

EPON OAM Settings

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Chapter 1 EPON OAM Settings

1.1 OAM Overview

EFM OAM of IEEE 802.3ah provides point-to-point link trouble/performance detection on the single link. However, EFM OAM cannot be applied to EVC and so terminal-to-terminal Ethernet monitoring cannot be realized. OAM PDU cannot be forwarded to other interfaces. Ethernet OAM regulated by IEEE 802.3ah is a relatively slow protocol. The maximum transmission rate is 10 frames per second and the minimum transmission rate is 1 frame per second.

1.1.1 OAM Protocol's Attributes

- Supporting Ethernet OAM devices and OAM attributes

The Ethernet OAM connection process is called as the Discovery phase when the OAM entity finds the OAM entity of the remote device and a stable session will be established. During the phase, the connected Ethernet OAM entities report their OAM mode, Ethernet OAM configuration information and local-node-supported Ethernet OAM capacity to each other by interacting the information OAM PDU. If the loopback configuration, unidirectional link detection configuration and link-event configuration have been passed on the Ethernet OAM of the two terminals, the Ethernet OAM protocol will start working on the link layer.

- Link monitoring

The Ethernet OAM conducts the link monitoring through Event Notification OAM PDU. If the link has troubles and the local link monitors the troubles, the local link will transmits Event Notification OAM PDU to the peer Ethernet OAM to report the normal link event. The administrator can dynamically know the network conditions through link monitoring. The definition of a normal link event is shown in table 1.

Table 1 Definition of the normal link event

Normal Link Event	Definition
Error signal periodical event	Means the threshold that error signals exceed in a period of N signals.
Error frame event	Means the threshold that error frames exceed at a time unit.
Error frame periodical event	Means the threshold that error frames exceed in a period of N frames.
Error frame second event	Means the threshold that the seconds of error frames exceed in a period of M seconds.

- Remote trouble indication

It is difficult to check troubles in the Ethernet, especially the case that the network performance slows down while physical network communication continues. OAM PDU defines a flag domain to allow Ethernet OAM entity to transmit the trouble information to the peer. The flag can stand for the following emergent link events:

- Link Fault: The physical layer detects that the reception direction of the local DTE has no effect. If troubles occur, some devices at the physical layer support unidirectional operations and allows trouble notification from remote OAM.
- Dying Gasp: If an irrecoverable local error occurs, such as OAM shutdown, the interface enters the **error-disabled** state and then is shut down.
- Critical Event: Uncertain critical events occur (critical events are specified by the manufacturer).

Information OAM PDU is continuously transmitted during Ethernet OAM connection. The local OAM entity can report local critical link events to remote OAM entity through Information OAM PDU. The administrator thus can dynamically know the link's state and handle corresponding errors in time.

- Remote loopback

OAM provides an optional link-layer-level loopback mode and conducts error location and link performance testing through non-OAM-PDU loopback. The remote loopback realizes only after OAM connection is created. After the OAM connection is created, the OAM entity in active mode triggers the remote loopback command and the peer entity responses the command. If the remote terminal is in loopback mode, all packets except OAM PDU packets and Pause packets will be sent back through the previous paths. Error location and link performance testing thus can be conducted. When remote DTE is in remote loopback mode, the local or remote statistics data can be queried and compared randomly. The query operation can be conducted before, when or after the loopback frame is transmitted to the remote DTE. Regular loopback check can promptly detect network errors, while segmental loopback check can help locating these network errors and then remove these errors.

1.1.2 OAM Mode

The device can conduct the OAM connection through two modes: active mode and passive mode. The device capacity in different mode is compared in table 1. Only OAM entity in active mode can trigger the connection process, while the OAM entity in passive mode has to wait for the connection request from the peer OAM entity. After the remote OAM discovery process is done, the local entity in active mode can transmit any OAM PDU packet if the remote entity is in active mode, while the local entity's operation in active mode will be limited if the remote entity is in passive mode. This is because the device in active mode does not react on remote loopback commands and variable requests transmitted by the passive remote entity.

Table 2 Comparing device capacity in active and passive modes

Capacity	Active Mode	Passive Mode
Initializing the Ethernet OAM discovery process	Yes	No

Responding to the OAM discovery initialization process	Yes	Yes
Transmitting the Information OAM PDU packet	Yes	Yes
Permitting to transmit the Event Notification OAM PDU packet	Yes	Yes
Allowing to transmit the Variable Request OAM PDU packet	Yes	No
Allowing to transmit Variable Response OAM PDU packet	Yes	Yes
Allowing to transmit the Loopback Control OAM PDU packet	Yes	No
Responding to Loopback Control OAM PDU	Yes, but there is a request that the peer must be in ACTIVE mode.	Yes
Allowing to transmit specified OAM PDU	Yes	Yes

After the Ethernet OAM connection is established, the OAM entities at two terminals maintain connection by transmitting the Information OAM PDU packets. If the Information OAM PDU packet from the peer OAM entity is not received in five seconds, the connection times out and a new OAM connection then requires to be established.

1.1.3 Components of the OAM Packet

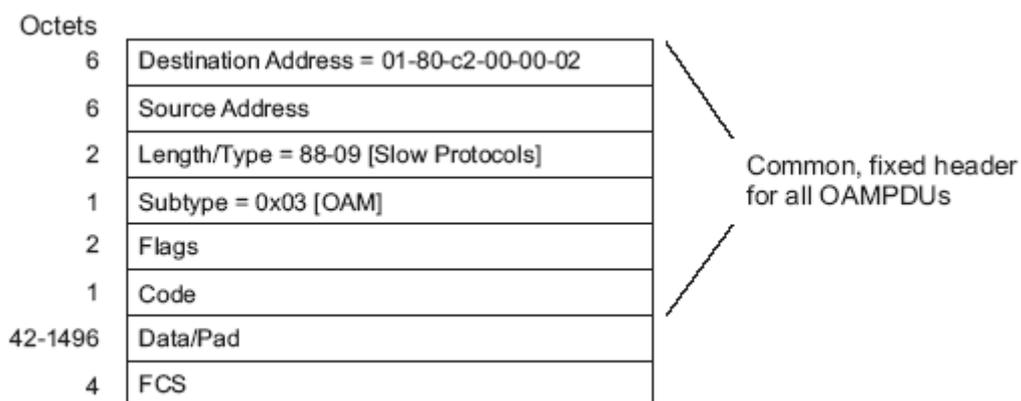


Figure 57-9—OAMPDU frame structure

Figure 1 Components of the OAM packet

The following are the meanings of the fields of the OAM packet:

- Destination address: means the destination MAC address of the Ethernet OAM packet.

- Source address: Source MAC address of the Ethernet OAM packet
It is the MAC address of the transmitter terminal's port and also a unicast MAC address.
- Length/Type: Always adopts the Type encoding. The protocol type of the Ethernet OAM packet is 0x8809.
- Subtype: The subtype of the protocol for Ethernet OAM packets is 0x03.
- Flags: a domain where the state of Ethernet OAM entity is shown
- Code: a domain where the type of the OAMPDU packet is shown
- Data/Pad: a domain including the OAMPDU data and pad values
- FCS: checksum of the frame

Table 3 Type of the CODE domain

CODE	OAMPDU
00	Information
01	Event Notification
02	Variable Request
03	Variable Response
04	Loopback Control
05-FD	Reserved
FE	Organization Specific
FF	Reserved

The Information OAM PDU packet is used to transmit the information about the state of the OAM entity to the remote OAM entity to maintain the OAM connection.

The Event Notification OAMPDU packet is used to monitor the link and report the troubles occurred on the link between the local and remote OAM entities.

The Loopback control OAMPDU packet is mainly used to control the remote loopback, including the state of the OAM loopback from the remote device. The packet contains the information to enable or disable the loopback function. You can open or shut down the remote loopback according to the contained information.

1.2 EPON OAM Configuration Task List

- Enabling Remote OAM Loopback
- Displaying the Information About OAM Protocol

1.3 EPON OAM Configuration Tasks

1.3.1 Enabling Remote EPON OAM Loopback

The procedure to enable remote loopback on an interface is shown in the following table:

Table 4 Enabling the remote loopback of EPON OAM

Procedure	Command	Purpose
Step1	ethernet oam remote-loopback {start stop} interface intf-type intf-id	Enables or disables remote loopback on an interface.
Step2	ethernet oam remote-loopback test num1 num2 interface intf-type intf-id	Means transmit num2 frames with num1 bytes on the LLID port.
Step3	show ethernet oam loopback-test-result interface intf-type intf-id	Displays the test results.

The remote OAM loopback cannot be enabled on the physical interface that belongs to the aggregation interface.

1.3.2 Setting the Timeout Time of the Discovery State Machine of EPON OAM

The steps to set in the privileged mode the timeout time of the discovery state machine of EPON OAM are shown below:

Table 5 Setting the timeout time of the discovery state machine of EPON OAM

Procedure	Command	Purpose
Step1	config	Enters the global configuration mode.
Step2	ethernet oam timeout <i>value</i>	Sets the timeout time of the discovery state machine of EPON OAM.

1.3.3 Displaying or Restraining the Logs of the Discovery State Machine of EPON OAM

The steps to display in the privileged mode the logs of the discovery state machine of EPON OAM are shown below:

Table 6 Displaying the logs of the discovery state machine of EPON OAM

Procedure	Command	Purpose
Step1	config	Enters the global configuration mode.
Step2	ethernet oam log discovery	Displays the logs of the discovery state machine of

	{ enable disable}	EPON OAM.
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1.3.4 Displaying or Restraining the Link Monitor Log of EPON OAM.

The procedure to display in the privileged mode the link monitor logs of EPON OAM on an interface is shown in the following table:

Table 7 Displaying the link monitor logs of EPON OAM

Procedure	Command	Purpose
Step1	config	Enters the global configuration mode.
Step2	ethernet oam log link-monitor { enable disable}	Displays the link monitor logs of EPON OAM.

1.3.5 Displaying the Information About the EPON OAM Protocol

Table 8 Displaying the information about the EPON OAM protocol

Command	Purpose
show ethernet oam ctc version-negotiation-result interface [intf-type intf-id]	Displays the negotiation result of CTC OAM on all interfaces or a designated interface.
show ethernet oam statistics interface [intf-type intf-id]	Displays on all ports or a certain designated port OAM packet statistics, which is conducted according to the value in the code domain in the OAM packets.
show ethernet oam configuration	Displays global OAM configuration.
show ethernet oam status interface [intf-type intf-id]	Displays on all ports or a designated port the local or peer's OAM status, including the OAM enabling status, OAM discovery state machine's status, OAM mode, allowable maximum size of the OAM packet, edit ID, peer's MAC address, manufacturer's OUI and detailed information of the peer, and supportable OAM function set.
show ethernet oam loopback-test-result interface [intf-type intf-id]	Displays the results of remote OAM loopback test.

1.4 Configuration Example

1.4.1 Network Environment Requirements

Connect an ONU to the EPON0/3 port of IEP3314. Then trigger on IEP3314 the remote loopback test towards ONU. The size of the test packet is 64 bytes and the number of the to-be-sent test packets is 10. After the test packets are completely sent, you can run the related command to display the test results.

1.4.2 Network Topology

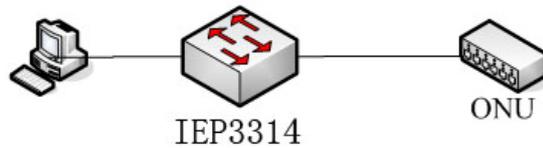


Figure 2 Network topology

1.4.3 Configuration Procedure

Configuring IEP3314:

```
Switch#ethernet oam remote-loopback start int e0/3:1
```

This is a intrusive loopback.

While loopback, you will be unable to pass traffic across that link.

```
Proceed with Remote Loopback(y/n)?y
```

```
Switch#ethernet oam remote-loopback test 64 10 interface e0/3:1
```

```
Switch#show ethernet oam loopback-test-result int e0/3:1
```

Loopback test result:

Out of Seqance frames: 0

10 packets transmitted, 10 received, 0% packet loss

rtt min/avg/max = 0/0/0 ms

```
Switch#ethernet oam remote-loopback stop int e0/3:1
```