C H A P T E R 44

Configuring Y.1731 Performance Monitoring

This chapter describes how to configure the Y.1731 Performance Monitoring on the Cisco ME 3400E switches.

This chapter includes the following sections:

Understanding Y.1731 Performance Monitoring

When service providers sell connectivity services to a subscriber, a Service Level Agreement (SLA) is reached between the buyer and seller of the service. The SLA defines the attributes offered by a provider and serves as a legal obligation on the service provider. As the level of performance required by subscribers increases, service providers need to monitor the performance parameters being offered. To capture the needs of the service providers, organizations have defined various standards such as IEEE 802.1ag and ITU-T Y.1731 that define the methods and frame formats used to measure performance parameters.

Y.1731 Performance Monitoring (PM) provides a standard ethernet PM function that includes measurement of ethernet frame delay, frame delay variation, frame loss, and frame throughput measurements specified by the ITU-T Y-1731 standard and interpreted by the Metro Ethernet Forum (MEF) standards group. As per recommendations, the ME 3400E switches should be able to send, receive and process PM frames in intervals of 1000ms (1000 frames per second) with the maximum recommended transmission period being 1000ms (1000 frames per second) for any given service.

To measure SLA parameters such as frame delay or frame delay variation, a small number of synthetic frames are transmitted along with the service to the end point of the maintenance region, where the Maintenance End Point (MEP) responds to the synthetic frame. For a function such as connectivity fault management, the messages are sent less frequently, while performance monitoring frames are sent more frequently.

Figure 44-1 illustrates Maintenance Entities (ME) and Maintenance End Points (MEP) typically involved in a point-to-point metro ethernet deployment for the Y.1731 standard.

Figure 44-1   A Point-to-Point Metro Ethernet Deployment with Typical Maintenance Entities and Maintenance Points
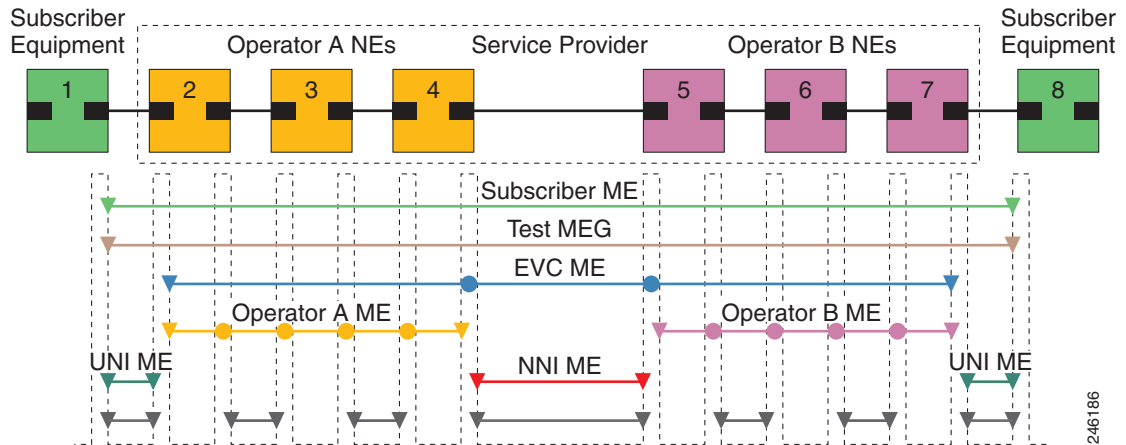
Performance monitoring parameters include

- Connectivity, page 41-2
- Frame Delay and Frame Delay Variation, page 41-2
- Frame Loss Ratio and Availability

Connectivity

The first step to performance monitoring is verifying the connectivity. Continuity check messages (CCM) are best suited for connectivity verification. Since they are optimized for fault recovery operation, they are not usually accepted as a component of an SLA due to the timescale difference between SLA and fault recovery. Instead, Connectivity Fault Management (CFM) and Continuity Check Database (CCDB) are used to verify connectivity. For more information on CFM see, Configuring Ethernet OAM, CFM, and E-LMI, page 43-1.

Frame Delay and Frame Delay Variation

Ethernet frame delay measurement (ETH-DM) is used for on-demand ethernet Operations, Administration, and Maintenance (OAM) to measure frame delay and frame delay variation.

Ethernet frame delay and frame delay variation are measured by sending periodic frames with ETH-DM information to the peer MEP and receiving frames with ETH-DM information from the peer MEP. During the interval, each MEP measures the frame delay and frame delay variation.

ETH-DM also collects information, such as worst and best case delays, average delay, and average delay variation. It provides a runtime display of delay statistics during a two-way delay measurement. ETH-DM records the last 100 samples collected per remote Maintenance End Point (MEP) or per CFM session.

There are the two methods of delay measurement, as defined by the ITU-T Y.1731 standard, One-way ETH-DM and Two-way ETH-DM. However, only Two-way ETH-DM is supported.

Two-way ETH-DM:

Each MEP transmits frames with ETH-DM request information to its peer MEP and receives frames with ETH-DM reply information from its peer MEP. Two way frame delay and frame delay variation are measured using delay measurement message (DMM) and delay measurement reply (DMR) frames.

Supported Interfaces

Y.1731 PM supports these interfaces:

- DMM on Switchport on OFM
- DMM on Switchport on IFM
- DMM on PC Switchport OFM
- DMM on PC Switchport IFM

Restrictions and Usage Guidelines

Follow these restrictions and usage guidelines when you configure Y.1731 PM:

- Y.1731 PM is not supported on these interfaces:
  - mLACP
  - Port MEPs
  - L2VFI
  - DMM support on EVC BD OFM
  - DMM support on PC EVC BD OFM
  - DMM support on EVC Xconnect OFM
  - DMM support on PC EVC Xconnect OFM
  - DMM support on EVC BD IFM
  - DMM support on PC EVC BD IFM
  - DMM support on EVC Xconnect IFM
  - DMM support on PC EVC Xconnect IFM
- Y.1731 PM is not supported on customer VLANs (C-VLANs). PM is only supported on service provider VLANs (S-VLANs).
- Frame interval of 1000 ms is only supported.
- PM does not support SNMP, although CLI and system-logging is supported.
- Frame throughput measurements are not supported.
- Clock synchronization is not mandatory for Two-way delay measurement.

These are the restrictions for PM support on port-channels:

- Adding or deleting a member link renders the session invalid.
- PM is not supported on a manual PC EVC load balancing configuration (UNI LAG).

Configuring Two-way Delay Measurement

To configure a two-way delay measurement, complete these steps:

	Command	Purpose
Step 1	**enable**	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal**	Enters global configuration mode.
Step 3	**ip sla** *n*	Enables the IP SLA configuration.
Step 4	**ethernet y1731 delay DMM domain** *domain* {{**vlan** | **evc**} *value*}{**mpid** | **mac-address**} *value* **cos** *value* **source** {**mpid** | **mac-address**} *value*	Configures a two-way delay measurement on the sender. • **evc**—Specifies the ethernet virtual circuit identifier. • **vlan**—Specifies the VLAN. • **cos**—Specifies the class of service. The value ranges between 0 and 7. • **mpid**—Specifies the destination MP ID. The value ranges between 1 and 8191. • **mac-address**—Specifies the destination mac-address. • **source**—Specifies the source MP ID or mac-address.
Step 5	**frame {interval | offset | size}** *value*	Configures Y.1731 frame parameters. • **interval**—Specifies the number of intervals. • **offset**—Specifies the frame offset to be used for calculations. The value ranges between 1 and 10. • **size**—Specifies the frame size. The value ranges between 64 and 384.
Step 6	**history {interval}** *value*	Configures Y.1731 history parameters. • **interval**—Specifies the number of intervals. The interval ranges between 1 and 10.
Step 7	**aggregate {interval}** *value*	Configures Y.1731 aggregation parameters. • **interval**—Specifies the number of intervals. The aggregation period, in seconds, ranges between 1 and 65535.
Step 8	**distribution {delay | delay-variation} {one-way | two-way}** *value*	Configures Y.1731 distribution parameters. • **delay**—Specifies delay distribution parameters. • **delay-variation**—Specifies delay-variation distribution parameters. • **one-way**—Specifies one-way distribution parameters. • **two-way**—Specifies two-way distribution parameters.
Step 9	**clock sync**	Checks whether the clocks are synchronized on the sender and receiver.

	Command	Purpose
Step 10	**max-delay** *value*	Configures the maximum delay in milliseconds. The value ranges between 1 and 65535.
Step 11	**owner** *value*	Specifies the operation owner.
Step 12	**exit**	Exits the Y.1731 submode and enters the global configuration mode.

Step 13	**ip sla schedule** *n* {**life** | **ageout** | **recurring** | **start-time**} *value* **start-time** *start time*	Schedules the two-way delay measurement on the sender.
		 • **Life**—Specifies the period time to execute in seconds.
		 • **Ageout**—Specifies the period time to keep the entry when inactive.
		 • **Recurring**—Specifies the probe to be scheduled automatically every day.
		 • **Start-time**—Specifies the time to start the entry. The options available are:
		   – after
		   – hh:mm
		   – hh:mm:ss
		   – now
		   – pending

Step 14	**exit**	Exits the global configuration mode.

Configuration Example

The following example shows a two-way frame delay measurement configuration:

```
Switch# enable
Switch# configure terminal
Switch(config)# ip sla 1
Switch(config-ip-sla)# ethernet y1731 delay DMM domain ifm_400 evc e1 mpid 401 cos 4
source mpid 1
Switch(config-sla-y1731-delay)# history interval 5
Switch(config-sla-y1731-delay)# aggregate interval 60
Switch(config-sla-y1731-delay)# exit
Switch(config)# ip sla schedule 1 start-time after 00:00:30
Switch(config)# exit
```

Verifying the Frame Delay Measurement Configurations

To verify and monitor the frame delay and frame delay variation measurement configuration, use this command in privileged EXEC mode:

```
Switch# show ip sla statistics n
Delay Statistics for        Operation n
Type of operation: Y1731 Delay Measurement
Latest operation start time: *21:37:08.895 PST Thu Aug 20 2009
Latest operation return code:
Distribution Statistics:
```

```
                    Interval <n>
                      Start time:
                      Elapsed/End time:
                      Number of measurements initiated: <x>
                      Number of measurements completed: <x>
                      Flag: OK
                      Delay:
                       Max/Avg/Min forward: x/y/z      -> Min is only shown if clocks are in sync
                       Max/Avg/Min backward: x/y/z     -> Only for two-way
                       Max/Avg/Min: x/y/z              -> Only for two-way
                       Timestamps forward: Max - 21:37:08.895 PST Thu Aug 20 2009/Min - 21:37:08.995 PST
                    Thu Aug 20 2009
                       Timestamps backward: Max - xxx/Min - yyy
                       Timestamps: Max - xxx/Min - yyy
                       Bucket Forward:
                        Bucket Range: 0-9 ms:
                         Total observations: <x>
                        Bucket Range: 10-19 ms:
                         Total observations: <x>
                        Bucket Range: 20-29 ms:
                         Total observations: <x>
                        Bucket Range: 30-39 ms:
                         Total observations: <x>
                       Delay Variance
                       Max/Avg/Min forward: x/y/z      -> Min is only shown if clocks are in sync
                       Max/Avg/Min backward: x/y/z     -> Only for two-way
                       Max/Avg/Min: x/y/z              -> Only for two-way
                       Bucket Forward:
                        Bucket Range: 0-9 ms:
                         Total observations: <x>
                        Bucket Range: 10-19 ms:
                         Total observations: <x>
                        Bucket Range: 20-29 ms:
                         Total observations: <x>
                        Bucket Range: 30-39 ms:
                         Total observations: <x>
                    Operation time to live: Forever
```

To display all details of frame delay and frame delay variation measurements, use the **show ip sla statistics detail** command.

```
Switch# show ip sla statistics detail
IPSLAs Latest Operation Statistics
IPSLA operation id: 3
Delay Statistics for Y1731 Operation 3
Type of operation: Y1731 Delay Measurement
Latest operation start time: *00:00:00.000 PST Mon Jan 1 1900
Latest operation return code: OK
Distribution Statistics:
Interval 1
 Type: Delay
 Start time:  *00:00:00.000 PST Mon Jan 1 1900
 Elapsed/End time:  *00:00:00.000 PST Mon Jan 1 1900
 Number of measurements initiated: 0
 Number of measurements completed: 0
 Flag: OK


Delay:
 Max/Avg/Min TwoWay: 140116936/140116944/140116952
 Timestamps TwoWay: Max - *00:00:00.000 PST Mon Jan 1 1900/Min - *00:00:00.000 PST Mon
Jan 1 1900
```

```
Bucket forward:
 Bucket Range: 0-4999 microsecond
  Total observations: 0
 Bucket Range: 5000-9999 microsecond
  Total observations: 0
 Bucket Range: 10000-14999 microsecond
  Total observations: 0
 Bucket Range: 15000-19999 microsecond
  Total observations: 0
 Bucket Range: 20000-24999 microsecond
  Total observations: 0
 Bucket Range: 25000-29999 microsecond
  Total observations: 0
 Bucket Range: 30000-34999 microsecond
  Total observations: 0
 Bucket Range: 35000-39999 microsecond
  Total observations: 0
 Bucket Range: 40000-44999 microsecond
  Total observations: 0
 Bucket Range: 45000--2 microsecond
  Total observations: 0

Bucket backward:
 Bucket Range: 0-4999 microsecond
  Total observations: 0
 Bucket Range: 5000-9999 microsecond
  Total observations: 0
 Bucket Range: 10000-14999 microsecond
  Total observations: 0
 Bucket Range: 15000-19999 microsecond
  Total observations: 0
 Bucket Range: 20000-24999 microsecond
  Total observations: 0
 Bucket Range: 25000-29999 microsecond
  Total observations: 0
 Bucket Range: 30000-34999 microsecond
  Total observations: 0
 Bucket Range: 35000-39999 microsecond
  Total observations: 0
 Bucket Range: 40000-44999 microsecond
  Total observations: 0
 Bucket Range: 45000--2 microsecond
  Total observations: 0

Bucket TwoWay:
 Bucket Range: 0-0 microsecond
  Total observations: 0
 Bucket Range: 1-1 microsecond
  Total observations: 0
 Bucket Range: 2-2 microsecond
  Total observations: 0
 Bucket Range: 3-3 microsecond
  Total observations: 0
 Bucket Range: 4--2 microsecond
  Total observations: 0

Delay Variance:
 Max/Avg backward positive: 140116936/140116944
 Timestamp backward positive: Max - *00:00:00.000 PST Mon Jan 1 1900
 Max/Avg backward negative: 140116936/140116944
 Timestamp backward negative: Max - *00:00:00.000 PST Mon Jan 1 1900
 Max/Avg TwoWay positive: 140116936/140116944
 Timestamp TwoWay positive: Max - *00:00:00.000 PST Mon Jan 1 1900
 Max/Avg TwoWay negative: 140116936/140116944
```

```
        Timestamp TwoWay negative: Max - *00:00:00.000 PST Mon Jan 1 1900


Bucket forward positive:
 Bucket Range: 0-4999 microsecond
  Total observations: 0
 Bucket Range: 5000-9999 microsecond
  Total observations: 0
 Bucket Range: 10000-14999 microsecond
  Total observations: 0
 Bucket Range: 15000-19999 microsecond
  Total observations: 0
 Bucket Range: 20000-24999 microsecond
  Total observations: 0
 Bucket Range: 25000-29999 microsecond
  Total observations: 0
 Bucket Range: 30000-34999 microsecond
  Total observations: 0
 Bucket Range: 35000-39999 microsecond
  Total observations: 0
 Bucket Range: 40000-44999 microsecond
  Total observations: 0
 Bucket Range: 45000--2 microsecond
  Total observations: 0

Bucket forward negative:
 Bucket Range: 0-4999 microsecond
  Total observations: 0
 Bucket Range: 5000-9999 microsecond
  Total observations: 0
 Bucket Range: 10000-14999 microsecond
  Total observations: 0
 Bucket Range: 15000-19999 microsecond
  Total observations: 0
 Bucket Range: 20000-24999 microsecond
  Total observations: 0
 Bucket Range: 25000-29999 microsecond
  Total observations: 0
 Bucket Range: 30000-34999 microsecond
  Total observations: 0
 Bucket Range: 35000-39999 microsecond
  Total observations: 0
 Bucket Range: 40000-44999 microsecond
  Total observations: 0
 Bucket Range: 45000--2 microsecond
  Total observations: 0

Bucket backward positive:
 Bucket Range: 0-4999 microsecond
  Total observations: 0
 Bucket Range: 5000-9999 microsecond
  Total observations: 0
 Bucket Range: 10000-14999 microsecond
  Total observations: 0
 Bucket Range: 15000-19999 microsecond
  Total observations: 0
 Bucket Range: 20000-24999 microsecond
  Total observations: 0
 Bucket Range: 25000-29999 microsecond
  Total observations: 0
 Bucket Range: 30000-34999 microsecond
  Total observations: 0
 Bucket Range: 35000-39999 microsecond
  Total observations: 0
```

```
     Bucket Range: 40000-44999 microsecond
      Total observations: 0
     Bucket Range: 45000--2 microsecond
      Total observations: 0

    Bucket backward negative:
     Bucket Range: 0-4999 microsecond
      Total observations: 0
     Bucket Range: 5000-9999 microsecond
      Total observations: 0
     Bucket Range: 10000-14999 microsecond
      Total observations: 0
     Bucket Range: 15000-19999 microsecond
      Total observations: 0
     Bucket Range: 20000-24999 microsecond
      Total observations: 0
     Bucket Range: 25000-29999 microsecond
      Total observations: 0
     Bucket Range: 30000-34999 microsecond
      Total observations: 0
     Bucket Range: 35000-39999 microsecond
      Total observations: 0
     Bucket Range: 40000-44999 microsecond
      Total observations: 0
     Bucket Range: 45000--2 microsecond
      Total observations: 0

    Bucket TwoWay positive:
     Bucket Range: 0-4999 microsecond
      Total observations: 0
     Bucket Range: 5000-9999 microsecond
      Total observations: 0
     Bucket Range: 10000-14999 microsecond
      Total observations: 0
     Bucket Range: 15000-19999 microsecond
      Total observations: 0
     Bucket Range: 20000-24999 microsecond
      Total observations: 0
     Bucket Range: 25000-29999 microsecond
      Total observations: 0
     Bucket Range: 30000-34999 microsecond
      Total observations: 0
     Bucket Range: 35000-39999 microsecond
      Total observations: 0
     Bucket Range: 40000-44999 microsecond
      Total observations: 0
     Bucket Range: 45000--2 microsecond
      Total observations: 0
```

To display the same outputs as the latest statistics detail command, use the **show ip sla history interval** **n** command. The number displayed is the number of intervals configured.

- Output for Loss Measurement:

```
Switch# show ip sla history 1 interval-statistics
Loss Statistics for Y1731 Operation 1
Type of operation: Y1731 Loss Measurement
Latest operation start time: *09:46:16.225 UTC Fri Nov 26 2010
Latest operation return code: OK
Distribution Statistics:

Interval 1
 Start time:  *09:46:16.225 UTC Fri Nov 26 2010
 End time:   *09:48:16.221 UTC Fri Nov 26 2010
```

```
Number of measurements initiated: 12006
Number of measurements completed: 12000
Flag: OK

Forward
 Number of Observations 11999
 Timestamps forward:
   Max - *09:47:20.252 UTC Fri Nov 26 2010/   Min - *09:48:16.221 UTC Fri Nov 26 2010
 Tx frame count: 30000
 Rx frame count: 20000
 Available indicators: 11999
 Unavailable indicators: 0
 Max/Avg/Min - (FLR % ): 1:3/2.78%/0:0
Backward
 Number of Observations 11999
 Timestamps backward:
   Max - *09:48:16.221 UTC Fri Nov 26 2010/   Min - *09:48:16.221 UTC Fri Nov 26 2010
 Tx frame count: 10000
 Rx frame count: 10000
 Available indicators: 11999
 Unavailable indicators: 0
 Max/Avg/Min - (FLR % ): 0:0/0.0%/0:0
```

- Output for Delay Measurement:

```
Switch# show ip sla history 10 interval-statistics
Delay Statistics for Y1731 Operation 10
Type of operation: Y1731 Delay Measurement
Latest operation start time: 10:58:30.144 PDT Tue Jan 4 2011
Latest operation return code: Timeout
Distribution Statistics:


Interval 1
 Start time:  10:58:30.144 PDT Tue Jan 4 2011
 End time:  10:59:05.140 PDT Tue Jan 4 2011
 Number of measurements initiated: 33
 Number of measurements completed: 34
 Flag: OK


Delay:
 Number of TwoWay observations: 34
  Max/Avg/Min TwoWay: 113364/100499/100099 (microsec)
 Time of occurrence TwoWay:
   Max - 10:59:05.140 PDT Tue Jan 4 2011
   Min - 10:58:40.076 PDT Tue Jan 4 2011

 Bin TwoWay:
       Bin Range (microsec)            Total observations
              0 - < 5000                     0
           5000 - < 10000                    0
          10000 - < 15000                    0
          15000 - < 20000                    0
          20000 - < 25000                    0
          25000 - < 30000                    0
          30000 - < 35000                    0
          35000 - < 40000                    0
          40000 - < 45000                    0
          45000 - < 4294967295              34

Delay Variance:
 Number of TwoWay positive observations: 19
  Max/Avg TwoWay positive: 13256/706 (microsec)
```

```
Time of occurrence TwoWay positive:
  Max - 10:59:05.140 PDT Tue Jan 4 2011
Number of TwoWay negative observations: 14
 Max/Avg TwoWay negative: 86/11 (microsec)
Time of occurrence TwoWay negative:
  Max - 10:58:40.076 PDT Tue Jan 4 2011


Bin TwoWay positive:
      Bin Range (microsec)          Total observations
               0 - < 5000                    18
            5000 - < 10000                    0
           10000 - < 15000                    1
           15000 - < 20000                    0
           20000 - < 25000                    0
           25000 - < 30000                    0
           30000 - < 35000                    0
           35000 - < 40000                    0
           40000 - < 45000                    0
           45000 - < 4294967295               0


Bin TwoWay negative:
      Bin Range (microsec)          Total observations
               0 - < 5000                    14
            5000 - < 10000                    0
           10000 - < 15000                    0
           15000 - < 20000                    0
           20000 - < 25000                    0
           25000 - < 30000                    0
           30000 - < 35000                    0
           35000 - < 40000                    0
           40000 - < 45000                    0
           45000 - < 4294967295               0
```

To display the performance monitoring session summary, use the **show ethernet cfm pm session summary** command.

```
Switch# show ethernet cfm pm session summary
Number of Configured Session : 1
Number of Active Session: 1
Number of Inactive Session: 0
```

Troubleshooting

These troubleshooting scenarios apply to the Y.1731 performance monitoring configurations:

Problem	Solution
When the IP SLA sessions do not come up.	Use the debug commands: • **debug ethernet cfm pm events** [**session** *<session id>*] • **debug ethernet cfm pm error** [**session** *<session id>*] • **debug ethernet cfm pm diagnostic** • **debug ethernet cfm pm ipc** [**session** *<session id>*] • **debug ethernet cfm pm packet** [**session** *<session id>*]