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ADTRAN®
Configuration Guide

Configuring Ethernet OAM Using Y.1731

This configuration guide provides information and configuration support for Ethernet operation, administration, and management (OAM) services using Y.1731 in ADTRAN Operating System (AOS) products. This guide provides an overview of Ethernet OAM and Y.1731 performance monitoring, as well as how to configure Ethernet OAM services using Y.1731. Additionally, the guide describes how to configure Y.1731 frame delay and frame loss monitoring sessions, how to use the Ethernet loopback function to verify bidirectional connectivity between maintenance entity group (MEG) end points (MEPs), and how to use the Ethernet linktrace function to determine MEP adjacency and discover network faults.

This guide consists of the following sections:

Ethernet OAM Overview

Large Ethernet networks often involve various 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.

ITU-T Y.1731: Ethernet OAM Protocol Building Block

OAM Functions and Mechanisms for Ethernet-based Networks, ITU-T standard Y.1731, is one of the many building blocks for Ethernet OAM. (Other OAM standards include Institute of Electrical and Electronics Engineers (IEEE) 802.1ag for connectivity fault management, IEEE 802.3ah for Ethernet link OAM, and Metro Ethernet Forum (MEF) Ethernet Local Management Interface (ELMI).

Y.1731 is a service layer protocol that measures service-level agreement parameters end-to-end from user-to-network interface (UNI) to UNI. To measure service-level agreement parameters such as 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 MEP responds to the synthetic frame.

The following procedures are included in the ITU-T Y.1731 standard:

- Connectivity fault management (CFM)
- Diagnostics (including throughput)
- Threshold-crossing events for out-of-bounds measurements
- Performance management
  - Frame delay
  - Frame delay variation (jitter)
  - Frame loss

Maintenance Objects and Attributes

This section describes the maintenance objects required to use Y.1731 services. Each maintenance object is described, as are some of the various attributes required to configure the object. Additional attributes of the maintenance objects will be defined later in the configuration section of this document as necessary. The following maintenance objects are described in this section:

Maintenance Entity Group

A maintenance entity group (MEG) object, as defined by Y.1731, includes different maintenance entities (MEs) that satisfy the following conditions: MEs in a MEG exist in the same administrative boundary, MEs in a MEG have the same MEG level, and MEs in a MEG belong to the same point-to-point or multipoint Ethernet connection. A MEG is a collection of MEs, and an ME refers to the direct connection between two MEPs in a MEG. A MEP forms an ME with every other MEP in the same MEG. A MEP has the ability to check for continuity and measure network performance across any of the MEs in its MEG where it is one of the two end-points. Additionally, the MEG's level attribute is used by all MEPs created within it.

An example of a MEG with multiple MEs is shown in *Figure 1* below. In it, there exists a MEG at level 6 on service virtual LAN ID (SVID) 101 between three devices. There are three MEs: the connection between A and B, the connection between B and C, and the connection between A and C. These MEPs all belong to the same MEG; however, Y.1731 measurements can be run across all of these ME connections.

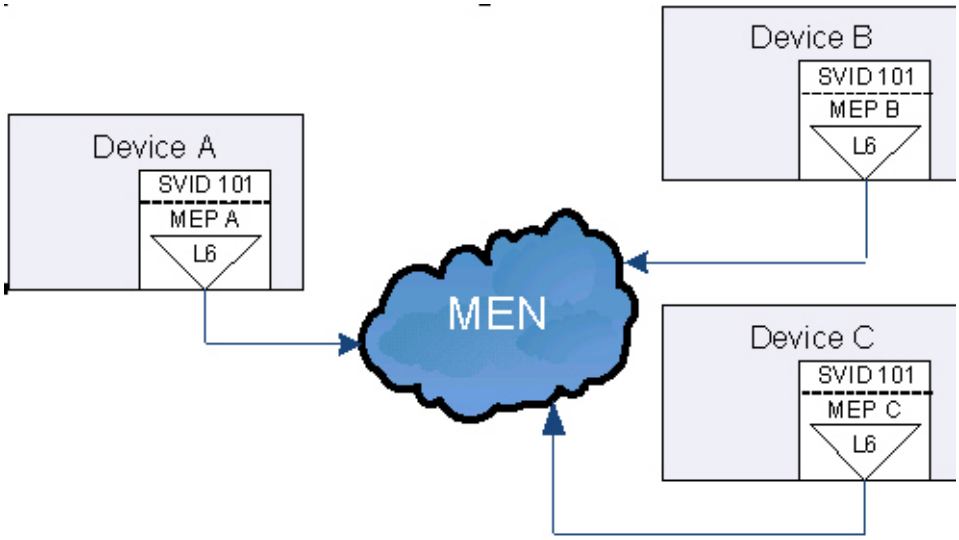

Figure 1. MEG Composed of Three MEs

The minimum attributes required to create or access a MEG are the MEG ID and MEG level after which the MEG attributes can be edited to make the MEG ready for operation. The reason why both MEG ID and MEG level must be used to create the MEG is to allow MEGs with the same name but different MEG levels to be unique. This may be required if a device must interoperate with other devices not under the control of the administrator that use the same MEG ID but operate at different MEG levels.

MEG Level

The MEG level is an attribute of a MEG that allows multiple Y.1731 services to use the same MEG name on a link but remain independent from one another if each service is using a different level. The MEG level range is 0 to 7 and the MEG level configured for a particular MEG is embedded in all Y.1731 frames transmitted by its MEPs.

The MEG level attribute is useful when Y.1731 services are nested to allow higher levels to operate across larger areas of the network compared to lower levels. Generally, a MEP will process all Y.1731 frames with a MEG level equal to or lower than its own and on the same service. Frames with a higher MEG level will not be processed, and the lower level MEP will be transparent resulting in the higher level frames being forwarded as normal data traffic.

In *Figure 2* below there are three different MEG levels: 6, 4, and 2. The highest MEG level is 6, and its Y.1731 frames pass over both the provider and operator levels allowing it to span the greatest distance in the network and provide the customer end-to-end Y.1731 services. The provider realm uses a MEG level of 4 to give the provider end-to-end Y.1731 OAM. The provider spans two different operators and each operator maintains their own realm of OAM in order to monitor services within their network of responsibility. In this example, each operator has their MEG level configured to 2 allowing MEG levels 3-7 to pass transparently over their MEPs.

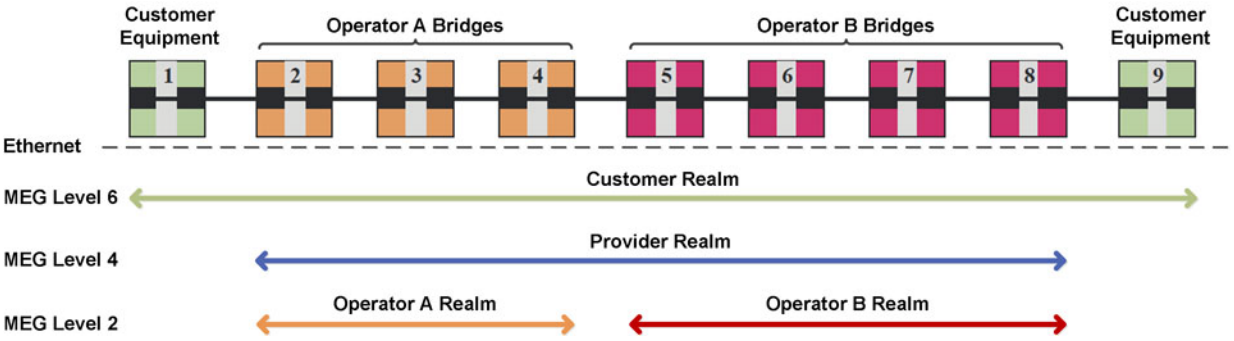

Figure 2. MEG Level Relationships

MEG ID

The MEG ID is composed of the MEG name format and MEG name. On a network device, the MEG ID must be unique on a per-MEG level basis. Two MEGs at the same MEG level cannot have the same MEG ID. By combining the MEG ID within the MEG level, multiple MEGs on the same device can use the same MEG ID if they exist at different MEG levels. An example is shown in *Table 1*. **MEG-A** in MEG level 2 and **MEG-A** in MEG level 4 are unique as they are on different MEG levels. Their services can be uniquely identified when parsing a Y.1731 frame by combining the MEG level and MEG ID values. The two **MEG-D** MEGs in MEG level 6 are not unique because they are operating on the same MEG level; therefore, their frames cannot be uniquely distinguished between one another.

Table 1. MEG ID Example

MEG level	MEG IDs
2	MEG-A, MEG-B
4	MEG-A, MEG-C
6	MEG-D, MEG-D

The MEG name format identifies the format of the MEG name and is present in Y.1731 frames transmitted by MEPs. The name formats supported are character strings and the ITU-T Carrier Code (ICC)-based format. The use of character strings allows MEPs in the MEG to interoperate with MEPs created on devices supporting 802.1ag.

The character string format indicates the name is composed of ASCII characters and the valid range for its length is 1 to 45 characters.

The ICC-based format consists of 13 characters of two subfields: the ICC followed by a unique MEG code (UMC).

Service Type and Service Value

For ADTRAN products, the service type is always a type of VLAN (for example, service VLAN tag (s-tag), customer edge VLAN tag (CE-VLAN tag), or stacks of tags such as s-tag and CE-VLAN tag) and the service value. Due to the rules of tag encapsulation, a MEP in a MEG of type S-VLAN is not compatible with a MEP in a MEG of type CE-VLAN.

Continuity Check Message Interval and Mode

The continuity check message (CCM) interval is the interval at which the local MEP will transmit CCMs and the interval at which it expects to receive CCMs from each peer in the MEG. In a properly configured MEG, all MEPs will use the same rate. *Table 2* lists the options allowed by the Y.1731 standard expressed as both retransmission interval and frames per time unit. The enumeration value is present in each CCM allowing the local MEP to indicate to its peers the period it is configured to use.

Table 2. CCM Intervals

Enumeration Value	Interval	Frames per x
1	3.33 ms	300 frames per second
2	10 ms	100 frames per second
3	100 ms	10 frames per second
4	1 s	1 frame per second
5	10 s	6 frames per minute
6	1 min	1 frame per minute
7	10 min	6 frames per hour

The CCM mode dictates the media access control (MAC) destination address used by local MEPs when transmitting CCMs. The CCM mode options are unicast or multicast. If unicast is selected, every CCM interval a local MEP in the MEG will transmit CCMs equal to the number of valid remote MEPs in the MEP database. A remote MEP is valid if a CCM has been received from it in the past, and its MAC address has been learned. An additional way to learn a remote MEP MAC address is by issuing a multicast loopback message (LBM) and storing the MAC addresses of all remote MEPs that send a loopback response (LBR) in response. If the CCM mode is unicast, one of the two following operations must be performed in order for a MEP to learn the MAC addresses of all remote MEPs in the MEG: multicast LBM or user provisioning of each remote MEP MAC address. If multicast is selected, local MEPs in the MEG will transmit a single CCM every CCM interval with the correct multicast Class 1 destination address.

Remote MEP

Remote MEPs are defined by their MEP identifier (MEP ID) which must be unique across the MEG. A remote MEP entry can operate in one of two modes dictated by the MEP database rule of the MEG. A remote MEP can operate in static or discovered mode.

- A static remote MEP will raise the loss of continuity (LOC) condition if it transitions from the OK state to the FAIL state. A static remote MEP will also be stored in the startup configuration after a write and will be restored following a subsequent reload.
- A discovered remote MEP will not raise the LOC condition if it transitions from the OK state to the Fail state. After a discovered remote MEP remains in the Fail state for 100 minutes, it will be removed from the MEG's MEP database. A discovered remote MEP will not be stored in the startup configuration and must be rediscovered after a system reload.

Remote MEP Database

On a network device, each MEG object manages its own MEP database. The MEP database contains all remote MEPs and also defines how remote MEPs can be added.

Maintenance Entity Group End Point

A MEP object, as defined by Y.1731, is the end point of an Ethernet MEG that initiates and terminates OAM frames for fault management and performance monitoring. A local MEP is created within a MEG on an interface on the network device. MEPs configured on other devices in the same MEG are called remote MEPs. The minimum attributes required to properly configure a MEP are a MEP ID, interface, and direction.

MEP ID

The MEP ID is the MEP's own identity in the MEG. The valid range for a MEP ID is 1 to 8191, and each MEP in the MEG must have a unique MEP ID. The MEP ID is present in all CCM frames and in LBRs in response to a multicast LBM.

Interface

The interface is the physical interface on which the MEP will reside. It must be an interface that supports Ethernet transport. Depending on the interfaces present on a product, the options could be EFM group, Ethernet, or Gigabit Ethernet.

Direction

The direction is the direction the MEP's active side will be facing in relationship to the switch. The two options are up and down. With an up direction, the MEP will receive frames egressing the switch and destined for the interface on which it resides, and it will transmit frames towards the switch from its interface. With a down direction, the MEP will receive frames ingressing the interface on which it resides before they reach the switch and will transmit frames out its interface without any interaction with the switch fabric.

Maintenance Entity Group Intermediate Point

A MEG intermediate point (MIP) object, as defined by Y.1731, is an intermediate point in a MEG capable of reacting to some OAM frames but not initiating OAM frames. A MIP is created within a MEG object of the network device. An ITU Y.1731 MIP is the equivalent of an IEEE 802.1ag MIP.

NetVanta products running AOS do not support the creation of MIPs.

Hardware and Software Requirements and Limitations

Ethernet OAM services using Y.1731 are supported on AOS products as outlined in the *Product Feature Matrix*, available online at *https://supportforums.adtran.com*.

In AOS version R11.10.0, multicast support was added. This feature allows a single multicast message to be sent to any MEP(s) in a MEG, or any device capable of receiving a multicast Y.1731 message, and trigger a response.

In AOS version R11.5.0, support for double-tagged MEPs was added. Both an s-tag and CE-VLAN tag can now be specified.

ADTRAN products with AOS version R11.4.0 and earlier support only the single-tagged service type. A MEP will examine only the outermost tag in a stack, if present.

NetVanta products running AOS do not support the creation of MIPs.

Configuring Ethernet OAM Services Using Y.1731

This section provides the minimum steps that are required to establish a basic Ethernet OAM service using Y.1731 and includes an example configuration. Follow these steps to establish Ethernet OAM service:

Step 1: Access the CLI

To access the CLI on your AOS unit, follow these steps:

1. Boot up the unit.
2. Telnet to the unit (**telnet** <*ip address*>), for example:

   telnet 10.10.10.1

> *If during the unit's setup process you have changed the default Internet Protocol (IP) address (**10.10.10.1**), use the configured IP address.*

3. Enter your user name and password at the prompt.

> *The AOS default user name is **admin** and the default password is **password**. If your product no longer has the default user name and password, contact your system administrator for the appropriate user name and password.*

4. Enter the Enable mode by entering **enable** at the prompt as follows:

   >**enable**

5. Enter your Enable mode password at the prompt.

> *The default Enable mode password is **password**. If your product no longer has the default Enable password, contact your system administrator for the appropriate password.*

6. Enter the unit's Global Configuration mode as follows:

   #**configure terminal**

   (config)#

Step 2: Enable the Y.1731 Subsystem

To enable the Y.1731 subsystem, enter the **ethernet y1731 enable** command at the Global Configuration command prompt.

(config)#**ethernet y1731 enable [down-mep md-level-check-filter]**

Syntax	Description
down-mep md-level-check-filter	Optional. Enables Y.1731 frames received on a UNI port to be discarded if the MD level of the Y.1731 frame is less than or equal to the MEG level of the down MEP configured on the device.

The following example enables the Y.1731 subsystem:

(config)**#ethernet y1731 enable**

Step 3: Create and Configure a Maintenance Entity Group

For proper provisioning, a MEP requires a running Ethernet virtual connection (EVC) with an s-tag equal to the service on which the MEP is operating.

For a down MEP, the MEP must be created on an interface that is a Metro Ethernet network (MEN) port of the EVC.

Up MEPs are only supported on UNI ports and, therefore, an up MEP must be created on a UNI of an EVC map which is connected to an EVC whose s-tag is equal to the MEP's service. To create a MEG, follow these steps on each unit to be included in the MEG:

The MEG name and MEG level of the MEGs created on each unit must be identical in order for the MEPs to operate within the same MEG.

1. From the Global Configuration command prompt, use the **ethernet y1731 meg** command to create a MEG and access the Y.1731 MEG configuration command set.

   (config)#**ethernet y1731 meg [char-string** *<name>* **| icc-umc** *<name>***] level** *<value>*

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ITU Carrier Code Unique MEG ID Code (ICC-UMC) format. Maximum length is 13 ASCII characters.
level *<value>*	Specifies the MEG level. Valid range is **0** to **7**.

   The following example creates a MEG named **MEG3** with a MEG level of 3:

   (config)#**ethernet y1731 meg char-string MEG3 level 3**

   (config-y1731-meg MEG3)#

2. Use the **ccm interval** command to specify the CCM interval. The default CCM interval is 1 second.

   (config-y1731-meg MEG3)#**ccm interval [100-milliseconds | 1-second | 10-seconds | 1-minute | 10-minutes]**

   The following example specifies a CCM interval of 1 minute:

   (config-y1731-meg MEG3)#**ccm interval 1-minute**

3. Use the **mep-database rule** command to specify the rule for adding new entries to the MEP database.

   (config-y1731-meg MEG3)#**mep-database rule [auto-discovery | auto-learning |**

configured-only]

Syntax	Description
auto-discovery	Specifies that CCMs received from remote MEPs that have not been previously configured are added as discovered remote MEPs in the MEP database.
auto-learning	Specifies that CCMs received from remote MEPs that have not been previously configured are added as static remote MEPs in the MEP database.
configured-only	Default. Specifies that CCMs received from remote MEPs must match the configured static remote MEP entries. CCMs received from an unknown remote MEP create the Unexpected MEP condition. Additionally, all remote MEPs in the database operate in static mode.

The following example specifies that CCMs received from previously unconfigured remote MEPs are added as discovered remote MEPs in the MEP database:

```
(config-y1731-meg MEG3)#mep-database rule auto-discovery
```

4. Specify the service type and service value of traffic on the MEG. Only one type of tagging (either single-tagged or double-tagged) can be specified.
   a. Use the **service single-tagged** command to specify the service type and service value of traffic on the MEG. This feature is used together with the Y.1731 EtherType, level, and local and remote MEP ID to identify Y.1731 packets that should be processed by the maintenance point (MP). The command indicates that the L2 header of the Y.1731 packets to be processed should contain either a single CE-VLAN ID tag or s-tag with the value specified.

      ```
      (config-y1731-meg MEG3)#service single-tagged [ce-vlan-id <vlan id> |
      s-tag <vlan id>]
      ```

Syntax	Description
ce-vlan-id <*vlan id*>	Specifies the CE-VLAN ID tag of traffic on the MEG. Valid range is **1** to **4094**.
s-tag <*tag*>	Specifies the s-tag of traffic on the MEG. Valid range is **1** to **4094**.

      The following example specifies that packets should contain an **s-tag** with a value of **1000**:

      ```
      (config-y1731-meg MEG3)#service single-tagged s-tag 1000
      ```

   b. Use the **service double-tagged** command to specify the service type and service value of traffic on the MEG. This feature is used together with the Y.1731 EtherType, level, and local and remote MEP ID to identify Y.1731 packets that should be processed by the MP. The command indicates that the L2 header of the Y.1731 packets to be processed should contain both a CE-VLAN ID tag and s-tag with the specified values.

      ```
      (config-y1731-meg MEG3)#service double-tagged s-tag <vlan id> ce-vlan-id
      <vlan id>
      ```


Syntax	Description
ce-vlan-id <*vlan id*>	Specifies the CE-VLAN ID tag of traffic on the MEG. Valid range is **1** to **4094**.
s-tag <*tag*>	Specifies the s-tag of traffic on the MEG. Valid range is **1** to **4094**.

The following example specifies that packets should contain both an **s-tag** with a value of **1000** and a CE-VLAN ID of **100**:

```
(config-y1731-meg MEG3)#service double-tagged s-tag 1000 ce-vlan-id 100
```

Step 4: Create and Configure Local and Remote MEPs

After creating MEGs on the units, local and remote MEPs must be defined on each unit within the MEGs. To create and configure local and remote MEPs on a unit, follow these steps:

1. Use the **remote-mep** command to add a remote MEP to the MEG. The remote MEP automatically becomes an entry in the remote MEP database for each local MEP in the MEG.

   ```
   (config-y1731-meg MEG3)#remote-mep <id>
   ```

Syntax	Description
<*id*>	Specifies the MEP identifier of the remote MEP. Valid range is **1** to **8191**.

   The following example creates a remote MEP with a MEP ID of **302**:

   ```
   (config-y1731-meg MEG3)#remote-mep 302
   ```

2. Use the **local-mep** command to access the Y.1731 Local MEP Configuration mode. If the MEP does not exist, a new one is created.

   ```
   (config-y1731-meg MEG3)#local-mep <id>
   ```

Syntax	Description
<*id*>	Specifies the MEP identifier of the local MEP. Valid range is **1** to **8191**.

   The following example creates a MEP with a MEP ID of **301**:

   ```
   (config-y1731-meg MEG3)#local-mep 301
   (config-y1731-mep301)#
   ```


3. Use the **direction** command to specify the direction that the active side of the MEP will be pointing in relation to the switch.

```
(config-y1731-mep301)#direction [up | down]
```

Syntax	Description
down	Specifies that the MEP will receive frames ingressing its associated interface before they reach the switch and will transmit those frames out the MEP's associated interface without any interaction with the switch.
up	Specifies that the MEP will receive frames egressing the switch and destined for the MEP's associated interface and will transmit frames towards the switch from the MEP's associated interface.

The following example specifies the MEP direction as **down**:

```
(config-y1731-mep301)#direction down
```

4. Use the **priority** command to configure the frame priority of tagged frames transmitted by the MEP.

```
(config-y1731-mep301)#priority <value>
```

Syntax	Description
<*value*>	Specifies the value of the priority bit in tagged frames transmitted by the MEP. Valid range is **0** to **7**. The default value is **7**.

The following example specifies a frame priority of **2** for tagged frames transmitted by the MEP:

```
(config-y1731-mep301)#priority 2
```

5. Use the **set interface** command to associate an interface or Ethernet in the first mile (EFM) group with the MEP.

```
(config-y1731-mep301)#set interface [efm-group <slot/group> |
gigabit-ethernet <slot/port>]
```

Syntax	Description
efm-group <*slot/group*>	Associates the specified EFM group with the MEP.
gigabit-ethernet <*slot/port*>	Associates the specified Gigabit Ethernet interface with the MEP.

The following example associates Gigabit Ethernet interface **0/1** with the MEP:

```
(config-y1731-mep301)#set interface gigabit-ethernet 0/1
```

6. Use the **ccm-enabled** command to enable transmission of continuity check message (CCM) frames by the MEP.
The following example enables transmission of CCM frames by the MEP:

```
(config-y1731-mep301)#ccm-enabled
```


7. Use the **no shutdown** command to enable the MEP.

```
(config-y1731-mep301)#no shutdown
```

Ethernet Y.1731 Basic Configuration Example

The following example is an Ethernet network consisting of two devices that belong to the same MEG. A MEP exists on each device to define the scope of the network the MEG covers. In this configuration, a MEG with identical MEG name and MEG level is created on each device, and a local MEP is created within the MEG on each device.

> NOTE
>
> *The configuration parameters in this example are sample configurations only. You should configure this application in a manner consistent with the needs of your network. CLI prompts have been removed from the example to allow you to copy and paste directly from this guide into the CLI. You should not copy this configuration without first making the necessary adjustments to ensure it will function properly in your network.*

Figure 3. Network Diagram

Device A Configuration

```
!
ethernet y1731 enable
!
!
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
  remote-mep 302
  local-mep 301
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    no shutdown
!
```

Device B Configuration

```
!
ethernet y1731 enable
!
!
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
```



```
  remote-mep 301
  local-mep 302
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    no shutdown
!
```

Configuring Frame Delay Performance Monitoring

The following sections provide information on configuring and viewing frame delay performance monitoring sessions:

- *One-Way Frame Delay Performance Monitoring on page 14*
- *Two-Way Frame Delay Performance Monitoring on page 20*

One-Way Frame Delay Performance Monitoring

A one-way frame delay performance monitoring session can be run between any two MEPs in the same MEG. A one-way delay measurement message (1DM) frame is sent from the source MEP to the target MEP which terminates the 1DM frame and calculates the one-way frame delay. The 1DM frame is constructed to meet the Y.1731 standard definition.

Two timestamps are used for one-way frame delay messaging. The source MEP applies a transmit timestamp to the outgoing 1DM frame and the target MEP applies a receive timestamp upon reception of the 1DM frame. *Table 3* shows which MEP applies each timestamp.

Table 3. One-way Frame Delay Timestamps

Timestamp	Application Points
TxTimeStampf	Applied to the 1DM frame by the source MEP when transmitting the 1DM frame to the target MEP. Corresponds to the time when the 1DM frame is transmitted.
RxTimeStampf	Applied to the 1DM frame by the target MEP when receiving the 1DM frame. Corresponds to the time when the 1DM frame was received.

A local MEP can run several one-way frame delay performance monitoring sessions between it and a target as long as each session uses a different priority value. This allows the target MEP to simultaneously monitor frame delay performance at different classes of service.

If the two MEPs are time-of-day synchronized, all of the measurements below can be accurately performed:

- Minimum one-way frame delay
- Maximum one-way frame delay
- Mean one-way frame delay
- Maximum one-way frame delay variation (ref-pkt)
- Maximum one-way frame delay variation (inter-pkt)

Since the MEP initiating and transmitting the one-way frame delay session is not the same as the MEP processing and measuring the one-way frame delay, the transmit sessions are configured on the source MEP and the receive attributes are configured on the target MEP.

> NOTE *The instructions provided in this section assume that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to* *Configuring Ethernet OAM Services Using Y.1731 on page 7**.*

Configuring the Target Device

To configure the target device for a one-way frame delay performance monitoring session, follow these steps:

1. From the Global Configuration command prompt, use the **ethernet y1731 meg** command to access the Y.1731 MEG created in *Step 3: Create and Configure a Maintenance Entity Group on page 9*.

   ```
   (config)#ethernet y1731 meg [char-string <name> | icc-umc <name>] level <value>
   ```

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
level *<value>*	Specifies the MEG level. Valid range is **0** to **7**.

   The following example accesses the MEG named **MEG3** with a MEG level of 3:

   ```
   (config)#ethernet y1731 meg char-string MEG3 level 3
   (config-y1731-meg MEG3)#
   ```

2. Use the **local-mep** command to access the local MEP created in *Step 4: Create and Configure Local and Remote MEPs on page 11*.

   ```
   (config-y1731-meg MEG3)#local-mep <id>
   ```

Syntax	Description
<id>	Specifies the MEP identifier of the local MEP. Valid range is **1** to **8191**.

   The following example accesses a local MEP with a MEP ID of **302**:

   ```
   (config-y1731-meg MEG3)#local-mep 302
   (config-y1731-mep302)#
   ```


3. Use the **frame-delay one-way measurement-interval** command to specify the interval over which frame delay statistics are generated.

```
(config-y1731-mep302)#frame-delay one-way measurement-interval <seconds>
```

Syntax	Description
measurement-interval <*seconds*>	Specifies the interval over which frame delay statistics are generated. Valid range is **60** to **900** seconds. The default is **60** seconds.

The following example specifies a measurement interval of **90** seconds:

```
(config-y1731-mep302)#frame-delay one-way measurement-interval 90
```

Configuring the Source Device

To configure the source device for a one-way frame delay performance monitoring session, complete the following:

1. From the Global Configuration command prompt, use the **ethernet y1731 meg** command to access the Y.1731 MEG created in *Step 3: Create and Configure a Maintenance Entity Group on page 9*.

```
(config)#ethernet y1731 meg [char-string <name> | icc-umc <name>] level
<value>
```

Syntax	Description
char-string <*name*>	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc <*name*>	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
level <*value*>	Specifies the MEG level. Valid range is **0** to **7**.

The following example accesses the MEG named **MEG3** with a MEG level of 3:

```
(config)#ethernet y1731 meg char-string MEG3 level 3
(config-y1731-meg MEG3)#
```

2. Use the **local-mep** command to access the local MEP created in *Step 4: Create and Configure Local and Remote MEPs on page 11*.

```
(config-y1731-meg MEG3)#local-mep <id>
```

Syntax	Description
<*id*>	Specifies the MEP identifier of the local MEP. Valid range is **1** to **8191**.

The following example accesses a local MEP with a MEP ID of **301**:

```
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep301)#
```


3. Use the **frame-delay one-way measurement-interval** command to specify the interval over which one-way frame delay statistics are generated. If no measurement interval is specified, the default interval of **60** seconds is used.

```
(config-y1731-mep301)#frame-delay one-way measurement-interval <seconds>
```

Syntax	Description
<seconds>	Specifies the interval over which frame delay statistics are generated. Valid range is **60** to **900** seconds.

The following example specifies a measurement interval of 90 seconds:

```
(config-y1731-mep301)#frame-delay measurement-interval 90
```

4. Use the **frame-delay one-way** command to create aY.1731 one-way frame delay performance monitoring session between MEPs and enter the One-Way Frame Delay Monitoring Session Configuration mode.

```
(config-y1731-mep301)#frame-delay one-way <mep id | target mac address |
multicast> priority <value>
```

Syntax	Description
<mep id | *target mac address* | **multicast>**	Specifies the MEP ID or MAC address of the target MEP, or configures the session for multicast. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
priority *<value>*	Specifies the VLAN priority of the target MEP. Valid range is **0** to **7**.

The following example creates a one-way frame delay monitoring session with a remote MEP with a MEP ID of **302** and a VLAN priority of **7**:

```
(config-y1731-mep301)#frame-delay one-way 302 priority 7
(config-y1731-frame-delay)#
```

5. Use the **interval** command to set the time between 1DM transmissions.

```
(config-y1731-frame-delay)#interval <milliseconds>
```

Syntax	Description
interval *<milliseconds>*	Specifies the time in milliseconds (ms) between 1DM transmissions. Valid range is **100** to **10000** ms. The default is **1000** ms.

The following example specifies a 1DM transmission interval of **2000** ms:

```
(config-y1731-frame-delay)#interval 2000
```


6. Use the **size** command to set the size of the 1DM frame.

```
(config-y1731-frame-delay)#size <bytes>
```

Syntax	Description
<bytes>	Specifies the size of the 1DM frame in bytes. If no size is specified, 1DM fames are zero-padded up to 64 bytes. If the size is specified, a data type-length value (TLV) is used to ensure the 1DM frame is the correct length. Valid range is **0**, or **64** to **2000** bytes.

The following example specifies a 1DM frame size of **64** bytes:

```
(config-y1731-frame-delay)#size 64
```

7. Use the **data** command to specify a hex pattern used to fill the data TLV.

```
(config-y1731-frame-delay)#data <hex pattern>
```

Syntax	Description
<hex pattern>	Specifies a hex pattern used to fill the data TLV. Valid range is **0000** to **FFFF**. The default value is **0000**.

The following example specifies a hex pattern of **FFFF**:

```
(config-y1731-frame-delay)#data FFFF
```

8. Use the no shutdown command to enable the one-way frame delay performance monitoring session:

```
(config-y1731-frame-delay)#no shutdown
```

One-Way Frame Delay Performance Monitoring Example Configuration

The following example configuration creates a one-way frame delay monitoring session between two devices on a network. One device is configured as the source device for the session, and another device is configured as the target. The source MEP transmits 1DM frames toward the target device at the specified interval, and the target MEP measures the one-way frame delay. The example configuration assumes that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7*.

The configuration parameters in this example are sample configurations only. You should configure this application in a manner consistent with the needs of your network. CLI prompts have been removed from the example to allow you to copy and paste directly from this guide into the CLI. You should not copy this configuration without first making the necessary adjustments to ensure it will function properly in your network.

Source Device Configuration

```
!
ethernet y1731 enable
!
```



```
!
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
  remote-mep 302
  local-mep 301
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    no shutdown
    frame-delay one-way 302 priority 7
      no shutdown
!
```

Target Device Configuration

```
!
ethernet y1731 enable
!
!
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
  remote-mep 301
  local-mep 302
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    frame-delay one-way measurement-interval 90
    no shutdown
!
```

Viewing the One-Way Frame Delay Performance Monitoring Session Output

To view the one-way frame delay performance monitoring session output, follow these steps on the target device:

1. From the Enable command prompt, enter the **application** command:

   #**application**

2. Use the ethernet y1731 meg command to access the Y.1731 Application mode:

   (app)#**ethernet y1731 meg [char-string** *<name>* **| icc-umc** *<name>***]** *<level> <mep id>*

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is **45** ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

   The following example accesses the Y.1731 Application mode:


```
(app)#ethernet y1731 meg char-string MEG3 3 302
(app-y1731 MEG3)#
```

3. Use the **show frame-delay one-way** command to show the frame delay statistics and configuration of one-way frame delay monitoring sessions:

```
(app-y1731 MEG3)#show frame-delay one-way [<session id> realtime]
```

Syntax	Description
<session id>	Optional. Specifies that results for a specific frame delay monitoring session are displayed. Valid range is **1** to **n**.
realtime	Optional. Displays full-screen output in realtime. Information is continuously updated on the console.

The following example displays the statistics for one-way frame delay session **1**:

```
#application
(app)#ethernet y1731 meg char-string MEG3 3 301
(app-y1731 MEG3)#show frame-delay one-way 1
```

```
Session 1 is Active
  Source MAC                    : 00:a0:c8:00:00:01
  VLAN Priority                 : 7
  Receive Interval          ms  : 1000.12
  Measurement Interval            Previous        Current
  Receive Count                 : 60              55
  Delay
    Mean                    ms  : 0.08            0.09
    Maximum                 ms  : 0.10            0.21
    Minimum                 ms  : 0.07            0.07
Delay Variation Maximum
    Inter-packet            ms  : 0.03            0.13
    Reference-packet        ms  : 0.03            0.14
```

Two-Way Frame Delay Performance Monitoring

A two-way frame delay performance monitoring session can be run between any two MEPs in the same MEG. A delay measurement message (DMM) is sent from the source MEP to the target MEP which replies with a delay measurement reply (DMR). The DMMs and DMRs are constructed to meet the Y.1731 standard definition.

The four timestamp method used in the DMR frame requires the target MEP to apply timestamps to the DMR frame indicating arrival and transmission time. This allows the source MEP to remove processing time at the target MEP and only measure the time the DMM/DMR frame was on the wire. Frame delay is calculated for each DMM/DMR transaction. *Table 4 below* displays which MEP applies a given timestamp.

TimeStamp Application Points

Table 4. Two-Way Frame Delay Timestamps

Timestamp	Application
TxTimeStampf	Applied to the DMM frame by the source MEP when transmitting a DMM frame to the target MEP. Corresponds to the time when the source MEP transmitted the DMM frame.
RxTimeStampf	Applied to the DMM frame by the target MEP when receiving a DMM frame from the source MEP. Corresponds to the time when the target MEP received the DMM frame.
TxTimeStampb	Applied to the DMR frame, along with TxTimeStampf and RxTimeStampf which are copied from the received DMM frame by the target MEP when transmitting DMR frames. Corresponds to the time when the DMR frame is transmitted by the target MEP.
RxTimeStampb	Applied to the DMR frame by the source MEP when receiving DMR frames. Corresponds to the time in which the DMR frame is received at the source MEP.

A local MEP can run several two-way frame delay performance monitoring sessions between it and a target as long as each session uses a different priority value. This allows the MEP to simultaneously monitor frame delay performance at different classes of service. The following metrics can be monitored using two-way frame delay:

- Minimum two-way frame delay
- Maximum two-way frame delay
- Mean two-way frame delay
- Maximum two-way frame delay variation (ref-pkt)
- Maximum two-way frame delay variation (inter-pkt)

If the two MEPs are time-of-day synchronized, additional measurements can be performed in both the source-to-target (out) direction and in the target-to-source (in) direction:

- Minimum one-way frame delay
- Maximum one-way frame delay
- Mean one-way frame delay

The instructions provided in this section assume that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7**.*

Configuring an Immediate Two-Way Frame Delay Monitoring Session

To create a two-way frame delay monitoring session that starts immediately, follow these steps:

1. From the Global Configuration command prompt, use the **ethernet y1731 meg** command to access the Y.1731 MEG created in *Step 3: Create and Configure a Maintenance Entity Group on page 9*.

   (config)#**ethernet y1731 meg [char-string** *<name>* **| icc-umc** *<name>***] level** *<value>*

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
level *<level>*	Specifies the MEG level. Valid range is **0** to **7**.

The following example accesses the MEG named **MEG3** with a MEG level of **3**:

```
(config)#ethernet y1731 meg char-string MEG3 level 3
(config-y1731-meg MEG3)#
```

2. Use the **local-mep** command to access the local MEP created in *Step 4: Create and Configure Local and Remote MEPs on page 11*.

```
(config-y1731-meg MEG3)#local-mep <id>
```

Syntax	Description
<id>	Specifies the MEP identifier of the local MEP. Valid range is **1** to **8191**.

The following example accesses a MEP with a MEP ID of **301**:

```
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep301)#
```

3. Use the **frame-delay two-way** command to create a Y.1731 two-way frame delay monitoring session between MEPs and enter the Two-Way Frame Delay Monitoring Session Configuration mode:

```
(config-y1731-mep301)#frame-delay two-way <mep id | target mac address |
                      multicast> priority <priority>
```

Syntax	Description
<mep id | *target mac address* | **multicast**>	Specifies the MEP ID or MAC address of the target MEP, or configures the session for multicast. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
priority *<priority>*	Specifies the VLAN priority of the target MEP. Valid range is **0** to **7**.

The following example creates a two-way frame delay monitoring session with a remote MEP, with a MEP ID of **302**, and a VLAN priority of **7**:

```
(config-y1731-mep301)#frame-delay two-way 302 priority 7
(config-y1731-frame-delay)#
```


4. Use the **interval** command to set the time between DMM transmissions.

```
(config-y1731-frame-delay)#interval <interval>
```

Syntax	Description
<interval>	Specifies the time in milliseconds (ms) between DMM transmissions. Valid range is **100** to **900000** ms. The default is **1000** ms.

The following example specifies a DMM transmission interval of **2000** ms:

```
(config-y1731-frame-delay)#interval 2000
```

5. Use the **measurement-interval** command to specify the interval over which frame delay statistics are generated.

```
(config-y1731-frame-delay)#measurement-interval <measurement interval>
[<repetition time> | none]
```

Syntax	Description
<measurement interval>	Specifies the number of seconds over which frame delay statistics are generated. If used with the *<repetition-time>* variable, must be in minute intervals (multiples of 60) and less than or equal to the repetition time. Valid range is **60** to **86400** seconds. The default is **60** seconds.
<repetition time>	Specifies the number of seconds between the start time of measurement intervals. The repetition time must be at least as long as the measurement interval and must be in minute intervals (multiples of 60). Valid range is **60** to **86400** seconds. The default is **60** seconds.
none	Specifies that the repetition time is equal to the measurement interval.

The following example specifies a measurement interval of **60** seconds and a repetition time of **180** seconds:

```
(config-y1731-frame-delay)#measurement-interval 60 180
```

6. Use the **size** command to set the size of the DMM frame.

```
(config-y1731-frame-delay)#size <bytes>
```

Syntax	Description
<bytes>	Specifies the size of the DMM frame in bytes. If no size is specified, DMM fames are zero-padded up to 64 bytes. If the size is specified, a data type-length value TLV is used to ensure the DMM frame is the correct length. Valid range is **0**, or **64** to **2000** bytes. The default is **0** bytes.

The following example specifies a DMM frame size of **64** bytes:

```
(config-y1731-frame-delay)#size 64
```


7. Use the **data** command to specify a hex pattern used to fill the data TLV.

```
(config-y1731-frame-delay)#data <hex pattern>
```

Syntax	Description
<hex pattern>	Specifies a hex pattern used to fill the data TLV. Valid range is **0000** to **FFFF**. The default value is **0000**.

The following example specifies a hex pattern of **FFFF**:

```
(config-y1731-frame-delay)#data FFFF
```

8. Use the **stop-time** command to specify the duration of the frame delay monitoring session (in seconds). This is how long the frame delay monitoring session will run after the session begins.

```
(config-y1731-frame-delay)#stop-time <stop time | forever>
```

Syntax	Description
<stop time>	Specifies the duration in seconds of the frame delay monitoring session. Valid range is **0** to **15552000** seconds (180 days).
forever	Specifies that the frame delay monitoring session will continue until it is manually stopped. This is the default value.

9. Use the **no shutdown** command to enable the two-way frame delay monitoring session:

```
(config-y1731-frame-delay)#no shutdown
```

Configuring a Scheduled Two-Way Frame Delay Monitoring Session

To schedule a two-way frame delay monitoring session to begin at a specified time of day, follow these steps:

1. From the Enable command prompt, enter the **application** command:

```
#application
```

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode:

```
(app)#ethernet y1731 meg [char-string <name> | icc-umc <name>] <level> <mep id>
```

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is **45** ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

The following example accesses the Y.1731 Application mode:

```
(app)#ethernet y1731 meg char-string MEG3 3 302
(app-y1731 MEG3)#
```

3. Use the **frame-delay two-way** command to configure a a scheduled two-way frame delay monitoring session:

```
(app)#frame-delay two-way <mep id | target mac address | multicast> priority
<priority> (count <count> | stop-time <stop>) interval <interval>
measurement-interval <measurement-interval> repetition-time
<repetition-time> start-time <start> size <size> data <data>
```

Syntax	Description
<*mep id* | *target mac address* | **multicast**>	Specifies the MEP ID or MAC address of the target MEP, or configures the session for multicast. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
count <*count*>	Optional. Specifies the number of DMMs sent to the target MEP. Cannot be used in conjunction with the **stop-time** parameter. Must be greater than or equal to the **measurement interval** divided by the **interval**. Valid range is **2** to **1024**.
data <*data*>	Optional. Specifies a hex pattern used to fill the data TLV. Valid range is **0x0000** to **0xFFFF**.
interval <*interval*>	Optional. Specifies the number of milliseconds between DMM transmissions. Valid range is **100** to **900000** ms.
measurement-interval <*measurement interval*>	Optional. Specifies the number of seconds over which frame delay statistics are generated. If used with the **repetition-time** parameter, must be in minute intervals (multiples of 60) and less than or equal to the repetition time. Valid range is **60** to **86400** seconds.
priority <*priority*>	Optional. Specifies the virtual local area network (VLAN) priority of the target MEP. Valid range is **0** to **7**.
repetition-time <*repetition time*>	Optional. Specifies the number of seconds between the start time of measurement intervals. The repetition time must be at least as long as the measurement interval and must be in minute intervals (multiples of 60). Valid range is **60** to **86400** seconds.
size <*size*>	Optional. Specifies the size in bytes of the DMM frame. If no size is specified, DMM fames are zero-padded up to 64 bytes. If the size is specified, a data type-length value (TLV) is used to ensure the DMM frame is the correct length. Valid range is **0**, or **64** to **2000** bytes.

Syntax	Description *(Continued)*
start-time <*start time*>	Optional. Specifies the absolute time of day, based on the configured time zone, that the measurement interval will begin. Specified in the format **HH:MM:SS**. For example, midnight is **00:00:00**.
stop-time <*stop-time*>	Optional. Specifies the duration in seconds of the frame delay monitoring session. Cannot be used in conjunction with the **count** parameter. Must be greater than or equal to the interval and must be large enough for one packet to be transmitted. If the stop time is not defined, then **count** will be used. If the stop time falls inside the repetition time but outside of the measurement interval, then the actual stop time will be shorter than the configured stop time. Valid range is **0** to **15552000** seconds (180 days).

After entering the MEP ID or address of the target MEP, the optional parameters can be entered in any combination and in any order.

The following example configures a scheduled two-way frame delay monitoring session for remote MEP **100** with a priority of **3**, a start time of **02:00:00** (2:00 A.M.), a stop time of **3600** seconds (one hour), and the default interval, measurement interval, repetition time, size, and data values:

```
(app)#ethernet y1731 meg char-string MEG3 3 302
(app-y1731 MEG3)#frame-delay two-way 100 priority 3 start-time 02:00:00
stop-time 3600
```

Two-Way Frame Delay Performance Monitoring Example Configuration

The following example configuration creates an immediate two-way frame delay monitoring session between two devices on a network. The session is configured on the source device targeting a MEP ID on the target device. Because the source device also measures the frame delay, all necessary configuration for the session is performed on the source device. The example configuration assumes that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7*.

The configuration parameters in this example are sample configurations only. You should configure this application in a manner consistent with the needs of your network. CLI prompts have been removed from the example to allow you to copy and paste directly from this guide into the CLI. You should not copy this configuration without first making the necessary adjustments to ensure it will function properly in your network.

Device Configuration

```
!
ethernet y1731 enable
!
!
```



```
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
  remote-mep 302
  local-mep 301
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    no shutdown
    frame-delay two-way 302 priority 7
      no shutdown
!
```

Viewing the Two-Way Frame Delay Performance Monitoring Session Output

To view the two-way frame delay performance monitoring session output, follow these steps:

1. From the Enable command prompt, enter the **application** command:

   #**application**

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode.

   (app)#**ethernet y1731 meg [char-string** *<name>* **| icc-umc** *<name>***]** *<level> <mep id>*

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

   The following example accesses the Y.1731 Application mode:

   (app)#**ethernet y1731 meg char-string MEG3 3 301**

   (app-y1731 MEG3)#

3. Use the **show frame-delay two-way** command to show the frame delay statistics and configuration of two-way frame delay monitoring sessions:

   (app-y1731 MEG3)#**show frame-delay two-way [***<session id>* **realtime]**

Syntax	Description
<session id>	Optional. Specifies that results for a specific frame delay monitoring session are displayed. Valid range is **1** to **n**.
realtime	Optional. Displays full-screen output in realtime. Information is continuously updated on the console.

   The following example displays the statistics for two-way frame delay session **1**:


```
#application
(app)#ethernet y1731 meg char-string MEG3 3 301
(app-y1731 MEG3)#show frame-delay two-way 1
MEP 301 Two-way Delay Session Results
```

Session 1 is Active

Session Type	: Proactive		
Target MAC	: 00:a0:c8:01:00:00		
VLAN Priority	: 3		
Start Time	: 12:01:10 UTC Thu Jan 01 1970		
Stop Time	: Forever		
DMM Transmit Interval	: 1000		
DMM Measurement Interval	: 60		
Repetition Time	: 60		
DMM Size	: 0		
DMM Payload Data	: 0000		
Measurement Interval	Previous		Current
DMMs Transmitted	: 60		28
DMRs Received	: 60		28
Valid DMRs Received	: 60		28
Invalid DMRs Received	: 0		0
Out-of-order DMRs Received	: 0		0
Suspect Flag	: No		No
Round-trip Delay			
Mean	ms:	0.00	0.00
Maximum	ms:	0.00	0.00
Minimum	ms:	0.00	0.00
Round-trip Delay Variation Mean			
Inter-packet	ms:	0.00	0.00
Round-trip Delay Variation Maximum			
Inter-packet	ms:	0.00	0.00
Reference-packet	ms:	0.00	0.00
Round-trip Delay Variation Minimum			
Inter-packet	ms:	0.00	0.00
Forward One-Way Delay			
Mean	ms:	0.00	0.00
Maximum	ms:	0.00	0.00
Minimum	ms:	0.00	0.00
Forward One-Way Delay Variation Mean			
Inter-packet	ms:	0.00	0.00
Forward One-Way Delay Variation Maximum			
Inter-packet	ms:	0.00	0.00
Forward One-Way Delay Variation Minimum			
Inter-packet	ms:	0.00	0.00
Backward One-Way Delay			
Mean	ms:	0.00	0.00
Maximum	ms:	0.00	0.00
Minimum	ms:	0.00	0.00
Backward One-Way Delay Variation Mean			
Inter-packet	ms:	0.00	0.00
Backward One-Way Delay Variation Maximum			
Inter-packet	ms:	0.00	0.00


```
Backward One-Way Delay Variation Minimum
  Inter-packet                    ms:  0.00                  0.00
```

Configuring Frame Loss Performance Monitoring

The following sections provide information on configuring and viewing frame loss performance monitoring sessions:

Single-Ended Frame Loss Monitoring

In Y.1731, the Ethernet loss measurement (ETH-LM) function can be used to monitor frame loss across a service by counting in-profile customer frames. This protocol operates in a single-ended mode in which one MEP initiates a session and sends a request to a peer MEP which sends a response. These sessions can be executed between any two MEPs in the same MEG.

During a session, a loss measurement message (LMM) is sent from the source MEP to the target MEP, which replies with a loss measurement reply (LMR). In this process, each MEP maintains a set of two counters that count the frames transmitted towards the target MEP and the frames received from that MEP. These counters increment when in-profile frames (those that are green or received with the drop eligible indicator (DEI) bit set to false) are transmitted and received. Frames counted in this process are only data frames, and not LMM or LMR frames.

A local MEP can run several single-ended frame loss performance monitoring sessions between itself and a target MEP as long as each session uses a different priority value. This allows the MEP to simultaneously monitor frame loss performance at different classes of service.

The metrics that can be monitored using single-ended frame loss are:

- Far-end frame loss ratio
- Near-end frame loss ratio

> **NOTE** *The instructions provided in this section assume that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to Configuring Ethernet OAM Services Using Y.1731 on page 7.*

Configuring an Immediate Single-Ended Frame Loss Monitoring Session

To create a single-ended frame loss monitoring session that starts immediately, follow these steps:

1. From the Global Configuration command prompt, use the **ethernet y1731 meg** command to access the Y.1731 MEG created in *Step 3: Create and Configure a Maintenance Entity Group on page 9*.

   ```
   (config)#ethernet y1731 meg [char-string <name> | icc-umc <name>] level
   <value>
   ```


Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
level *<level>*	Specifies the MEG level. Valid range is **0** to **7**.

The following example accesses the MEG named **MEG3** with a MEG level of **3**:

```
(config)#ethernet y1731 meg char-string MEG3 level 3
(config-y1731-meg MEG3)#
```

2. Use the **local-mep** command to access the local MEP created in *Step 4: Create and Configure Local and Remote MEPs on page 11*.

```
(config-y1731-meg MEG3)#local-mep <id>
```

Syntax	Description
<id>	Specifies the MEP identifier of the local MEP. Valid range is **1** to **8191**.

The following example accesses a MEP with a MEP ID of **301**:

```
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep301)#
```

3. Use the **frame-loss single-ended** command to create a Y.1731 single-ended frame loss monitoring session between MEPs and enter the Single-Ended Frame Loss Monitoring Session Configuration mode:

```
(config-y1731-mep301)#frame-loss single-ended <mep id | target mac address
                    | multicast> priority <priority>
```

Syntax	Description
<mep id | *target mac address* | **multicast**>	Specifies the MEP ID or MAC address of the target MEP, or configures the session for multicast. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
priority *<priority>*	Specifies the VLAN priority of the target MEP. Valid range is **0** to **7**.

The following example creates a single-ended frame loss monitoring session with a remote MEP, with a MEP ID of **302**, and a VLAN priority of **7**:

```
(config-y1731-mep301)#frame-loss single-ended 302 priority 7
(config-y1731-frame-loss)#
```


4. Use the **interval** command to set the time between LMM transmissions.

```
(config-y1731-frame-loss)#interval <interval>
```

Syntax	Description
<interval>	Specifies the time in milliseconds (ms) between LMM transmissions. Valid range is **100** to **900000** ms. The default is **1000** ms.

The following example specifies a LMM transmission interval of **2000** ms:

```
(config-y1731-frame-loss)#interval 2000
```

5. Use the **measurement-interval** command to specify the interval over which frame loss statistics are generated.

```
(config-y1731-frame-loss)#measurement-interval <measurement interval>
[<repetition time> | none]
```

Syntax	Description
<measurement interval>	Specifies the number of seconds over which frame loss statistics are generated. If used with the *<repetition-time>* variable, must be in minute intervals (multiples of 60) and less than or equal to the repetition time. Valid range is **60** to **86400** seconds. The default is **60** seconds.
<repetition time>	Specifies the number of seconds between the start time of measurement intervals. The repetition time must be at least as long as the measurement interval and must be in minute intervals (multiples of 60). Valid range is **60** to **86400** seconds. The default is **60** seconds.
none	Specifies that the repetition time is equal to the measurement interval.

The following example specifies a measurement interval of **60** seconds and a repetition time of **180** seconds:

```
(config-y1731-frame-loss)#measurement-interval 60 180
```

6. Use the **size** command to set the size of the LMM frame.

```
(config-y1731-frame-loss)#size <bytes>
```

Syntax	Description
<bytes>	Specifies the size of the LMM frame in bytes. If no size is specified, LMM fames are zero-padded up to 64 bytes. If the size is specified, a data type-length value TLV is used to ensure the LMM frame is the correct length. Valid range is **0**, or **64** to **2000** bytes. The default is **0** bytes.

The following example specifies a LMM frame size of **64** bytes:

```
(config-y1731-frame-loss)#size 64
```


7. Use the **data** command to specify a hex pattern used to fill the data TLV.

   (config-y1731-frame-loss)#**data** *<hex pattern>*

Syntax	Description
<hex pattern>	Specifies a hex pattern used to fill the data TLV. Valid range is **0000** to **FFFF**. The default value is **0000**.

   The following example specifies a hex pattern of **FFFF**:

   (config-y1731-frame-loss)#**data FFFF**

8. Use the **stop-time** command to specify the duration of the frame loss monitoring session (in seconds). This is how long the frame loss monitoring session will run after the session begins.

   (config-y1731-frame-loss)#**stop-time** *<stop time* **| forever***>*

Syntax	Description
<stop time>	Specifies the duration in seconds of the frame loss monitoring session. Valid range is **0** to **15552000** seconds (180 days).
forever	Specifies that the frame loss monitoring session will continue until it is manually stopped. This is the default value.

9. Use the **no shutdown** command to enable the single-ended frame loss monitoring session:

   (config-y1731-frame-loss)#**no shutdown**

Configuring a Scheduled Single-Ended Frame Loss Monitoring Session

To schedule a single-ended frame loss monitoring session to begin at a specified time of day, follow these steps:

1. From the Enable command prompt, enter the **application** command:

   #**application**

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode:

   (app)#**ethernet y1731 meg [char-string** *<name>* **| icc-umc** *<name>***]** *<level> <mep id>*

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is **45** ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

   The following example accesses the Y.1731 Application mode:


```
(app)#ethernet y1731 meg char-string MEG3 3 302
(app-y1731 MEG3)#
```

3. Use the **frame-loss single ended** command to configure a scheduled single-ended frame loss monitoring session:

```
(app)#frame-loss single-ended <mep id | target mac address | multicast>
priority <priority> (count <count> | stop-time <stop>) interval <interval>
measurement-interval <measurement-interval> repetition-time
<repetition-time> start-time <start> size <size> data <data>
```


Syntax	Description
<*mep id* | *target mac address* | **multicast**>	Specifies the MEP ID or MAC address of the target MEP, or configures the session for multicast. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
count <*count*>	Optional. Specifies the number of LMMs sent to the target MEP. Cannot be used in conjunction with the **stop-time** parameter. Must be greater than or equal to the **measurement interval** divided by the **interval**. Valid range is **2** to **1024**.
data <*data*>	Optional. Specifies a hex pattern used to fill the data TLV. Valid range is **0x0000** to **0xFFFF**.
interval <*interval*>	Optional. Specifies the number of milliseconds between LMM transmissions. Valid range is **100** to **900000** ms.
measurement-interval <*measurement interval*>	Optional. Specifies the number of seconds over which frame loss statistics are generated. If used with the **repetition-time** parameter, must be in minute intervals (multiples of 60) and less than or equal to the repetition time. Valid range is **60** to **86400** seconds.
priority <*priority*>	Optional. Specifies the virtual local area network (VLAN) priority of the target MEP. Valid range is **0** to **7**.
repetition-time <*repetition time*>	Optional. Specifies the number of seconds between the start time of measurement intervals. The repetition time must be at least as long as the measurement interval and must be in minute intervals (multiples of 60). Valid range is **60** to **86400** seconds.
size <*size*>	Optional. Specifies the size in bytes of the LMM frame. If no size is specified, LMM fames are zero-padded up to 64 bytes. If the size is specified, a data type-length value (TLV) is used to ensure the LMM frame is the correct length. Valid range is **0**, or **64** to **2000** bytes.
start-time <*start time*>	Optional. Specifies the absolute time of day, based on the configured time zone, that the measurement interval will begin. Specified in the format **HH:MM:SS**. For example, midnight is **00:00:00**.
stop-time <*stop-time*>	Optional. Specifies the duration in seconds of the frame delay monitoring session. Cannot be used in conjunction with the **count** parameter. Must be greater than or equal to the interval and must be large enough for one packet to be transmitted. If the stop time is not defined, then **count** will be used. If the stop time falls inside the repetition time but outside of the measurement interval, then the actual stop time will be shorter than the configured stop time. Valid range is **0** to **15552000** seconds (180 days).

After entering the MEP ID or address of the target MEP, the optional parameters can be entered in any combination and in any order.

The following example configures a scheduled single-ended frame-loss monitoring session for remote MEP **100** with a priority of **3**, a start time of **02:00:00** (2:00 A.M.), a stop time of

3600 seconds (one hour), and the default interval, measurement interval, repetition time, size, and data values:

```
(app)#ethernet y1731 meg char-string MEG3 3 302
(app-y1731 MEG3)#frame-loss single-ended 100 priority 3 start-time 02:00:00
stop-time 3600
```

Single-Ended Frame Loss Monitoring Session Example Configuration

The following example configuration creates an immediate single-ended frame loss monitoring session between two devices on a network. The session is configured on the source device targeting a MEP ID on the target device. Because the source device also measures the frame loss, all necessary configuration for the session is performed on the source device. The example configuration assumes that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7*.

The configuration parameters in this example are sample configurations only. You should configure this application in a manner consistent with the needs of your network. CLI prompts have been removed from the example to allow you to copy and paste directly from this guide into the CLI. You should not copy this configuration without first making the necessary adjustments to ensure it will function properly in your network.

Device Configuration

```
!
ethernet y1731 enable
!
!
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
  remote-mep 302
  local-mep 301
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    no shutdown
    frame-loss single-ended 302 priority 7
      no shutdown
```

Viewing Single-Ended Frame Loss Monitoring Session Output

To view the single-ended frame loss monitoring session output, follow these steps:

1. From the Enable command prompt, enter the **application** command:

   ```
   #application
   ```

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode:

   ```
   (app)#ethernet y1731 meg [char-string <name> | icc-umc <name>] <level> <mep
   id>
   ```


Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

The following example accesses the Y.1731 application command set:

```
(app)#ethernet y1731 meg char-string MEG3 3 301
(app-y1731 MEG3)#
```

3. Use the **show frame-loss single-ended** command to show the frame loss statistics and configuration of the single-ended frame loss monitoring sessions:

```
(app-y1731 MEG3)#show frame-loss single-ended [<session id> realtime]
```

Syntax	Description
<session id>	Optional. Specifies that results for a specific frame loss monitoring session are displayed. Valid range is **1** to **n**.
realtime	Optional. Displays full-screen output in realtime. Information is continuously updated on the console.

The following example displays the statistics for frame loss monitoring session **1**:

```
#application
(app)#ethernet y1731 meg char-string MEG3 3 301
(app-y1731 MEG3)#show frame-loss single-ended 1
MEP 301 Single-Ended Frame Loss Results

 Session 1 is Active
    Session Type                    : Proactive
    Target MAC                      : 00:a0:c8:01:00:00
    VLAN Priority                   : 3
    Start Time                      : 12:01:10 UTC Thu Jan 01 1970
    Stop Time                       : Forever
    LMM Transmit Interval           : 1000
    LMM Measurement Interval        : 60
    Repetition Time                 : 60
    LMM Size                        : 0
    LMM Payload Data                : 0000
    Measurement Interval              Previous          Current
    LMMs Transmitted                : 60              28
    LMRs Received                   : 60              28
    Valid LMRs Received             : 60              28
    Invalid LMRs Received           : 0               0
    Out-of-order LMRs Received      : 0               0
    Suspect Flag                    : No              No
    Frame Loss Near End             : 0               1141
```


Frame Loss Far End	: 0	1141
Frame Expected Near End	: 14	2862
Frame Expected Far End	: 14	2858
Frame Loss Ratio Near End	: 0.0000	0.3987
Frame Loss Ratio Far End	: 0.0000	0.3992
Min Frame Loss Ratio Near End	: 0.0000	0.0000
Min Frame Loss Ratio Far End	: 0.0000	0.0000
Max Frame Loss Ratio Near End	: 0.0000	0.4362
Max Frame Loss Ratio Far End	: 0.0000	0.4360
Max Consecutive Frame Loss	: 0	0

Single-Ended Synthetic Frame Loss Monitoring

In Y.1731, the Ethernet synthetic frame loss measurement (ETH-SLM) function can be used to monitor frame loss across a service by counting synthetic data frames. This protocol operates in a single-ended mode in which one MEP initiates a session and sends a request to a peer MEP which sends a response. These sessions can be executed between any two MEPs in the same MEG.

During a session, a synthetic loss message (SLM) is sent from the source MEP to the target MEP, which replies with a synthetic loss reply (SLR). In this process, each MEP maintains a set of two counters that count the frames transmitted towards the target MEP and the frames received from that MEP. These counters increment when the synthetic frames are transmitted and received. Frames counted in this process are SLM and SLR frames, not actual data frames.

A local MEP can run several single-ended frame loss performance monitoring sessions between itself and a target MEP as long as each session uses a different priority value. This allows the MEP to simultaneously monitor frame loss performance at different classes of service.

The metrics that can be monitored using single-ended synthetic frame loss are:

- Far-end frame loss ratio
- Near-end frame loss ratio

The instructions provided in this section assume that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7**.*

Configuring an Immediate Single-Ended Synthetic Frame Loss Monitoring Session

To create a single-ended synthetic frame loss monitoring session that starts immediately, follow these steps:

1. From the Global Configuration command prompt, use the **ethernet y1731 meg** command to access the Y.1731 MEG created in *Step 3: Create and Configure a Maintenance Entity Group on page 9*.

   ```
   (config)#ethernet y1731 meg [char-string <name> | icc-umc <name>] level
   <value>
   ```


Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
level *<level>*	Specifies the MEG level. Valid range is **0** to **7**.

The following example accesses the MEG named **MEG3** with a MEG level of **3**:

```
(config)#ethernet y1731 meg char-string MEG3 level 3
(config-y1731-meg MEG3)#
```

2. Use the **local-mep** command to access the local MEP created in *Step 4: Create and Configure Local and Remote MEPs on page 11*.

```
(config-y1731-meg MEG3)#local-mep <id>
```

Syntax	Description
<id>	Specifies the MEP identifier of the local MEP. Valid range is **1** to **8191**.

The following example accesses a MEP with a MEP ID of **301**:

```
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep301)#
```

3. Use the **frame-loss synthetic single-ended** command to create a Y.1731 single-ended synthetic frame loss monitoring session between MEPs and enter the Single-Ended Synthetic Frame Loss Monitoring Session Configuration mode:

```
(config-y1731-mep301)#frame-loss synthetic single-ended <mep id | target
                      mac address | multicast> priority <priority>
```

Syntax	Description
<mep id | *target mac address* | **multicast**>	Specifies the MEP ID or MAC address of the target MEP, or configures the session for multicast. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
priority *<priority>*	Specifies the VLAN priority of the target MEP. Valid range is **0** to **7**.

The following example creates a single-ended synthetic frame loss monitoring session with a remote MEP, with a MEP ID of **302**, and a VLAN priority of **7**:

```
(config-y1731-mep301)#frame-loss synthetic single-ended 302 priority 7
(config-y1731-syn-frame-loss)#
```


4. Use the **interval** command to set the time between SLM transmissions.

```
(config-y1731-syn-frame-loss)#interval <interval>
```

Syntax	Description
<interval>	Specifies the time in milliseconds (ms) between SLM transmissions. Valid range is **100** to **900000** ms. The default is **1000** ms.

The following example specifies a SLM transmission interval of **2000** ms:

```
(config-y1731-syn-frame-loss)#interval 2000
```

5. Use the **measurement-interval** command to specify the interval over which frame loss statistics are generated.

```
(config-y1731-syn-frame-loss)#measurement-interval <measurement interval>
[<repetition time> | none]
```

Syntax	Description
<measurement interval>	Specifies the number of seconds over which frame loss statistics are generated. If used with the *<repetition-time>* variable, must be in minute intervals (multiples of 60) and less than or equal to the repetition time. Valid range is **60** to **86400** seconds. The default is **60** seconds.
<repetition time>	Specifies the number of seconds between the start time of measurement intervals. The repetition time must be at least as long as the measurement interval and must be in minute intervals (multiples of 60). Valid range is **60** to **86400** seconds. The default is **60** seconds.
none	Specifies that the repetition time is equal to the measurement interval.

The following example specifies a measurement interval of **60** seconds and a repetition time of **180** seconds:

```
(config-y1731-syn-frame-loss)#measurement-interval 60 180
```

6. Use the **size** command to set the size of the SLM frame.

```
(config-y1731-syn-frame-loss)#size <bytes>
```

Syntax	Description
<bytes>	Specifies the size of the SLM frame in bytes. If no size is specified, SLM fames are zero-padded up to 64 bytes. If the size is specified, a data type-length value TLV is used to ensure the SLM frame is the correct length. Valid range is **0**, or **64** to **2000** bytes. The default is **0** bytes.

The following example specifies a SLM frame size of **64** bytes:

```
(config-y1731-syn-frame-loss)#size 64
```


7. Use the **data** command to specify a hex pattern used to fill the data TLV.

```
(config-y1731-syn-frame-loss)#data <hex pattern>
```

Syntax	Description
<hex pattern>	Specifies a hex pattern used to fill the data TLV. Valid range is **0000** to **FFFF**. The default value is **0000**.

The following example specifies a hex pattern of **FFFF**:

```
(config-y1731-syn-frame-loss)#data FFFF
```

8. Use the **stop-time** command to specify the duration of the frame loss monitoring session (in seconds). This is how long the frame loss monitoring session will run after the session begins.

```
(config-y1731-syn-frame-loss)#stop-time <stop time | forever>
```

Syntax	Description
<stop time>	Specifies the duration in seconds of the frame loss monitoring session. Valid range is **0** to **15552000** seconds (180 days).
forever	Specifies that the frame loss monitoring session will continue until it is manually stopped. This is the default value.

9. Use the **no shutdown** command to enable the single-ended frame loss monitoring session:

```
(config-y1731-syn-frame-loss)#no shutdown
```

Configuring a Scheduled Single-Ended Synthetic Frame Loss Monitoring Session

To schedule a single-ended synthetic frame loss monitoring session to begin at a specified time of day, follow these steps:

1. From the Enable command prompt, enter the **application** command:

```
#application
```

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode:

```
(app)#ethernet y1731 meg [char-string <name> | icc-umc <name>] <level> <mep id>
```

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is **45** ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

The following example accesses the Y.1731 Application mode:

```
(app)#ethernet y1731 meg char-string MEG3 3 302
```



```
(app-y1731 MEG3)#
```

3. Use the **frame-loss synthetic single ended** command to configure a scheduled single-ended synthetic frame loss monitoring session:

```
(app)#frame-loss synthetic single-ended <mep id | target mac address |
multicast> priority <priority> (count <count> | stop-time <stop>) interval
<interval> measurement-interval <measurement-interval> repetition-time
<repetition-time> start-time <start> size <size> data <data>
```

Syntax	Description
<*mep id* | *target mac address* | **multicast**>	Specifies the MEP ID or MAC address of the target MEP, or configures the session for multicast. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
count <*count*>	Optional. Specifies the number of SLMs sent to the target MEP. Cannot be used in conjunction with the **stop-time** parameter. Must be greater than or equal to the **measurement interval** divided by the **interval**. Valid range is **2** to **1024**.
data <*data*>	Optional. Specifies a hex pattern used to fill the data TLV. Valid range is **0x0000** to **0xFFFF**.
interval <*interval*>	Optional. Specifies the number of milliseconds between SLM transmissions. Valid range is **100** to **900000** ms.
measurement-interval <*measurement interval*>	Optional. Specifies the number of seconds over which frame loss statistics are generated. If used with the **repetition-time** parameter, must be in minute intervals (multiples of 60) and less than or equal to the repetition time. Valid range is **60** to **86400** seconds.
priority <*priority*>	Optional. Specifies the virtual local area network (VLAN) priority of the target MEP. Valid range is **0** to **7**.
repetition-time <*repetition time*>	Optional.Specifies the number of seconds between the start time of measurement intervals. The repetition time must be at least as long as the measurement interval and must be in minute intervals (multiples of 60). Valid range is **60** to **86400** seconds.
size <*size*>	Optional. Specifies the size in bytes of the SLM frame. If no size is specified, SLM fames are zero-padded up to 64 bytes. If the size is specified, a data type-length value (TLV) is used to ensure the SLM frame is the correct length. Valid range is **0**, or **64** to **2000** bytes.
start-time <*start time*>	Optional. Specifies the absolute time of day, based on the configured time zone, that the measurement interval will begin. Specified in the format **HH:MM:SS**. For example, midnight is **00:00:00**.
stop-time <*stop-time*>	Optional. Specifies the duration in seconds of the frame delay monitoring session. Cannot be used in conjunction with the **count** parameter. Must be greater than or equal to the interval and must be large enough for one packet to be transmitted. If the stop time is not defined, then **count** will be used. If the stop time falls inside the repetition time but outside of the measurement interval, then the actual stop time will be shorter than the configured stop time. Valid range is **0** to **15552000** seconds (180 days).

> *After entering the MEP ID or address of the target MEP, the optional parameters can be entered in any combination and in any order.*

The following example configures a scheduled single-ended synthetic frame-loss monitoring session for remote MEP **100** with a priority of **3**, a start time of **02:00:00** (2:00 A.M.), a stop time of **3600** seconds (one hour), and the default interval, measurement interval, repetition time, size, and data values:

```
(app)#ethernet y1731 meg char-string MEG3 3 302
(app-y1731 MEG3)#frame-loss synthetic single-ended 100 priority 3
start-time 02:00:00 stop-time 3600
```

Single-Ended Synthetic Frame Loss Monitoring Session Example Configuration

The following example configuration creates a single-ended synthetic frame loss monitoring session between two devices on a network. The session is configured on the source device targeting a MEP ID on target device. Because the source device also measures the frame loss, all necessary configuration for the session is performed on the source device. The example configuration assumes that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7*.

> *The configuration parameters in this example are sample configurations only. You should configure this application in a manner consistent with the needs of your network. CLI prompts have been removed from the example to allow you to copy and paste directly from this guide into the CLI. You should not copy this configuration without first making the necessary adjustments to ensure it will function properly in your network.*

Device Configuration

```
!
ethernet y1731 enable
!
!
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
  remote-mep 302
  local-mep 301
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    no shutdown
    frame-loss synthetic single-ended 302 priority 7
      no shutdown
!
```

Viewing the Single-Ended Synthetic Frame Loss Monitoring Session Output

To view the single-ended synthetic frame loss monitoring session output, follow these steps:

1. From the Enable command prompt, enter the **application** command:

   #**application**

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode:

   (app)#**ethernet y1731 meg [char-string** *<name>* **| icc-umc** *<name>***]** *<level> <mep id>*

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

   The following example accesses the Y.1731 application command set:

   (app)#**ethernet y1731 meg char-string MEG3 3 301**

   (app-y1731 MEG3)#

3. Use the **show frame-loss synthetic single-ended** command to show the synthetic frame loss statistics and configuration of the single-ended synthetic frame loss monitoring sessions:

   (app-y1731 MEG3)#**show frame-loss synthetic single-ended [***<session id>* **realtime]**

Syntax	Description
<session id>	Optional. Specifies that results for a specific synthetic frame loss monitoring session are displayed. Valid range is **1** to **n**.
realtime	Optional. Displays full-screen output in realtime. Information is continuously updated on the console.

The following example displays the statistics for synthetic frame loss monitoring session **1**:

```
#application
(app)#ethernet y1731 meg char-string MEG3 3 301
(app-y1731 MEG3)#show frame-loss synthetic single-ended 1
MEP 301 Synthetic Single-Ended Frame Loss Results

Session 1 is Active
  Session Type                    : Proactive
  Target MAC                      : 00:a0:c8:01:00:00
  VLAN Priority                   : 3
  Start Time                      : 12:01:10 UTC Thu Jan 01 1970
  Stop Time                       : Forever
  SLM Transmit Interval           : 1000
  SLM Measurement Interval        : 60
  Repetition Time                 : 60
  SLM Size                        : 0
  SLM Payload Data                : 0000
  Measurement Interval              Previous          Current
  SLMs Transmitted                : 60              28
  SLRs Received                   : 60              28
  Valid SLRs Received             : 60              28
  Invalid SLRs Received           : 0               0
  Out-of-order SLRs Received      : 0               0
  Suspect Flag                    : No              No
  Frame Loss Near End             : 0               1141
  Frame Loss Far End              : 0               1141
  Frame Expected Near End         : 14              2862
  Frame Expected Far End          : 14              2858
  Frame Loss Ratio Near End       : 0.0000          0.3987
  Frame Loss Ratio Far End        : 0.0000          0.3992
  Min Frame Loss Ratio Near End   : 0.0000          0.0000
  Min Frame Loss Ratio Far End    : 0.0000          0.0000
  Max Frame Loss Ratio Near End   : 0.0000          0.4362
  Max Frame Loss Ratio Far End    : 0.0000          0.4360
  Max Consecutive Frame Loss      : 0               0
```

Frame Loss Monitoring Using CCM Sequence Numbers

Due to the lack of Y.1731 standard frame loss measurement support in third-party devices, a nonstandard method to calculate frame loss using the sequence number in received CCMs (ETH-CLM) can be used to support frame loss measurement capabilities.

This is not the preferred method to measure frame loss for two major reasons: the MEP may not support incrementing the sequence number in each consecutive CCM transmitted, and the method only allows for detection of near end frame loss.

Frame loss is measured upon reception of every CCM. When a CCM is received from an remote MEP, the sequence number, RxCcm[tc], is compared to the previously received CCM's sequence number, RxCcm[tp], from the same remote MEP. The difference in sequence numbers indicates if CCM frames were lost. If the difference is one, then no frames were lost, otherwise the result of the difference minus one indicates how many CCM frames were lost.

Because ETH-CLM is a statistical sampling for frame loss, it is possible for the customer to experience frame loss at a rate different from that measured by ETH-CLM. Appendix VI of the ITU Y.1731 07/2011 standard details the frame loss measurement accuracy that can be achieved when using ETH-CLM.

The ETH-CLM administrative state will determine whether or not frame loss is calculated based on received CCM sequence numbers. If it is enabled, the local MEP will perform the calculation for each remote MEP in its MEP database.

The instructions provided in this section assume that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7**.*

To enable frame loss monitoring using CCM sequence numbers, follow these steps:

1. From the Global Configuration mode, use the **ethernet y1731 meg** command to access the Y.1731 MEG created in *Step 3: Create and Configure a Maintenance Entity Group on page 9*.

   ```
   (config)#ethernet y1731 meg [char-string <name> | icc-umc <name>] level <value>
   ```

Syntax	Description
char-string <*name*>	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc <*name*>	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
level <*value*>	Specifies the MEG level. Valid range is **0** to **7**.

   The following example accesses the MEG named **MEG3** with a MEG level of **3**:

   ```
   (config)#ethernet y1731 meg char-string MEG3 level 3
   (config-y1731-meg MEG3)#
   ```


2. Use the **local-mep** command to access the local MEP created in *Step 4: Create and Configure Local and Remote MEPs on page 11*.

```
(config-y1731-meg MEG3)#local-mep <id>
```

Syntax	Description
<id>	Specifies the MEP identifier of the local MEP. Valid range is **1** to **8191**.

The following example accesses a MEP with a MEP ID of **301**:

```
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep301)#
```

3. If transmission of CCM frames is not already enabled on the MEP, use the **ccm-enabled** command to enable CCM frame transmission. The following example enables CCM frame transmission:

```
(config-y1731-mep301)#ccm-enabled
```

4. Use the **ccm frame-loss sequence-number** command to specify that frame loss be calculated using the sequence number in CCMs. The following example specifies that frame loss should be calculated using the sequence number in CCMs:

```
(config-y1731-mep301)#ccm frame-loss sequence number
```

5. Use the **ccm frame-loss measurement-interval** command to specify the interval over which frame loss statistics are generated.

```
(config-y1731-mep301)#ccm frame-loss measurement-interval <measurement interval>
```

Syntax	Description
<measurement interval>	Specifies the interval over which frame loss statistics are generated. Valid range is **60** to **900** seconds. The default is **60** seconds.

The following example specifies a measurement interval of **90** seconds:

```
(config-y1731-mep301)#ccm frame-loss measurement-interval 90
```

Frame Loss Monitoring Using CCM Sequence Numbers Example Configuration

The following example configuration enables frame loss monitoring using CCM sequence numbers on a MEP. The example configuration assumes that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7*.

The configuration parameters in this example are sample configurations only. You should configure this application in a manner consistent with the needs of your network. CLI prompts have been removed from the example to allow you to copy and paste directly from this guide into the CLI. You should not copy this configuration without first making the necessary adjustments to ensure it will function properly in your network.

Device Configuration

```
!
ethernet y1731 enable
!
!
ethernet y1731 meg char-string "MEG3" level 3
  service single-tagged s-tag 1000
  remote-mep 302
  local-mep 301
    direction down
    set interface gigabit-ethernet 0/1
    ccm-enabled
    ccm frame-loss sequence-number
    no shutdown
!
```

Viewing Frame Loss Monitoring Using CCM Sequence Numbers Output

To view the ETH-CLM frame loss monitoring session output, enter the **show ethernet y1731 mep remote** command at the Enable command prompt:

```
#show ethernet y1731 mep remote
Remote MEP 302
  MEGID                          : MEG3
  Local MEP                      : 301
  MAC Address                    : 00:a0:c8:02:0e:16
  Current State                  : okay
  Age                            : 0d 02:43:47
  Provisioned State              : Static
  Total CCMs Received            : 9818
  Last Sequence Number           : 15576
  Last RDI                       : False
  Frame-Loss Monitoring            Active
  Measurement Interval             Previous        Current
  CCM Received                   : 60              14
  Frame Loss Near End            : 0               0
  Frame Loss Ratio Near End      : 0.0000          0.0000
  Max Consecutive Frames Lost    : 0               0
  Port Status                    : Not present
  Interference Status            : Not present
```


Verifying Bidirectional Connectivity Using Ethernet Loopback

The Y.1731 unicast Ethernet loopback (ETH-LB) function is used to verify bidirectional connectivity with a peer MEP. During Ethernet loopback operation, a MEP generates an LBM, and in response to the LBM, the target MEP will send an LBR. The unit then reports whether a LBR was successfully received or timed out, and if the LBR was received out of order or with missing data. Additionally, the minimum, average, and maximum round-trip times are reported.

The instructions provided in this section assume that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7**.*

To use the unicast Ethernet loopback function, follow these steps:

1. From the Enable command prompt, enter the **application** command.

   ```
   #application
   ```

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode.

   ```
   (app)#ethernet y1731 meg [char-string <name> | icc-umc <name>] <level> <mep id>
   ```

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

   The following example accesses the Y.1731 application command set:

   ```
   (app)#ethernet y1731 meg char-string MEG3 3 301
   (app-y1731 MEG3)#
   ```


3. Use the **loopback** command to start an Ethernet loopback session.

loopback [unicast *<mep id | target mac address>* **| multicast] [priority** *<value>***] [count** *<value>***] [interval** *<interval>***] [timeout** *<value>***] [size** *<value>***] [data [***<hex pattern>* | **random]] [validate] [verbose]**

Syntax	Description
unicast <*mep id* | *target mac address*>	Specifies the MEP ID or MAC address of the target MEP. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
multicast	Specifies that the session is configured for multicast.
priority <*value*>	Optional. Specifies the VLAN priority of the target MEP. Valid range is **0** to **7**.
count <*value*>	Optional. Specifies the number of LBMs sent to the target MEP. Valid range is **2** to **1024**.
interval <*interval*>	Optional. Specifies the time (in milliseconds) between LBM transmissions. Valid range is **100** to **10000** ms.
timeout <*value*>	Optional. Specifies the interval at which the loopback feature times out if there is no response to an LBM. Valid range is **100** to **5000** milliseconds.
size <*bytes*>	Optional. Specifies the size of the LBM frame in bytes. If no size is specified, LBM fames are zero-padded up to 64 bytes. If the size is specified, a data TLV is used to ensure the LBM frame is the correct length. Valid range is **64** to **9242** bytes.
data	Optional. Specifies a data pattern used to fill the data TLV.
<*hex pattern*>	Specifies a hex pattern used to fill the data TLV. Valid range is **0000** to **FFFF**.
random	Specifies a pseudo randomly generated number pattern.
validate	Optional. Validates the connection between the MEPs.
verbose	Optional. Specifies that details are included in loopback test results.

The following example performs a loopback test between local MEP **301** and remote MEP **302**:

```
(app-y1731 MEG3)#loopback unicast 302

Source MEP 301 starting transmission of 5 LBM messages at a 1000 ms
interval and 5000 ms timeout targeting RMEP ID 302

Type CTRL+C to abort.
Legend:'!' = Success       '*' = Timeout
   'd' = Data Mismatch 'o' = Out of Order

!!!!!
Success rate is 100 percent (5/5)
Round-trip min/avg/max = 0/0/1 ms
```


The output from a multicast loopback test displays two characters for each multicast LBM packet. The first indicates known, expected, remote MEP responses, and the second indicates new responses from an unknown remote MEP(s). After an unknown remote MEP response is received, subsequent responses from that responder are considered expected and are logged appropriately in the known (first) character. There is a limit of eight responding remote devices; the first eight are accepted regardless of how many of them are configured and have learned MAC addresses. The following example displays output from a multicast loopback test:

```
(app-y1731 MEG3)#loopback multicast

Source MEP 3416 starting transmission of 60 LBM messages at a 1000 ms
interval and 5000 ms timeout sending out multicast LBM

Type CTRL+C to abort.
                                  Legend
------------------------------------------------------------------------
---
Note:  Once an unknown RMEP responds, subsequent valid responses are
       expected and logged appropriately:
RMEP responses:
       '!' = Success all RMEPs       '*' = All RMEPs timed out
       'd' = At least one Data-Mismatch response
       'o' = At least one Out of Order response
       'p' = Partial RMEP(s) response
       '-' = No known RMEPs
RMEP database existence:
       '.' = No unknown RMEP response      'u' = Unknown RMEP(s) response

WARNING:  RMEPs exist without learned mac addresses.
          Responses from these RMEPs will be characterized as unknown.
RMEPs without learned MACs:  16

o. !. !. !. !. !. !. p. o. !. !. p. p. o. !. !. !. !. !. !. p. o. !. p. o.
!. !. !. !. !. !. !. p. o. !. !. !. !. !. !. !. !. !. !. !. !. !.
```

Determining Adjacency and Faults Using Ethernet Linktrace

The Y.1731 Ethernet linktrace (ETH-LT) function provides a list of MIPs (identified by their MAC addresses) that are encountered across the network from the source MEP to the target MEP. The Ethernet linktrace function can be used to determine the adjacency relationship between two MEPs in a network and to help pinpoint the location of a failure in the network.

The instructions provided in this section assume that devices on the network have been configured for Ethernet OAM services using Y.1731. For more information, refer to *Configuring Ethernet OAM Services Using Y.1731 on page 7**.*

To use the Ethernet linktrace function, follow these steps:

1. From the Enable command prompt, enter the **application** command.

   #**application**

2. Use the **ethernet y1731 meg** command to access the Y.1731 Application mode.

   (app)#**ethernet y1731 meg [char-string** *<name>* **| icc-umc** *<name>***]** *<level> <mep id>*

Syntax	Description
char-string *<name>*	Specifies a MEG name using a character string format. Maximum length is 45 ASCII characters.
icc-umc *<name>*	Specifies a MEG name using the ICC-UMC format. Maximum length is 13 ASCII characters.
<level>	Specifies the MEG level. Valid range is **0** to **7**.
<mep id>	Specifies the MEP ID. Valid range is **1** to **8191**.

   The following example accesses the Y.1731 application command set:

```
(app)#ethernet y1731 meg char-string MEG3 3 301
(app-y1731 MEG3)#
```

3. Use the **linktrace** command to trace the link between MEPs.

   linktrace *<mep id | target mac address>* **[ttl** *<value>***] [sorted | verbose | sorted verbose]**

Syntax	Description
<mep id | target mac address>	Specifies the MEP ID or MAC address of the target MEP. Valid MEP ID range is **1** to **8191**. Enter MAC addresses in hexadecimal format, for example: **xx:xx:xx:xx:xx:xx**.
sorted	Optional. Sorts the results of the trace by MEP ID or MAC address.
ttl *<value>*	Optional. Specifies the maximum permitted number of mapped MIP address hops. Valid range is **1** to **255**.
verbose	Optional. Specifies that trace results are shown in detail.

   The following example traces the link between local MEP **301** and remote MEP **302**:

```
(app-y1731 MEG3)#linktrace 302
Type CTRL+C to abort.
TTL 64, timeout is 2000 milliseconds.
Tracing route to target MEPID 302 from MEP 301

------------------------------------------------------------------------
----
Hop   Relay_Action  Forwarding_Action
   Reply Contents
------------------------------------------------------------------------
----
```



```
1     RLY_HIT       Term Mep
   Last Egress MAC/ID: 00:a0:c8:01:03:21 [0000]
   Ingress MAC/Action: 00:a0:c8:12:34:58 ingOk
   Ingress Port-ID   : Gigabit-Ethernet 0/2

Destination remote MEPID 302 reached at hop 1
```

Tracking and Responding to NNI defects and UNI Failures

Tracks that monitor for network-to-network interface (NNI) defects and UNI failures can be defined on the AOS unit and used to dynamically alter the operation of the unit in response to the defect or failure. These tracks allow the unit to change its behavior in response to LOC and remote defect indication (RDI) conditions, decreased upload and download bandwidth of EFM groups, and the line protocol status of the MEN port. For more information on configuring tracks for Y.1731, refer to *Network Monitoring in AOS,* available online from *http://supportforums.adtran.com*.

Saving Y.1731 Performance Monitoring Session Data

By default, each time a new measurement interval occurs during a Y.1731 performance monitoring session, ETH-DM, ETH-LM, and ETH-SLM, the data from the previous interval is overwritten. The performance monitoring file save feature allows performance monitoring logs to be stored in non-volatile memory in a series of hour-long log files compressed in xz format. The unit records session data to the current log file at user-specified intervals. At the end of the user-specified log lifetime, the logs are rotated out in a first-in first-out fashion; the oldest files are deleted to make room for the new files. Each performance monitoring session type is stored in a separate file in the user-specified directory. The file is automatically named by the unit using the following format:

*<device serial>*__**<DM | LM | SLM>.Data_**__*<date and time>*__**.pm.xz[.current]**__

Parameter	Description
<device serial>	Specifies the serial number of the unit.
DM	Specifies that the file is a single-ended (two-way) frame delay log.
LM	Specifies that the file is a single-ended frame loss log.
SLM	Specifies that the file is a single-ended synthetic frame loss log.
<date and time>	Specifies the date and time at which the log ends in the format **YYYY-MM-DD_hh.mm.ss**, for example: **2014-12-30_14:00:00**. This specifies the last time interval that the file will be written.
.pm.xz	Specifies the file extension of the log file.
.current	Appended to files that are still in use and could have data written to them.

The following example is a sample ETH-SLM file name that is no longer writable:

LBADTN340767_SLM.Data_2014-12-04_15.00.00.pm.xz

The following example is a sample ETH-LM file name of a file to which the unit is currently writing:

LBADTN340767_LM.Data_2014-12-04_15.00.00.pm.xz.current

If the file directory for the log files is changed, the files in the previous save directory will not be deleted for log rotation. Log rotation only occurs for files in the currently-specified save directory.

If any of the following conditions occur during a measurement interval, the measurement will be considered suspect, and it will be marked with a suspect flag:

- There is LOC during a measurement interval. If the LOC alarm is raised in the MEP by CCMs during a measurement interval, the suspect flag will be raised for that measurement interval.
- The clock is adjusted by more than 10 seconds. If the system clock is adjusted by more than 10 seconds during a measurement interval, the suspect flag will be raised.
- The performance monitoring session is started during a measurement interval. If the session starts during a measurement interval (for example, a performance monitoring session is initiated at 3:00 with a measurement interval of 5 minutes, and the start time is set to 3 minutes after 3:00) then the suspect flag will be raised for that measurement interval.
- The performance session is stopped during a measurement interval. If the session stops during a measurement interval (for example, a performance monitoring session was initiated at 3:00 with a measurement interval of 5 minutes, and the stop time is set to 3 minutes after 3:00) then the suspect flag will be raised for that measurement interval.
- The EVC status transitions to **Not Running** during a measurement interval. If the EVC over which the performance monitoring session is conducted transitions to a **Not Running** state during a measurement interval, the suspect flag will be raised for that measurement interval.
- The MEP transitions to an **Unavailable** or **Out of Service** state during a measurement interval. If the MEP goes to an **Unavailable** or **Out of Service** state during a measurement interval, the suspect flag will be raised for that measurement interval.

Saving Two-way Frame Delay Session Data

To specify that averaged two-way frame delay measurement interval data is saved to performance monitoring logs, use the **frame-delay two-way file-save averaged** command from the Y.1731 Local MEP Configuration mode. Use the **no** form of this command to disable saving data to the performance monitoring logs. The following example enables saving two-way frame delay data to the performance monitoring logs:

```
(config)#ethernet y1731 meg char-string MEG3 level 3
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep3)#frame-delay two-way file-save averaged
```

Saving Single-Ended Frame Loss Session Data

To specify that averaged single-ended frame loss measurement interval data is saved to performance monitoring logs, use the **frame-loss single-ended file-save averaged** command from the Y.1731 Local MEP Configuration mode. Use the **no** form of this command to disable saving data to the performance monitoring logs. The following example enables saving single-ended frame loss data to the performance monitoring logs:


```
(config)#ethernet y1731 meg char-string MEG3 level 3
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep3)#frame-loss single-ended file-save averaged
```

Saving Single-Ended Synthetic Frame Loss Session Data

To specify that averaged single-ended synthetic frame loss measurement interval data is saved to performance monitoring logs, use the **frame-loss synthetic single-ended file-save averaged** command from the Y.1731 Local MEP Configuration mode. Use the **no** form of this command to disable saving data to the performance monitoring logs. The following example enables saving single-ended synthetic frame loss data to the performance monitoring logs:

```
(config)#ethernet y1731 meg char-string MEG3 level 3
(config-y1731-meg MEG3)#local-mep 301
(config-y1731-mep3)#frame-loss synthetic single-ended file-save averaged
```

Specifying the Performance Monitoring Log Memory Consumption Limit

To specify the maximum amount of memory that can be used to store Y.1731 performance monitoring log files, use the **ethernet y1731 file-save consumption-limit** command from the Global Configuration mode. The limit specified must be larger than the space consumed by one performance monitoring file in order to allow the file to be written to memory. By default, the maximum memory used by each performance monitoring log file type is **1000000** bytes. Use the **no** form of this command to return to the default value.

```
(config)#ethernet y1731 file-save consumption-limit [frame-delay two-way
   <memory> | frame-loss single-ended <memory> | frame-loss synthetic
   single-ended <memory>]
```

Syntax	Description
frame-delay two-way <*memory*>	Specifies the maximum amount of memory in bytes used by two-way frame delay (ETH-DM) performance monitoring logs. Valid range is **1000** to **4294967295**.
frame-loss single-ended <*memory*>	Specifies the maximum amount of memory in bytes used by single-ended frame loss (ETH-LM) performance monitoring logs. Valid range is **1000** to **4294967295**.
frame-loss synthetic single-ended <*memory*>	Specifies the maximum amount of memory in bytes used by single-ended synthetic frame loss (ETH-SLM) performance monitoring logs. Valid range is **1000** to **4294967295**.

The following example specifies that ETH-LM performance monitoring logs should use a maximum of **2000000** bytes:

```
(config)#ethernet y1731 file-save consumption-limit frame-loss single-ended
   2000000
```


Viewing Performance Monitoring Session Log Data

To display specified Y.1731 current performance monitoring measurements, use the **show ethernet y1731 file-save** command from the Enable Configuration mode. The displayed output is current measurement information that has not yet been saved to a file.

```
#show ethernet y1731 file-save [<filename> | current frame-delay two-way |
   current frame-loss single-ended | current frame-loss synthetic
   single-ended]
```

Syntax	Description
<filename>	Specifies the filename of the file to be displayed.
current frame-delay two-way	Specifies that the current frame-delay two-way log file should be displayed.
current frame-loss single-ended	Specifies that the current single-ended frame-loss log file should be displayed.
current frame-loss synthetic single-ended	Specifies that the current single-ended synthetic frame-loss log file should be displayed.

The following example displays the current ETH-LM measurements:

```
#show ethernet y1731 file-save current frame-loss single-ended
Current LM Session Data:

Single-Ended Loss Measurement Data Set
Fileformat Version: 1.02
EVC.Name |EVC.VLAN-ID|EVC.PCP|Device.Serial|Dest.MAC|LM.period|LM.TestID|LM.Suspect|
LM.Start_ToD|LM.End_ToD|LM.PDU-sent|LM.PDU-received|LM.Forward.TX.framecount|LM.Forward.RX.f
ramecount|LM.Backward.TX.framecount|LM.Backward.RX.framecount
```

