectivity fault locations. The Ethernet ping utility transmits loopback messages from one MEP to another designated MEP. When the messages are sent, they are sent either to a unicast MAC address or MEP ID, which include each response and its characteristics in the output, or to a group address, which displays a list of responding devices in the output.

To use the Ethernet ping utility, enter the following command at the Enable mode prompt: **ping ethernet [**<*target-mac-address*> | <*target-mep-id*>**] [domain** <*domain name*> | **none] [association** <*association name*>**] [mep** <*mep-id*>**] [interface** <*interface*>**] [count** <*number*>**] [priority** <*priority*>**] [drop-eligible] [size** <*bytes*>**] [data** <*pattern*>**] [timeout** <*timeout*>**] [interval** <*interval*>**] [verbose] [validate data]**.

The **ping ethernet** command uses many different parameters, which are detailed below.

*After specifying the target for the loopback messages, the other parameters can be entered in any order.*

*This command will not appear in the CLI unless Ethernet OAM CFM is enabled.*

- **[**<*target-mac-address*> | <*target-mep-id*>**]**
  This parameter indicates the target used by the loopback messages to find the destination MEP. The target MAC address is the unicast MAC address of the target MEP. The target MEP ID is the MEP ID of the target MEP. Target MAC addresses are entered in the following format: HH:HH:HH:HH:HH:HH. Target MEP IDs are numerical values ranging from **1** to **8191**.

  

  *If the MEP ID is used as the target, the remote MEP must exist in the MEP CCM database (meaning the remote MEP is transmitting valid CCMs) so that the MEP ID can be translated to the MAC address before the loopback message is transmitted.*

  

- **[domain** <*domain name*> | **none]**

  Optional. This parameter indicates the name of the MD to which the transmitting MEP belongs. If the **source-mep-id** of the MEP is specified and unique throughout the AOS device, or if there is only one MEP configured on this AOS device, then this parameter is optional. Otherwise, the parameter should be entered and reflect the name of the MD to which the transmitting unit belongs. The command is entered in the same manner as when configuring the MD or MA (detailed on page 10).

- **[association** <*association name*>**]**

  Optional. This parameter indicates the name of the MA to which the transmitting MEP belongs. If the **source-mep-id** of the MEP is specified and unique throughout the AOS device, or if there is only one MEP configured on this AOS device, then this parameter is optional. Otherwise, the parameter should be entered and reflect the name of the MA to which the transmitting unit belongs. The command is entered in the same manner as when configuring the MD or MA (detailed on page 10).

- **[mep** <*mep-id*>**]**

  Optional. This parameter indicates the ID of the MEP that will transmit the loopback messages (source MEP). If the domain and association are specified and there is only one MEP in that domain or association, or if there is only one MEP configured on that unit, this parameter is not required. Otherwise, the parameter should be entered and reflect the numerical value assigned to the MEP at configuration of the MA (refer to *Specify the MA Network Settings* on page 12). The value range is **1** to **8191**.

- **[interface** <*interface*>**]**

  Indicates the interface on which the transmitting MEP is configured. Specify an interface in the format <*interface type [slot/port |slot/port.subinterface id]*>. For example, for an Ethernet subinterface, use **eth 0/1.1**. For a list of appropriate interfaces, enter **interface ?** at the prompt.

- **[count** <*number*>**]**

  Specifies the number of loopback messages to send. The range is **1** to **1000000**. If the target of the message is defined as **all**, the default value is **1**. Otherwise, the default value is **5**.

- **[priority** <*priority*>**]**

  Specifies the 802.1p priority bits that are sent in the loopback message. The range is **0** to **7**. The default priority value is the priority value configured on the MEP.

- **[drop-eligible]**

  Specifies the drop eligible bit value in the VLAN tag. By default, this value is not set.

  

- **[size** <*bytes*>**]**

  Specifies the size (in bytes) of the loopback messages. This value determines the amount of information used to populate the data TLV of the loopback messages to make the entire Ethernet payload the specified size. The data TLV is always included in loopback messages, and the size defined with this command directly affects how large the data TLV can be to keep the Ethernet payload the specified size. The byte range is **1** to **60**. The default byte size is **2**.

- **[data** <*pattern*>**]**

  Specifies the data pattern to be carried in the data TLV of the loopback message. The pattern is up to four hexadecimal digits. The system repeats or truncates the pattern to fill the specified size. The pattern range is **0** to **ffff**. The default pattern is **abcd**.

- **[timeout** <*timeout*>**]**

  Specifies the time (in seconds) that the MEP will wait for a response to the loopback message. The range is **0** to **60** seconds, and the default time is **2** seconds.

- **[interval** <*interval*>**]**

  Specifies the interval (in milliseconds) between transmissions of loopback messages. This setting does not affect the timeout used to wait for a response to each transmitted loopback message. The interval value range is **100** to **60000** milliseconds, and the default interval is **1000** milliseconds.

- **[verbose]**

  Optional. Specifies that the results are in detailed, rather than summary, format.

- **[validate data]**

  Specifies whether or not the transmitting MEP validates the contents of the data TLV in the received loopback messages. By default, data TLV validation does not occur.

To initiate an Ethernet ping, enter the command with the parameters necessary for your network.

The following are example command entries to send loopback messages and sample output from the ping utility. You can see in each example the number of messages to be sent, the source and destination MEPs, the timeout rate, and how many attempts to reach the destination MEP were successful. The second example provides the data for each attempt because of the **verbose** keyword.

```
#ping ethernet 201 domain Domain1 association MA1
        Type CTRL+C to abort.
        Legend:    '!' = Success, '*' = Request timed out, 'd' = Data Mismatch
                   'o' = Out of order, '.' = No reply, 'e' = Unknown error.

        Sending 5, 100-byte LBRs to MEP 201 from MEP 1, timeout is 2 seconds:
        !!!!!
        Success rate is 100 percent (5/5), round-trip min/avg/max = 202/668/1011 ms
```

  

**#ping ethernet 201 mep 1 validate-data verbose**

```
Sending 5, 100-byte LBRs to MEP 201 from MEP 1, timeout is 2 seconds:
Reply from MEP 201 : payload bytes=126 time=506ms ID=11 In-order, Data matches
Reply from MEP 201 : payload bytes=126 time=706ms ID=12 In-order, Data matches
Reply from MEP 201 : payload bytes=126 time=405ms ID=13 In-order, Data matches
Reply from MEP 201 : payload bytes=126 time=607ms ID=14 In-order, Data matches
Reply from MEP 201 : payload bytes=126 time=1011ms ID=15 In-order, Data matches

Success rate is 100 percent (5/5), round-trip min/avg/max = 405/647/1011 ms
```

## Ethernet Traceroute

Ethernet traceroute uses Ethernet CFM linktrace protocol (as described in IEEE 802.1ag) to discover the path through the Ethernet network to a specified MEP. It operates in a similar fashion to IP traceroute utilities, except that it uses Ethernet OAM linktrace messages rather than IP ICMP or UDP echo messages. Ethernet OAM linktrace messages operate on Layer 2, rather than Layer 3, as do ICMP or UDP echo messages. Using the Ethernet traceroute utility through Ethernet OAM CFM indicates the network path to a destination, and aids in discovering connectivity fault locations. When the linktrace messages are sent, they are sent to a unicast MAC address or MEP ID, and a list of MIPs along the path to the target MEP is displayed in the output. Ethernet traceroute is particularly useful for detecting the path between MEPs.

To use the Ethernet traceroute utility, enter the following command at the Enable mode prompt: **traceroute ethernet [**<*target-mac-address*> | <*target-mep-id*>**] [domain** <*domain name*> | **none] [association** <*association name*>**] [mep** <*mep-id*>**] [interface** <*interface*>**] [ttl** <*value*>**] [timeout** <*timeout*>**] [fdb-only] [sorted]**.

The **traceroute ethernet** command uses many different parameters, which are detailed below.

*After specifying the target for the linktrace messages, the other parameters can be entered in any order.*

*This command will not appear in the CLI unless Ethernet OAM CFM is enabled.*

- **[**<*target-mac-address*> | <*target-mep-id*>**]**

  This parameter indicates the target used by the loopback messages to find the destination MEP. The target MAC address is the unicast MAC address of the target MEP. The target MEP ID is the MEP ID of the target MEP. Target MAC addresses are entered in the following format: HH:HH:HH:HH:HH:HH. Target MEP IDs are numerical values ranging from **1** to **8191**.

  

> NOTE *If the MEP ID is used as the target, the remote MEP must exist in the MEP CCM database (meaning the remote MEP is transmitting valid CCMs) so that the MEP ID can be translated to the MAC address before the linktrace message is transmitted.*

> NOTE *In the following parameters, enough information must be given to uniquely identify the source MEP. If the values entered are insufficient to uniquely identify a single source MEP as configured on the system, an error message is returned and the command is rejected.*

- **[domain** <*domain name*> **| none]**

  Optional. This parameter indicates the name of the MD to which the transmitting MEP belongs. If the **source-mep-id** of the MEP is specified and unique throughout the AOS device, or if there is only one MEP configured on this AOS device, then this parameter is optional. Otherwise, the parameter should be entered and reflect the name of the MD to which the transmitting unit belongs. The command is entered in the same manner as when configuring the MD or MA (detailed on page 10).

- **[association** <*association name*>**]**

  Optional. This parameter indicates the name of the MA to which the transmitting MEP belongs. If the **source-mep-id** of the MEP is specified and unique throughout the AOS device, or if there is only one MEP configured on this AOS device, then this parameter is optional. Otherwise, the parameter should be entered and reflect the name of the MA to which the transmitting unit belongs. The command is entered in the same manner as when configuring the MD or MA (detailed on page 10).

- **[mep** <*mep-id*>**]**

  Optional. This parameter indicates the ID of the MEP that will transmit the linktrace messages (source MEP). If the domain and association are specified and there is only one MEP in that domain or association, or if there is only one MEP configured on that unit, this parameter is not required. Otherwise, the parameter should be entered and reflect the numerical value assigned to the MEP at configuration of the MA (refer to *Specify the MA Network Settings* on page 12). The value range is **1** to **8191**.

- **[interface** <*interface*>**]**

  Indicates the interface on which the transmitting MEP is configured. Specify an interface in the format <*interface type [slot/port |slot/port.subinterface id]*>. For example, for an Ethernet subinterface, use **eth 0/1.1**. For a list of appropriate interfaces, enter **interface ?** at the prompt.

- **[ttl** <*value*>**]**

  Specifies the time to live (TTL) field of the linktrace message. The TTL field indicates the number of hops, or MIPs, remaining to travel before a linktrace message is dropped. The range is between **0** and **255**. The default TTL is **64**.

- **[timeout** <*timeout*>**]**

  Specifies the time (in seconds) that the MEP will wait for a response to the linktrace message. The range is **0** to **60** seconds, and the default time is **5** seconds.

  

- **[fdb-only]**
  This parameter specifies that the MIPs on the route only use their forwarding database, and not their MIP CCM database, when deciding if/how to forward the linktrace message.
- **[sorted]**
  This parameter specifies that the Ethernet traceroute utility will wait until all traceroute results have been received and sorted by hop count before displaying them. The output is displayed with all traceroute results at once. This is useful when there are multiple paths because it is easier to discern each path. By default, the traceroute utility displays the results in the order they are received.

To initiate an Ethernet ping, enter the command with the parameters necessary for your network.

The following is an example command entry to send linktrace messages and sample output from the traceroute utility. The output shows the hop to particular MAC addresses, the previous hop MAC addresses, the action of the message (forwarded, terminated, etc.), the action upon ingress and egress of the message, and the relay action.

**#traceroute ethernet 201 mep 1**

```
Type CTRL+C to abort.

TTL 255. LTM Timeout is 5 seconds
Tracing route to        MEPID 201 (00:10:94:00:00:06)
                from    MEPID 1
                in      Domain_1/MA_1
MD Level 7, vlan 0
Traceroute sent via interface eth 0/1

-------------------------------------------------------------------------------------------------------------------------------
Hops    Mac                             Flags           Ingress-Action          Relay Action
          PrevHop                                               Egress-Action
-------------------------------------------------------------------------------------------------------------------------------
1       00:10:94:00:00:00               Forwarded       InNoTLV                 RLY_MPDB
            00:A0:C8:16:96:0D                                   EgOK
3       00:10:94:00:00:05               Forwarded       InNoTLV                 RLY_MPDB
            00:10:94:00:00:04                                   EgOK
2       00:10:94:00:00:04               Forwarded       InNoTLV                 RLY_MPDB
            00:10:94:00:00:00                                   EgOK
4       00:10:94:00:00:06 (Eg)          Terminal        InNoTLV                 RLY_HIT
            00:10:94:00:00:05

Destination reached
```


*Remember that linktrace can be a tree-structure, and is not always linear. The "PrevHop" for Hop 3 in the previous example tells you the MAC of Hop 2. This gives you a way to trace the linktrace message when a tree-structure exists. Refer to Section J.5 of IEEE 802.1ag for more information.*

  

## Defects and Alarms

### Ethernet OAM CFM Defect Conditions

The following table describes the five CFM defect conditions, as well as the root cause, the priority, and the importance of each.

**Table 1. Ethernet OAM CFM Defect Conditions**

| Defect | Description | Cause(s) | Priority | Importance |
|---|---|---|---|---|
| DefXconCCM | Indicates an MEP that could be from another MA is sending CCMs to an MEP in this MA. | The CCM received is from an MEP that does not have a MAID that matches the local MEP's MAID, or that the transmitting MEP has an MD level lower than the local MEP's. | 5 | Highest |
| DefErrorCCM | Indicates erroneous CCMs are being received from some MEP in the local MEP's MA. | The transmitting MEP's ID is not in the MA's configured list of remote MEPs, the MEP ID is not the same as the receiving MEP's ID, or the CCM interval does not match the configured value. | 4 | |
| DefRemoteCCM | Indicates the local MEP is not receiving CCMs from an MEP in its configured list. | An MEP in this MEP's configured list has not sent a CCM in three CCM intervals. | 3 | |
| DefMACStatus | Indicates the last CCM received by this MEP from another MEP indicated the other MEP's associated MAC is reporting an error status via the Port or Interface Status TLV. | Either all remote MEPs are reporting Port Status TLV errors, or at least one remote MEP is reporting an Interface Status TLV error. | 2 | |
| DefRDICCM | Indicates the last CCM received by this MEP from some remote MEP contained the remote defect indication (RDI) bit. | At least one MEP is reporting RDI. | 1 | Lowest |

  

### Ethernet OAM CFM Alarms

As indicated previously, alarm notifications are sent either by using the AOS event priority system or through SNMP notification. The alarms are sent as priority 1 (error), and cleared alarms are sent as priority 3 (notice). SNMP notification of alarms are sent to the fault alarm address configured on the MEP reporting the fault. No SNMP notification is sent when an alarm clears. Alarm priorities can be changed using the **alarm-priority-level** command as described on page 17. SNMP notification can be activated using the **snmp-trap fault alarm** command as described on page 17.

## Ethernet OAM CFM Configuration Examples

The following examples provide sample configurations to help you understand how Ethernet OAM CFM is configured. The configuration parameters entered in these examples are sample configurations only, and are only used for instructive purposes. You should configure these applications in a manner consistent with the needs of your particular network. CLI prompts have been removed from the configuration examples to provide you with a method of copying and pasting configurations directly from this guide into the CLI. You should not copy these configurations without first making the necessary adjustments to ensure they will function properly in your network.

### Basic Configuration Example

The following configuration example is a basic configuration with only one domain. This configuration shows the enabling of CFM, the activation of CFM warning messages, and the configuration of one domain (**Domain1)** with three associated MEPs (**1**, **2**, and **5** under **Association1**). CFM is then applied to the Gigabit Ethernet interface.

The following is the configuration:

```
ethernet cfm
ethernet cfm log-changes

ethernet cfm domain Domain1 level 5
    association Association1
        component gigabit-ethernet 0/2 vlan none
        remote-mep 1
        remote-mep 2
        remote-mep 5
        exit
    exit

interface gigabit-eth 0/2
    ip address 10.22.121.44 255.255.255.0
    no ip proxy-arp
    ethernet-cfm down
    ethernet-cfm mep Domain1 Association1 down
        ccm-enabled
        mep-enabled
        exit
    no shutdown
    exit
exit
```

  

## CPE Router to CFM End Device

In this example, the customer router is an enterprise router facing into the carrier network. The subscriber domain is named **Domain1** and functions at **level 6**. The interdomain domain is named **Access1** functioning at **level 0**.

In this configuration, all customer traffic, whether tagged or untagged, has an S-tag applied by the operator's network element at ingress to the network. CFM messages are sent untagged so the operator's MIPs and MEPs have visibility into the customer's CFM router (CFM is at the S-tag level).

The following is the corresponding configuration:

```
ethernet cfm
ethernet cfm domain Domain1 level 6
    association Assoc1
        component eth 0/1 vlan none
        remote-mep 1000
        exit
    exit

interface eth 0/1
    ethernet-cfm mep Domain1 Assoc1 1001 down
        mep-enabled
        ccm-enabled
        exit
    exit

ethernet cfm domain Access1 level 0
    association Assoc1
        component eth 0/1 vlan none
        remote-mep 50
        exit
    exit

interface eth 0/1
    ethernet-cfm mep Access1 Assoc1 51 down
        mep-enabled
        ccm-enabled
        exit
    exit
exit
```

  

## Ethernet OAM CFM Command Summary

The following table describes each command associated with Ethernet OAM CFM.

**Table 2. Ethernet OAM CFM Command Summary**

| Access Prompt | Command | Description |
|---|---|---|
| (config)# | **[no] ethernet cfm** | Enables Ethernet OAM CFM on the AOS device. |
| (config)# | **[no] ethernet cfm log-changes** | Enables CFM warning messages. Using the **no** form causes the warning messages to appear as debug messages. Warning messages are disabled by default. |
| (config)# | **[no] ethernet cfm domain [**<*name*> **\| none] level** <*level*> | Enables and creates an MD by specifying the MD's domain name and domain level. Also enters the MD configuration mode. Names can be up to 42 characters in length, and levels range from **0** to **7**. |
| (config-ecfm-domain)# | **[no] remote-mep hold-time** <*minutes*> | Specifies the length of time an associated MEP remains in the MD's MEP database after the MEP has failed. The range is **1** to **65535** minutes, with a default value of **100** minutes. |
| (config-ecfm-domain)# | **[no] association** <*name*> | Enables and creates an MA by specifying the MA's name. Also enters the MA's configuration mode. Names can be up to 42 characters in length. |
| (config-ecfm-assoc)# | **[no] ccm interval [100ms \| 1s \| 10s \| 1m \| 10m]** | Specifies how frequently MEPs in this association send CCMs. Time selections are 100 milliseconds, 1 second, 10 seconds, 1 minute, or 10 minutes. The default interval is **1** second. Using the **no** form of this command returns the interval to the default value. |

  

**Table 2. Ethernet OAM CFM Command Summary *(Continued)***

| Access Prompt | Command | Description |
|---|---|---|
| (config-ecfm-assoc)# | **[no] remote-mep** <*mep-id*> | Creates a list of remote MEPs for this association. MEP IDs are unique numerical values given to each MEP. The range is **1** to **8191**. The **no** form of this command removes the MEP from the list. |
| (config-ecfm-assoc)# | **[no] mep-validation [start-delay** <*delay*>**]** | Enables or disables MEP validation of its CCM database with the list of remote MEPs. Enabled by default. **Start-delay** is the time in seconds before the MEP validates CCMs. The range is **1** to **65535** seconds. The default delay is **30** seconds. |
| (config-ecfm-assoc)# | **[no] component** <*component*> **vlan [none \|** <*vlan id*>**]** | Creates a set of VLANs as a fixed group on a particular component, assigns these VLANs to be protected by this MA on this component, and enters component configuration. The <*component*> parameter is specified in the format <*component type [slot/port]*>. VLAN IDs range from **1** to **4094**. |
| (config-ecfm-ma-comp)# | **[no] mp-sender-id [none \| chassis-id \| management-address]** | Enables each MEP in this association to send sender ID TLVs. By default, this setting corresponds to that of the parent association. |
| (config)# | **interface** <*interface*> | Specifies an interface to configure and enable for Ethernet OAM CFM. Also specifies on which interface the MEP is created. |
| (config-<*interface*>)# | **[no] ethernet-cfm down** | Enables and disables downstream Ethernet OAM CFM at the interface level. By default, downstream Ethernet OAM CFM is disabled. |

  

**Table 2. Ethernet OAM CFM Command Summary *(Continued)***

| Access Prompt | Command | Description |
|---|---|---|
| (config-<*interface*>)# | **[no] ethernet-cfm mep [**<*domain name*> **\| none]** <*association name*> <*mep id*> **down** | Creates an MEP on the interface and enters MEP configuration mode. The <*domain name*> and <*association name*> parameters are the MD and MA to which the MEP belongs. The MEP ID is a numerical identifier given to the MEP. The range is **1** to **8191**. |
| (config-<*interface*>-mep)# | **[no] mep-enabled** | Enables the MEP, and all MEPs in its association. Disabled by default. |
| (config-<*interface*>-mep)# | **[no] ccm-enabled** | Enables MEP CCM transmissions. Disabled by default. |
| (config-<*interface*>-mep)# | **[no] priority** <*value*> | Specifies the priority given to CFM and linktrace messages transmitted by this MEP. The value range is **0** to **7**, with a default value of **7**. |
| (config-<*interface*>-mep)# | **[no] alarm-timers** <*alarm time*> <*reset time*> | Specifies the amount of time a defect condition must occur before it triggers an alarm, and specifies the amount of time a defect condition must be absent before a new alarm can be triggered. The time range is **2500** to **10000** milliseconds. The default alarm time is **2500** ms, default reset time is **10000** ms. |
| (config-<*interface*>-mep)# | **[no] alarm-priority-level [errorccm \| macstatus \| none \| rdi-ccm \| remoteccm \| xconccm]** | Specifies the lowest level priority condition that generates an alarm on this MEP. Each priority and default condition is described in Table 1 on page 24. By default, alarms are generated at priority **1** events. |
| (config-<*interface*>-mep)# | **snmp-trap fault alarm** | Enables SNMP notification of alarms for this MEP. By default, SNMP notification is disabled. |

  

**Table 2. Ethernet OAM CFM Command Summary *(Continued)***

| Access Prompt | Command | Description |
|---|---|---|
| > or # | **ping ethernet [**<*target-mac-address*> **|** <*target-mep-id*>**] [domain** <*domain name*> **| none] [association** <*association name*>**] [mep** <*mep id*>**] [interface** <*interface*>**] [count** <*number*>**] [priority** <*priority*>**] [drop-eligible] [size** <*bytes*>**] [data** <*pattern*>**] [timeout** <*timeout*>**] [interval** <*interval*>**] [verbose] [validate data]** | Initiates a loopback message from an MEP to another MEP to test accessibility of the destination MEP. For syntax description, range values, and default values, refer to *Ethernet Ping* on page 18. |
| > or # | **traceroute ethernet [**<*target-mac-address*> **|** <*target-mep-id*>**] [domain** <*domain name*> **| none] [association** <*association name*>**] [mep** <*mep id*>**] [interface** <*interface*>**] [ttl** <*value*>**] [timeout** <*timeout*>**] [fdb-only] [sorted]** | Initiates a linktrace message from an MEP to another MEP to trace the packet route to a destination MEP. For syntax description, range values, and default values, refer to *Ethernet Traceroute* on page 21. |

  

# Troubleshooting

The following section describes **show**, **clear**, and **debug** commands associated with Ethernet OAM CFM. These commands can be beneficial in tracking the configuration of domains, associations, MEPs, and components, as well as in verifying correct configuration and implementation. These commands also display object statistics and errors. A table describing each command is included in the *Troubleshooting Command Summary* on page 41.

## Show Commands

**Show** commands are beneficial in confirming configuration. These commands are issued from the Enable mode prompt. There are five **show** commands associated with Ethernet OAM CFM. It is important to remember that when referencing a target MEP or set of MEPs, there are a number of ways to describe the MEPs of interest. In most cases, you have an option of specifying some combination of MD, MD level, MA, VLAN or VLAN ID list, direction, or interface. Therefore, you must be very specific in your entries. If there are no matches between the descriptions you enter, an error message is returned.

### show ethernet cfm stack [interface <*interface*> | vlan <*vlan id*> | level <*level*>]

The **show ethernet cfm stack** command displays the content of the CFM stack. There is one CFM stack per bridge, and the stack permits the retrieval of information about the MEPs configured for any given interface. You can choose to limit the output results by interface, VLAN, or domain level. The output displayed is the result of the entered configuration as it is interpreted and applied by the CFM stack, not just a display of the entered configuration. If no keywords are specified, the display includes all entities on all interfaces on a device.

The **interface** <*interface*> parameter specifies that the output is limited to the specified interface. Specify an interface in the format <*interface type [slot/port |slot/port.subinterface id]*>. For example, for an Ethernet subinterface, use **eth 0/1.1**. For a list of appropriate interfaces, enter **interface ?** at the prompt. By default, all interfaces are displayed.

The **vlan** <*vlan id*> parameter specifies that the output is limited to a specific VLAN. The VLAN ID range is **1** to **4095**. By default, all VLANs are displayed.

The **level** <*level*> parameter specifies that the output is limited to a specific MD level. The MD level range is **0** to **7**. By default, all domain levels are displayed.

  

The following is sample output from the **show ethernet cfm stack** command:

```
>enable
#show ethernet cfm stack
0-----------1-------------2-------------3-------------4-------------5-------------6-----------7-------------8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
-------------------------------------------------------------------------------------------------------------------
Interface     Vlan      Lvl       Domain/Assoc
                          MEPID          MAC
-------------------------------------------------------------------------------------------------------------------
eth 0/1       0         7         Domain_1/MA_1
                          1              00:A0:C8:16:96:0D
eth 0/2       20        5         Domain1/Assoc2
                        2012             00:0a:c8:00:01:03
```

### show ethernet cfm domain [<*domain name*> | none] [detail]

The **show ethernet cfm domain** command displays the configured maintenance domains. If no domain name is specified, information about all domains is displayed. The <*domain name*> parameter displays information about a specific domain, and the **detail** parameter displays detailed information rather than a summary.

The following is sample output from the **show ethernet cfm domain** command:

```
>enable
#show ethernet cfm domain
-------------------------------------------------------------------------------------------------
Index  Domain                                  Lvl          Assoc-Count
-------------------------------------------------------------------------------------------------
1      Bogus                                    5            1
2      BenchTest                                5            1
```

The following is sample output from the **show ethernet cfm domain detail** command:

```
>enable
#show ethernet cfm domain detail
Domain Name: Bogus
  SNMP Index:   1
  Level:        5
  Associations: 1
    test


Domain Name:  BenchTest
  SNMP Index:   2
  Level:        5
  Associations: 1
    BenchAssoc
```

  

### show ethernet cfm association [<*domain name*> | none] [<*association name*>] [detail]

The **show ethernet cfm association** command displays configured maintenance associations. If no domain and association name is specified, information about all configured associations is displayed. The <*domain name*> parameter limits the output to associations in the specified domain. The <*association name*> parameter limits output to the specified association. The **detail** keyword displays detailed information rather than a summary.

The following is sample output from the **show ethernet cfm association** command:

```
>enable
#show ethernet cfm association
-------------------------------------------------------------------------------------------------------------------------
Index       Domain/Association                                  CCM     MEP-Cnt
                    Component   VID    Sender-ID
-------------------------------------------------------------------------------------------------------------------------
1           Bogus/Test                                          1sec        0
1           BenchTest/BenchAssoc                                1min        3
                    giga-eth       0/2 0      none
```

The following is sample output from the **show ethernet cfm association detail** command:

```
>enable
#show ethernet cfm association detail
Domain Name:  Bogus
Assoc Name:   Test
  SNMP Index:   1
  CCM Interval: 1sec
  Components:
  MEP Count:    0

Domain Name:  BenchTest
Assoc Name:   BenchAssoc
  SNMP Index:   1
  CCM Interval: 1min
  Components:
    giga-eth 0/2  (VLAN=0, ID=none)
  MEP Count:    3
    1 (remote)
    2 (remote)
    3 (local)
```

  

### show ethernet cfm mep local [domain [<*domain name*> | none] | association <*association name*>] [mep-id <*mep id*>] [interface <*interface*>] [detail | statistics | fault]

The **show ethernet cfm mep local** command displays the MEPs configured on the local MA. If no additional parameters are specified, information about all local MEPs are displayed. The **domain** <*domain name*> parameter limits output to the MEPs in the specified domain. The **association** <*association name*> parameter limits output to the MEPs in the specified association. The **mep-id** <*mep id*> parameter limits output to the MEPs with the specified ID. The MEP ID range is **1** to **8191**. By default, all MEPs are displayed. The **interface** <*interface*> parameter specifies that the output is limited to the MEPs configured on the specified interface. Specify an interface in the format <*interface type [slot/port |slot/port.subinterface id]*>. For example, for an Ethernet subinterface, use **eth 0/1.1**. For a list of appropriate interfaces, enter **interface ?** at the prompt. By default, MEPs on all interfaces are displayed. The **detail** keyword specifies that the information is detailed, rather than in summary format. The **statistics** keyword specifies that only the MEP statistics are displayed. The **fault** keyword specifies that only the MEP fault information is displayed.

The following is sample output from the **show ethernet cfm mep local detail** command:

```
>enable
#show ethernet cfm mep local detail
MEPs configured on this device

MEP-ID:       3
Domain/Assoc:  BenchTest/Test
Mac Address:   00:A0:C9:00:D8:B2   Interface: giga-eth 0/2   Vlan:     0
Level:        5                Direction: down          Priority: 7
Admin State:   up               CCM State: yes

Fault Notification Settings
-----------------------------------------------
Highest Allowed Defect:  MacStatus
AlarmTime:  2500 ms      ResetTime:  10000 ms
SNMP Trap:  Disabled

Current Fault State
-----------------------------------
Fault State:  Defect     Last Reported Fault:  08:41 PM, 09/16/2008

Current Highest Defect:  None
Current Defects(Highest to Lowest defect priority):
    Xcon CCM:   -
    Err'd CCM:  -
    Remote CCM: -
    MAC Status: -
    RDI:        -
```

  

```
Message Statistics
----------------------------------
CCMs Transmitted:    2787    CCMs Received Out of Sequence: 4
LBRs Transmitted:    0          Next LBM ID:                36
LBRs Received:       30         LBRs Received Out of Order:    0
LBRs with bad data:  0
Next LTM ID:         1          Unexpected LTRs:               0
```

The following is sample output from the **show ethernet cfm mep local fault** command:

```
>enable
#show ethernet cfm mep local fault
MEPs configured on this device

MEP-ID:       3
Domain/Assoc:  BenchTest/Test
Mac Address:   00:A0:C9:00:D8:B2   Interface: giga-eth 0/2   Vlan:     0
Level:        5                    Direction: down           Priority: 7
Admin State:   up                  CCM State: yes

Fault Notification Settings
-------------------------------------------------
Highest Allowed Defect:  MacStatus
AlarmTime:  2500 ms      ResetTime:  10000 ms
SNMP Trap:  Disabled

Current Fault State
---------------------------------------
Fault State:  Defect     Last Reported Fault:  08:41 PM, 09/16/2008

Current Highest Defect:  None
Current Defects(Highest to Lowest defect priority):
    Xcon CCM:   -
    Err'd CCM:  -
    Remote CCM: -
    MAC Status: -
    RDI:
```

  

### show ethernet cfm mep remote [domain [<*domain name*> | none] | association <*association name*>] [local-mep-id <*mep id*>] [interface <*interface*>] [level <*level*>] [remote-mep <*mep id*>]

The **show ethernet cfm mep remote** command displays information learned from remote MEPs and stored in a local MEP's CCM database. If no arguments are specified, information about all remote MEPs is displayed. The **domain** <*domain name*> parameter limits output to the remote MEPs for all local MEPs in the specified domain. The **association** <*association name*> parameter limits output to the remote MEPs for all local MEPs in the specified association. The **local-mep-id** <*mep id*> parameter limits output to the remote MEPs for all local MEPs with the specified ID. The MEP ID range is **1** to **8191**. By default, all remote MEPs for all local MEPs are displayed. The **interface** <*interface*> parameter specifies that the output is limited to the MEPs configured on the specified interface. Specify an interface in the format <*interface type [slot/port |slot/port.subinterface id]*>. For example, for an Ethernet subinterface, use **eth 0/1.1**. For a list of appropriate interfaces, enter **interface ?** at the prompt. By default, MEPs on all interfaces are displayed. The **level** <*level*> parameter limits output to a specific maintenance domain level. The level range is **0** to **7**. By default, all levels are displayed. The **remote-mep** <*mep-id*> parameter limits output to the remote MEPs with the specified MEP ID. The MEP ID range is **1** to **8191**. By default, all remote MEPs are displayed.

The following is sample output from the **show ethernet cfm mep remote** command:

```
>enable
#show ethernet cfm mep remote
Local MEP 3
  Domain/Assoc:  BenchTest/BenchAssoc
  Level: 5   VLAN: 0
  Interface: giga-eth 0/2
  Remote MEPs: (* = static)

   ID    State  Age       MAC                          RDI  Port     Iface
  ------------------------------------------------------------------------------------------------------------
 * 1     Ok     165936    00:A0:C8:1F:CE:B0             -   No TLV   Up
 * 2     Ok     165936    00:A0:C8:00:62:F2             -   No TLV   Up
```

  

## Clear Commands

The **clear** commands are entered from the Enable mode prompt, and are used to clear statistics and counters for MEPs. There are two clear commands for Ethernet OAM CFM, one to clear MEP data from the MEP CCM database, and one to clear all CFM statistics held by specific MEPs.

### clear ethernet cfm mep remote [domain [<*domain name*> | none] | association <*association name*>] [mep-id <*mep id*>] [remote-mep <*mep id*>]

The **clear ethernet cfm mep remote** command clears entries about remote MEPs that are stored in the MEP CCM database. These entries are cleared whether the remote MEP is configured or not. If no arguments are specified, the MEP CCM database for all MEPs is cleared. If the **domain** <*domain name*> parameter is used, only the MEP CCM database of MEPs in the specified domain is cleared. If the **association** <*association name*> parameter is used, only the MEP CCM database of MEPs in the specified association are cleared. If the **mep-id** <*mep id*> parameter is used, only the MEP CCM database of local MEPs with the specific MEP ID is cleared. The MEP ID range is **1** to **8191**. If the **remote-mep** <*mep id*> parameter is used, only the remote MEPs are cleared from the CCM database of the specified local MEP. The MEP ID range is **1** to **8191**.

To clear CCM database entries on all remote MEPs that are part of **domain1** and communicate with the local MEP matching MEP ID **1000**, enter the command as follows:

```
>enable
#clear ethernet cfm mep remote domain domain1 mep-id 1000
```

### clear counters ethernet cfm [domain [<*domain name*> | none] | association <*association name*>] [mep-id <*mep id*>] [interface <*interface*>] [level <*level*>]

The **clear counters ethernet cfm** command clears the statistics held by the specified MEP. If no arguments are specified, the statistics for all MEPs are cleared. If the **domain** <*domain name*> parameter is specified, only the statistics for MEPs in that domain are cleared. If the **association** <*association name*> parameter is used, only the statistics for MEPs in that association are cleared. If the **mep-id** <*mep id*> parameter is used, only the statistics for MEPs with the specified MEP ID are cleared. The MEP ID range is **1** to **8191**. If the **interface** <*interface*> parameter is used, only the statistics for MEPs configured on the specific interface are cleared. Specify an interface in the format <*interface type [slot/port | slot/port.subinterface id]*>. For example, for an Ethernet subinterface, use **eth 0/1.1**. For a list of appropriate interfaces, enter **interface ?** at the prompt. If the **level** <*level*> parameter is used, statistics for all MEPs configured on the specified MD level are cleared. The level range is **0** to **7**.

To clear all MEP statistics on MD level 5, enter the command as follows:

```
>enable
#clear counters ethernet cfm level 5
```

  

## Debug Commands

**Debug** commands are issued from the Enable mode prompt, and display information associated with activities performed by CFM objects. There are nine **debug** commands associated with Ethernet OAM CFM.

> NOTE *Turning on a large amount of debug information can adversely affect the performance of your unit.*

### debug ethernet cfm

The **debug ethernet cfm** command enables system-wide CFM debugging. All debug messages configured in the CFM subsystem are displayed. The following is sample output from this command:

```
>enable
#debug ethernet cfm
2008.09.22 11:00:08 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:00:09 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=195)
2008.09.22 11:00:09 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:00:10 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=196)
2008.09.22 11:00:10 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:00:11 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=197)
2008.09.22 11:00:11 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:00:12 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=198)
2008.09.22 11:00:12 CFM.MD MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
```

> NOTE *Use this command with caution as it causes a large amount of debug information. Large amounts of debug information can adversely affect the performance of your unit. To avoid an excess of debug information generation, you can alternately select a debug command that does not activate all CFM debug messages at once.*

### debug ethernet cfm ccm xmit [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet cfm ccm xmit** command enables CFM debugging for the CCM transmit path. All outgoing CCM messages are logged in addition to any problems that occur in their creation and transmission. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

The following is sample output from the **debug ethernet cfm ccm xmit** command:

```
>enable
#debug ethernet cfm ccm xmit
2008.09.22 11:01:43 CFM.CCM MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=290)
2008.09.22 11:01:44 CFM.CCM MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=291)
2008.09.22 11:01:45 CFM.CCM MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=292)
2008.09.22 11:01:46 CFM.CCM MD:BenchTest|MA:BenchAssoc|MEP:1|CCM|Sent CCM (ID=293)
```

  

### debug ethernet cfm ccm rcv [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet cfm ccm rcv** command enables CFM debugging for the CCM receive path. All incoming CCM messages are logged in addition to any problems that occur in their reception and processing. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

The following is sample output from the **debug ethernet cfm ccm rcv** command:

```
>enable
#debug ethernet cfm ccm rcv
2008.09.22 11:02:49 CFM.CCR MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:02:50 CFM.CCR MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:02:51 CFM.CCR MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:02:52 CFM.CCR MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
2008.09.22 11:02:53 CFM.CCR MD:BenchTest|MA:BenchAssoc|MEP:1|CCR|Rx CCM from MEPID 2
```

### debug ethernet loopback request [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet loopback request** command enables CFM debugging for the loopback request path. All loopback messages are logged in addition to any problems that occur in the creation and issue of loopback messages. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

To enable debug messages for loopback requests, enter the command as follows:

```
>enable
#debug ethernet loopback request
```

### debug ethernet loopback response [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet loopback response** command enables CFM debug messages for the loopback response path. All received loopback messages are logged, in addition to any problems that occur in their processing. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

To enable debug messages for received loopback requests, enter the command as follows:

```
>enable
#debug ethernet loopback response
```

  

### debug ethernet cfm linktrace request [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet cfm linktrace request** command enables CFM debug messages for the linktrace request path. All linktrace messages are logged in addition to any problems that occur in the creation and issue of linktrace messages. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

To enable debug messages for linktrace requests, enter the command as follows:

```
>enable
#debug ethernet cfm linktrace request
```

### debug ethernet cfm linktrace response [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet cfm linktrace response** command enables CFM debug messaging for the linktrace response path. All received linktrace messages are logged in addition to any problems that occur in their processing. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

The following is sample output from the **debug ethernet cfm linktrace response** command:

```
>enable
#debug ethernet cfm linktrace response
2008.09.22 11:10:44 CFM.LTF MD:BenchTest|MA:BenchAssoc|MEP:1|LTF|Rx LTM
2008.09.22 11:10:44 CFM.LTF MD:BenchTest|MA:BenchAssoc|MEP:1|LTF|Set Rx State: Current:
    MR_IDLE, New: MR_RESPOND
2008.09.22 11:10:44 CFM.LTF MD:BenchTest|MA:BenchAssoc|MEP:1|LTF|Set Tx State: Current:
    RT_IDLE, New: RT_WAITING
2008.09.22 11:10:44 CFM.LTF MD:BenchTest|MA:BenchAssoc|MEP:1|LTF|Set Rx State: Current:
    MR_RESPOND, New: MR_IDLE
2008.09.22 11:10:45 CFM.LTF MD:BenchTest|MA:BenchAssoc|MEP:1|LTF|Set Tx State: Current:
    RT_WAITING, New: RT_TRANSMITTING
2008.09.22 11:10:45 CFM.LTF MD:BenchTest|MA:BenchAssoc|MEP:1|LTF|XmitOldestLtr (down): Tx
    success
2008.09.22 11:10:45 CFM.LTF MD:BenchTest|MA:BenchAssoc|MEP:1|LTF|Set Tx State: Current:
    RT_TRANSMITTING, New: RT_IDLE
```

### debug ethernet cfm remote-mep [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet cfm remote-mep** command enables CFM debug messaging for remote MEPs in the MEP database. All changes to the state of a remote MEP, including statically created and dynamically discovered MEPs, are logged and displayed. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

  

The following is sample output from the **debug ethernet cfm remote-mep** command:

```
>enable
#debug ethernet cfm remote-mep
2008.09.22 11:13:50 CFM.RMEP MD:BenchTest|MA:BenchAssoc|MEP:1|RMEP|Set CCMdefect: true
2008.09.22 11:13:53 CFM.MD:BenchTest|MA:BenchAssoc|MEP:1| mep signaled new fault alarm state (3)
```

### debug ethernet cfm alarm [domain <*domain name*>] [association <*association name*>] [mep <*mep id*>]

The **debug ethernet cfm alarm** command enables CFM debug messaging for the CFM fault alarm system. The details of state changes to the alarm system are logged. The **domain** <*domain name*> parameter limits output to MEPs of a specific domain. The **association** <*association name*> limits output to MEPs of a specific association. The **mep** <*mep id*> parameter limits output to local MEPs that match the specified MEP ID. The MEP ID range is **1** to **8191**.

The following is sample output from the **debug ethernet cfm alarm** command:

```
>enable
#debug ethernet cfm alarm
2008.09.22 11:06:20 CFM.FNG MD:BenchTest|MA:BenchAssoc|MEP:1|FNG|Set state: FNG_DEFECT
2008.09.22 11:06:22 CFM.FNG MD:BenchTest|MA:BenchAssoc|MEP:1|FNG|Set state:
    FNG_REPORT_DEFECT
2008.09.22 11:06:22 CFM.FNG MD:BenchTest|MA:BenchAssoc|MEP:1|FNG|Set state:
    FNG_DEFECT_REPORTED
2008.09.22 11:06:22 CFM.MD:BenchTest|MA:BenchAssoc|MEP:1| mep signaled new fault
```

## Troubleshooting Command Summary

The following table summarizes the Ethernet OAM CFM troubleshooting commands.

**Table 3. Ethernet OAM CFM Troubleshooting Commands**

| Prompt | Command | Description |
|---|---|---|
| # | **show ethernet cfm stack [interface** <*interface*> **\| vlan** <*vlan id*> **\| level** <*level*>**]** | Displays the content of the CFM stack. Output can be limited by interface, VLAN, or level. |
| # | **show ethernet cfm domain [**<*domain name*> **\| none] [detail]** | Displays the MDs configured on the system. |
| # | **show ethernet cfm association [**<*domain name*> **\| none] [**<*association name*>**] [detail]** | Displays MAs configured on the system. |
| # | **show ethernet cfm mep local [domain [**<*domain name*> **\| none] \| association** <*association name*>**] [mep-id** <*mep id*>**] [interface** <*interface*>**] [detail \| statistics \| fault]** | Displays MEPs configured on the system. |

  

**Table 3. Ethernet OAM CFM Troubleshooting Commands *(Continued)***

| Prompt | Command | Description |
|---|---|---|
| # | **show ethernet cfm mep remote [domain [**<*domain name*>** \| none] \| association** <*association name*>**] [local-mep-id** <*mep id*>**] [interface** <*interface*>**] [level** <*level*>**] [remote-mep** <*mep id*>**]** | Displays information learned from remote MEPs and stored in a local MEP's CCM database. |
| # | **clear ethernet cfm mep remote [domain [**<*domain name*>** \| none] \| association** <*association name*>**] [mep-id** <*mep id*>**] [remote-mep** <*mep id*>**]** | Clears entries about remote MEPs in the MEP CCM database. Action can be limited to MEPs that are in a specific domain, association, or match a specific local or remote MEP ID. The MEP ID range is **1** to **8191**. |
| # | **clear counters ethernet cfm [domain [**<*domain name*>** \| none] \| association** <*association name*>**] [mep-id** <*mep id*>**] [interface** <*interface*>**] [level** <*level*>**]** | Clears all statistics held by the specified MEP. Action can be limited to MEPs that are in a specific domain, association, match a specific MEP ID, interface, or MD level. The MEP ID range is **1** to **8191**. The level range is **0** to **7**. |
| # | **debug ethernet cfm** | Enables system-wide CFM debug messaging. |
| # | **debug ethernet cfm ccm xmit [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for CCM transmit paths. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |
| # | **debug ethernet cfm ccm rcv [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for CCM receive paths. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |
| # | **debug ethernet loopback request [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for loopback message request paths. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |
| # | **debug ethernet loopback response [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for loopback message response paths. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |
| # | **debug ethernet cfm linktrace request [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for linktrace message request paths. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |
| # | **debug ethernet cfm linktrace response [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for linktrace message response paths. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |

  

**Table 3. Ethernet OAM CFM Troubleshooting Commands *(Continued)***

| Prompt | Command | Description |
|---|---|---|
| # | **debug ethernet cfm remote-mep [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for remote MEPs in the MEP database. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |
| # | **debug ethernet cfm alarm [domain** <*domain name*>**] [association** <*association name*>**] [mep** <*mep id*>**]** | Enables CFM debug messaging for the CFM alarm system. Output can be limited by domain, association, or MEP ID. The MEP ID range is **1** to **8191**. |

  