ITU-T Y.1731 Performance Monitoring in a Service Provider Network

ITU-T Y.1731 performance monitoring provides standard-based Ethernet performance monitoring that encompasses the measurement of Ethernet frame delay, frame-delay variation, and throughput as outlined in the ITU-T Y.1731 specification and interpreted by the Metro Ethernet Forum (MEF). Service providers offer service level agreements (SLAs) that describe the level of performance customers can expect for services. This document describes the Ethernet performance management aspect of SLAs.

Prerequisites for ITU-T Y.1731 Performance Monitoring in a Service Provider Network

- IEEE-compliant connectivity fault management (CFM) must be configured and enabled for Y.1731 performance monitoring to function.

Note Y1731 is supported over Port Channel interfaces.

Restrictions for ITU-T Y.1731 Performance Monitoring in a Service Provider Network

- A frame-delay measurement message (DMM) with CFMoXconnect on a Cisco ASR 920 router works only if the **control-word** command is enabled. If the remote end of the pseudowire does not enable the

control-word command by default, enable the command to get the DMM time stamp working. Cisco ASR 9000 Series Routers and ALU 7450 are examples of peer platforms where the **control-word** command needs to be enabled.

- When the core network has multiple paths, the Tx and Rx DMM/DMR packets can be sent and received on different ports. If the ports belong to a different interface module (IM), time stamping can be out of sync and in certain cases the Rx value can be lower than the Tx value. This value will be displayed as 0 in the raw database output. As a workaround, configure Precision Time Protocol (PTP) between the two connectivity fault management (CFM) endpoint routers.

- Y1731 is supported with the **rewrite** command configuration on Ethernet Flow Points (EFPs) throughout the Layer 2 circuit. However, the configuration may be in such a way that the Y1731 PDUs may be transmitted without a tag. This results in the other end of the Layer 2 circuit not being able to ascertain the CoS value which determines the SLA session to which the PDUs belong. Therefore, the **rewrite** command configuration is not supported

- Y.1731 Performance Monitoring (PM) is not supported on MEPs that are configured on TEFP.

- Y.1731 Performance Monitoring (PM) is not supported on MEPs that are configured on ports.

Note   In ITU-T Y1731, 1DM measurement should mandate only PTP to have clock sync between sender & receiver.

Information About ITU-T Y.1731 Performance Monitoring in a Service Provider Network

Frame Delay and Frame-Delay Variation

The Frame Delay parameter can be used for on-demand OAM measurements of frame delay and frame-delay variation. When a maintenance end point (MEP) is enabled to generate frames with frame-delay measurement (ETH-DM) information, it periodically sends frames with ETH-DM information to its peer MEP in the same maintenance entity. Peer MEPs perform frame-delay and frame-delay variation measurements through this periodic exchange during the diagnostic interval.

An MEP requires the following specific configuration information to support ETH-DM:

- MEG level—MEG level at which the MEP exists

- Priority

- Drop eligibility—marked drop ineligible

- Transmission rate

- Total interval of ETH-DM

- MEF10 frame-delay variation algorithm

A MEP transmits frames with ETH-DM information using the TxTimeStampf information element. TxTimeStampf is the time stamp for when the ETH-DM frame was sent. A receiving MEP can compare the

TxTimeStampf value with the RxTimef value, which is the time the ETH-DM frame was received, and calculate one-way delay using the formula *frame delay = RxTimef – TxTimeStampf*.

One-way frame-delay measurement (1DM) requires that clocks at both the transmitting MEP and the receiving MEPs are synchronized. Measuring frame-delay variation does not require clock synchronization and the variation can be measured using 1DM or a frame-delay measurement message (DMM) and a frame-delay measurement reply (DMR) frame combination.

If it is not practical to have clocks synchronized, only two-way frame-delay measurements can be made. In this case, the MEP transmits a frame containing ETH-DM request information and the TxTimeStampf element, and the receiving MEP responds with a frame containing ETH-DM reply information and the TxTimeStampf value copied from the ETH-DM request information.

Two-way frame delay is calculated as *(RxTimeb–TxTimeStampf)–(TxTimeStampb–RxTimeStampf)*, where RxTimeb is the time that the frame with ETH-DM reply information was received. Two-way frame delay and variation can be measured using only DMM and DMR frames.

To allow more precise two-way frame-delay measurement, the MEP replying to a frame with ETH-DM request information can also include two additional time stamps in the ETH-DM reply information:

- RxTimeStampf—Time stamp of the time at which the frame with ETH-DM request information was received.

- TxTimeStampb—Time stamp of the time at which the transmitting frame with ETH-DM reply information was sent.

- The timestamping happens at the hardware level for DMM operations.

Note The frame-loss, frame-delay, and frame-delay variation measurement processes are terminated when faults related to continuity and availability occur or when known network topology changes occur.

An MIP is transparent to the frames with ETH-DM information; therefore, an MIP does not require information to support the ETH-DM function.

The figure below shows a functional overview of a typical network in which Y.1731 performance monitoring is used.

Figure 1: Y.1731 Performance Monitoring
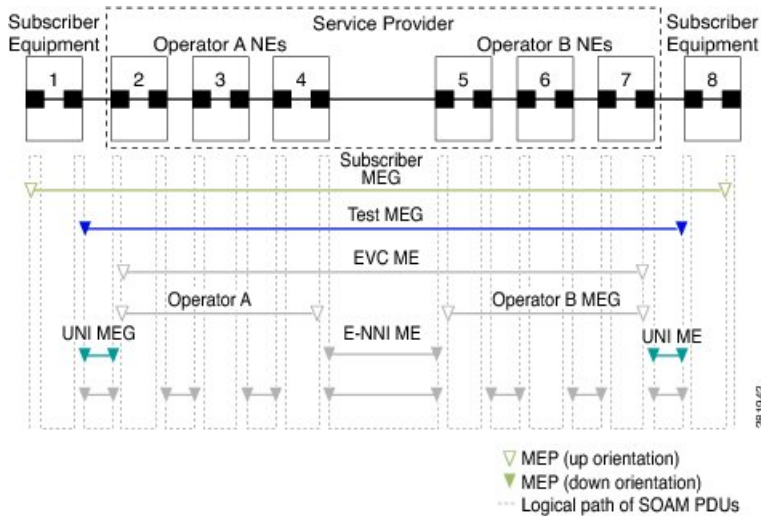
Benefits of ITU-T Y.1731 Performance Monitoring

Combined with IEEE-compliant connectivity fault management (CFM), Y.1731 performance monitoring provides a comprehensive fault management and performance monitoring solution for service providers. This comprehensive solution in turn lessens service providers' operating expenses, improves their service-level agreements (SLAs), and simplifies their operations.

How to Configure ITU-T Y.1731 Performance Monitoring in a Service Provider Network

Configuring Performance Monitoring Parameters

The following new commands were introduced that can be used to configure and display performance monitoring parameters: **debug ethernet cfm pm**, **monitor loss counters**, and **show ethernet cfm pm**.

For more information about CFM and Y.1731 performance monitoring commands, see the *Cisco IOS Carrier Ethernet Command Reference*. For more information about debug commands, see the *Cisco IOS Debug Command Reference*.

Configuration Examples for Configuring ITU-T Y.1731 Performance Monitoring Functions

Example: Configuring Performance Monitoring

For Y.1731 performance monitoring configuration examples, see *Configuring IP SLAs Metro-Ethernet 3.0 (ITU-T Y.1731) Operations*. For information about Y.1731 On-Demand and Concurrent Operations, see *Configuring IP SLAs Metro-Ethernet 3.0 (ITU-T Y.1731) Operations*.

Application of QoS Policies on ITU-T Y.1731 Egress Packets

Table 1: Feature History

Feature Name	Release Information	Feature Description
Application of QoS Policies on ITU-T Y.1731 Egress Packets	Cisco IOS XE Cupertino 17.9.1	You can now apply QoS policies on Y.1731 egress packets. Operations, Administration, and Maintenance (OAM) functions and mechanisms for Ethernet-based networks are defined in ITU-T Y.1731. With this implementation, you can prioritize OAM traffic; for example, prioritizing operational information used to detect faults and determining network performance.

The number of Y.1731 egress packets that are dropped, due to bandwidth limitation, must be reflected accurately. To facilitate the application of QoS on Y.1731 egress packets, the following requirements are implemented:

Note We recommend that you maintain sufficient free QoS labels to enable QoS for Y.1731 egress packets.

- Y.1731 performance management probe packets are subject to QoS on the measurement nodes because they have appropriate packet type of service (ToS) marking to take the same path as regular data do through the transit nodes. Packets are processed identically in the transit path.

- Y.1731 packet must bypass ingress QoS at user-network interface (UNI) and hit EQoS on the network-network interface (NNI) of endpoints.

- Ensure that Y.1731 functionalities, such as delay measurement and frame-delay measurement message (DMM) packets, are considered as transit traffic, because these packets measure the delay of green packets in the network.

• For MPLS, the CoS-EXP mapping is preserved for CPU-injected Y.1731 traffic.

Restrictions for the Application of QoS on Y.1731 Egress Packets

• In case of data traffic not marked with MPLS EXP at the imposition, all packets fall under the class-default policy-map at the egress. In such cases, if the Y.1731 sessions also have CoS 0 configured in them, then the Y.1731 packets are likely to get discarded, subject to the bandwidth availability.

• It is supported only in L2VPN (Xconnect/VPLS) services.

• It is not supported for EVC BD services.

• It is not supported with CFM Down MEP sessions.

Enabling QoS on ITU-T Y.1731 Egress Packets

Follow the steps below to apply egress QoS on ITU-T Y.1731 egress packets:

1. Execute the **platform qos-feature y1731-qos enable** command to enable QoS for Y.1731 egress packets.

Note Use the **no** form of the command to disable QoS for Y.1731 egress packets.

2. Execute the **write memory** command to save the running configuration as the startup configuration.

3. Reload the system for the configuration to take effect.

Example

```
Router#show run | sec y1731-qos
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#platform qos-feature y1731-qos en
Router(config)#end

Router#show run | sec y1731-qos
platform qos-feature y1731-qos enable
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#no platform qos-feature y1731-qos enable
Router(config)#end
```

Configuration Example

This example shows the configuration of Y.1731 Dela Measurement Messages (DMM)/1DM frames and Synthetic Loss Measurement (SLM)/Loss Measurement Management (LMM):

```
ip sla 1
ethernet y1731 delay DMM domain d1 evc evc10 mpid 1002 cos 4 source mpid 1001
frame size 1000
frame interval 10
ip sla schedule 1 life forever start-time now
```

```
ip sla 2
ethernet y1731 delay 1DM domain d1 evc evc10 mpid 1002 cos 0 source mpid 1001
frame size 1000
frame interval 10
ip sla schedule 2 life forever start-time now
ip sla 3
ethernet y1731 loss SLM domain d1 evc evc10 mpid 1002 cos 6 source mpid 1001
frame size 1000
frame interval 10
ip sla schedule 3 life forever start-time now
ip sla 4
ethernet y1731 loss LMM domain d1 evc evc10 mpid 1002 cos 8 source mpid 1001
frame interval 10
ip sla schedule 4 life forever start-time now
```