

Configuring 802.3ah OAM Link-Fault Management

Ethernet OAM link-fault management can be used for physical link-level fault detection and management. It uses a new, optional sublayer in the data link layer of the OSI model. Ethernet OAM can be implemented on any full-duplex point-to-point or emulated point-to-point Ethernet link. A system-wide implementation is not required; OAM can be deployed on particular interfaces of a router. Transmitted Ethernet OAM messages or OAM PDUs are of standard length, untagged Ethernet frames within the normal frame length limits in the range 64–1518 bytes.

To configure OAM link-fault management on an Ethernet interface:

1. Specify a Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet interface, and enable IEEE 802.3ah OAM support on the interface. When the IEEE 802.3ah OAM protocol is enabled on a physical interface, the discovery process is automatically triggered. The default discovery mode of a local interface is active.

```
host1(config)#interface GigabitEthernet 6/0  
host1(config-if)#ethernet oam lfm
```



NOTE: You must enable the OAM link-fault management feature to be able to configure parameters that govern the link monitoring and management process.

All of the following steps are optional. You can choose which of the OAM configurations you want to set up on the interface to enable link-fault administration. If you enable OAM support on the interface without specifying any of the other parameters, such as discovery mode and threshold settings, default values are assumed for those attributes.

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2. Specify whether the interface or the peer initiates the discovery process by configuring the link discovery mode to active or passive.

```
host1(config-if)#ethernet oam lfm mode active
```

In this case, the discovery mode of the interface is set as active. In active mode, the interface discovers and monitors the peer on the link if the peer also supports IEEE 802.3ah OAM functionality. An OAM entity in active mode initiates the discovery process by sending an Information OAM PDU to the multicast address of the slow protocol (0180.c200.0002) at a configured rate. In a carrier environment, the customer edge (CE) devices are normally configured for passive mode operation, whereas the provider edge (PE) equipment is configured for active mode operation.

3. Specify the frequency, in milliseconds, at which OAM PDUs are sent to the peer to keep the OAM association alive.

```
host1(config-if)#ethernet oam lfm pdu-transmit-interval 200
```

In this example, the local interface is configured to send Information OAM PDUs every 200 milliseconds to the remote peer. This OAM PDU includes local, remote, and organization-specific information, and contains a local-information TLV.

The rate of transmission of OAM PDUs can be a number in the range 100–1000 milliseconds; the default value is 1000 milliseconds.

4. Specify the number of OAM PDUs that a local OAM client can fail to receive from a remote peer before a link-fault event is triggered. The product of the PDU timer and the PDU loss threshold equals the lost-link timer value, which is used to reset the Discovery state diagram that maintains the states of the OAM entities and determines the condition of the link based on various stored values.

```
host1(config-if)#ethernet oam lfm pdu-lost-threshold 4
```

In this example, the local interface is set to wait for 4 OAM PDUs to be missed from the remote peer before it generates a link-fault event. You can configure the local interface to wait for a larger number of OAM PDUs to be missed from the remote peer in networks that are prone to high losses and fluctuating performances, such as jitter, higher latency, and poor transmission of packets.

The number of OAM PDUs that can fail to be received from a remote peer before the local OAM entity triggers a link-fault event can be in the range 3–10; the default period is 5 PDUs.

5. Configure the interface to detect local link faults and send events to the remote OAM entity when problems are noticed on the link. When link monitoring is enabled, the interface sends event OAM protocol data units (PDUs) when errors occur and interprets event OAM PDUs from the remote peer. Link monitoring can be effective only if both the local client and remote peer agree to support it.

You can specify the event threshold values on an interface for the local errors that occur or a period of time during which such local errors are detected. The following are the error events that you can track using the OAM functionality:

- Error frame events
 - Symbol error events
 - Error frame second events
- a. Configure a low threshold value for sending frame error events, which when exceeded causes an Errored Frame Event TLV to be sent to the remote OAM entity. The Errored Frame Event TLV counts the number of errored frames detected during the specified period.

```
host1(config-if)#ethernet oam lfm link-monitor frame-seconds threshold high 600
```

In this case, a low error frame threshold of 600 frames is set. When this threshold is exceeded, an Errored Frame Event TLV is sent to the remote peer.

- b. Configure a high threshold value for frame errors, which when exceeded triggers an action.

```
host1(config-if)#ethernet oam lfm link-monitor frame-seconds threshold high 60
```

In this case, a high error frame threshold of 60 frames is set. When this threshold is exceeded, the action configured on the interface using the **ethernet oam lfm high-threshold action** command is taken.

- c. Configure a period of time during which error frames are counted for both high and low threshold settings. The time duration is specified in hundred millisecond units.

host1(config-if)#ethernet oam lfm link-monitor frame-seconds window 10

In this case, the window during which error frames are counted is set as 10 hundred millisecond units. The configured window is valid for both high and low threshold settings. The high and low threshold settings are reset whenever a new window, during which errors are counted, commences.

- d. Configure a low threshold value for errored frame seconds, which causes an Errored Frame Seconds Summary Event TLV to be sent to the OAM entity when the threshold is exceeded. The Errored Frame Seconds Summary Event TLV counts the number of errored frame seconds that occurred during the specified period. An errored frame second is any 1-second period that has at least one errored frame.

host1(config-if)#ethernet oam lfm link-monitor frame-seconds-summary threshold low 60

In this case, a low errored frame seconds threshold of 60 frame seconds is set. When this threshold is exceeded, an Errored Frame Seconds Summary Event TLV in an Event Notification OAM PDU is sent from the local OAM entity to the remote peer.

- e. Configure a high threshold value for errored frame seconds, which when exceeded triggers an action.

host1(config-if)#ethernet oam lfm link-monitor frame-seconds-summary threshold high 6

In this case, a high threshold of 6 errored frame seconds is set. When this threshold is exceeded, the action configured on the interface using the **ethernet oam lfm high-threshold action** command is taken.

- f. Specify a period of time in which frame seconds summary error events are counted for both high and low threshold settings. The time period used for counting events is specified in seconds.

host1(config-if)#ethernet oam lfm link-monitor frame-seconds-summary window 10

In this case, frame seconds summary events are detected during a period of 10 seconds. The configured window is valid for both high and low threshold settings. The high and low threshold settings are reset whenever a new window, during which errors are counted, commences.

- g. Configure a low threshold value for symbol error events that causes an Errored Symbol Period Event TLV to be sent to the OAM entity when it is exceeded. The Errored Symbol Period Event TLV counts the number of symbol error events that occurred during the specified period.

host1(config-if)#ethernet oam lfm link-monitor symbol-period threshold low 60

In this case, a low symbol errors threshold of 60 symbols is set. When this threshold is exceeded, an Errored Symbol Period Event TLV in an Event Notification OAM PDU is sent from the local OAM entity to the remote peer. This event is generated if the symbol error count is equal to or greater than the specified threshold for that period.

- h. Configure a high threshold value for symbol errors, which when exceeded, triggers an action.

```
host1(config-if)#ethernet oam lfm link-monitor symbol-period threshold low 10
```

In this case, a low symbol errors threshold of 10 symbols is set. When this threshold is exceeded, the action configured on the interface using the **ethernet oam lfm high-threshold action** command is taken.

- i. Specify a period of time in which symbol error events are counted for both high and low threshold settings. The time period is specified in seconds.

```
host1(config-if)#ethernet oam lfm link-monitor symbol-period window 10
```

In this case, symbol error events are counted over a period of 10 seconds. The configured window is valid for both high and low threshold settings. The high and low threshold settings are reset whenever a new window, during which errors are counted, commences.



NOTE: We recommend that you do not use a multiple of the number of symbols because the window size varies greatly, depending on the speed of the link. For example, a 10 Gigabit Ethernet link generates 10.3x10M symbols per second. If the window has a lower bound of 1M symbols, sampling the symbol error statistic occurs every 97 microseconds.

Some of the interfaces do not support statistics for errored symbol events. If you configure a monitor for symbol errors on such interfaces, the setting does not have any effect.

- 6. Configure a specific action to occur when a high threshold for an error is exceeded on an Ethernet OAM interface. You can configure the OAM application to influence the operational state of the link, when a link quality threshold is exceeded or a critical event PDU is received from the peer, or both. If you configured the action for an OAM event to disable an Ethernet OAM interface when a high threshold for an error is exceeded, the link moves to the operational down status.

```
host1(config-if)#ethernet oam lfm high-threshold action failover
```

In this case, when the high threshold is exceeded for a local link error, a failover occurs to the secondary link of the redundant port on GE-2 and GE-HDE line modules that are paired with GE-2 SFP I/O modules.

- 7. Configure the Ethernet OAM link-fault management functionality to detect failure conditions that occurred at a remote peer and influence the state of the link based on an Event Notification PDU received from the remote peer. You can also set the action to be performed when a failure condition is observed in the

link. If you enable detection of faults that occurred at the remote peer, the local OAM entity monitors unspecified critical event, unrecoverable error, and loss-of-signal conditions that the remote peer notifies it using an Information OAM PDU with the Critical Event, Dying Gasp, and Link Fault bits set in the Flags field.

```
host1(config-if)#ethernet oam lfm remote-failure critical-event action  
disable-interface
```

```
host1(config-if)#ethernet oam lfm remote-failure dying-gasp action  
disable-interface
```

```
host1(config-if)#ethernet oam lfm remote-failure link-fault action disable-interface
```

The operational status of the interface is set to down when an OAM PDU is received from the remote peer by the local OAM entity to signal fault conditions at the remote entity.

8. Set an interface into loopback mode to enable the current Ethernet OAM configuration for the interface of the local OAM entity to allow initiation of remote loopback operation or to respond to a remote loopback request from a peer.

```
host1(config-if)#ethernet oam lfm remote-loopback supported
```



NOTE: You must configure the interface of the local OAM entity to be placed in remote loopback mode and respond to loopback requests from the remote peer by using the **ethernet oam lfm remote-loopback supported** command before you enable the remote peer to loop back PDUs by using the **start** or **stop** keywords with the **ethernet oam lfm remote-loopback** command in Privileged Exec mode. Otherwise, a warning message is displayed prompting you to configure the interface of the local OAM entity to be placed in remote loopback mode.

Also, the remote peer can place the local OAM entity in loopback mode only if you configured the **ethernet oam lfm remote-loopback supported** command on the local entity to enable remote loopback functionality on the local entity.

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9. Configure the local OAM entity to instruct the remote peer at the specified interface to start looping back the non-OAM PDUs that it receives from the local OAM entity or to stop the resending of such received non-OAM PDUs from the local entity.
 - a. Enable the remote loopback operation on a remote OAM entity, which causes the remote entity at the specified Gigabit Ethernet interface to loop any received non-OAM PDUs back to the local entity.

```
host1#ethernet oam lfm remote-loopback start interface gigabitEthernet  
1/0
```

This configuration setting is not preserved across a reboot. The setting that you configured on the local OAM entity to start or stop the loopback operation on the remote peer is not available after a warm or cold restart of the router, because the router does not store the secure logs in NVS.



NOTE: If you attempt to enable the loopback operation on a remote OAM entity by entering the **ethernet oam lfm remote-loopback start** command, an error message is displayed if the remote entity is not configured for loopback behavior and if the interface of the local entity is not placed into loopback mode (to send and receive loopback PDUs).

- b. Alternatively, you can disable the remote loopback operation on the remote OAM entity by instructing it to not loop back any received non-OAM PDUs from the local OAM entity.

```
host1#ethernet oam lfm remote-loopback stop interface gigabitEthernet  
1/0
```

When you halt the remote loopback operation to cause the remote peer to not loop back any PDUs that it receives from the local entity by using the **ethernet oam lfm remote-loopback stop** command, the number of frames and bytes that are transmitted from the local entity to the remote peer when the local interface is in loopback mode, and the number of frames and bytes that are received from the remote peer when the remote peer is in loopback mode are displayed using appropriate field labels at the CLI prompt. You can also view the calculated loopback parameter values later from the Remote Loopback section in the output of the **show ethernet oam lfm status** command.

- Related Topics**
- Guidelines for Configuring 802.3ah OAM Link-Fault Management
 - ethernet oam lfm
 - ethernet oam lfm mode
 - ethernet oam lfm high-threshold
 - ethernet oam lfm link-monitor frame-seconds
 - ethernet oam lfm link-monitor frame-seconds-summary
 - ethernet oam lfm link-monitor symbol-period
 - ethernet oam lfm pdu-lost-threshold
 - ethernet oam lfm pdu-transmit-interval
 - ethernet oam lfm remote-failure
 - ethernet oam lfm remote-loopback
 - ethernet oam lfm remote-loopback supported
 - Monitoring OAM Link-Fault Management Configuration for an Interface
 - Monitoring OAM Link-Fault Management Discovery Settings for an Interface

- Monitoring OAM Link-Fault Management Statistics for an Interface
- Monitoring OAM Link-Fault Management Sessions on All Configured Interfaces

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