

# Technical Specification MEF 7.1

## **Phase 2 EMS-NMS Information Model**

October 2009

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#### Summary

This Specification describes the Network View interface between an Ethernet Element Management System (EMS) and Network Management System (NMS) supporting Metro Ethernet Services Phase 1 and Phase 2 networks by providing the profile of management entities based on ITU-T Q.840.1. This specification also provides a mapping to the TMF's MTNM 3.5 Ethernet model.

The requirements and analysis for the management interface between an Ethernet Element Management System (EMS) and Network Management System (NMS) are provided in ITU-T Q.840.1, using the TMN interface specification methodology described in M.3020. In Q.840.1, a network view of Metro Ethernet and EoT managed entities are modeled according to a protocol-neutral information modeling approach, and the UML use case descriptions, class diagrams and sequence diagrams are also provided for both the requirements and the analysis of this management interface. In addition this document draws upon service requirements identified in MEF, ITU-T, and IEEE documents identified in the reference section.

Specifically this document adds management support for Service OAM.



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## Metro Ethernet Phase 2 EMS-NMS Interface

## 1 Scope

This Specification describes the Network View interface between an Ethernet Element Management System (EMS) and Network Management System (NMS) supporting Metro Ethernet Services Phase 1 and Phase 2 networks by providing the profile of management entities. Metro Ethernet Services attributes are defined in MEF-10.1. Appendix I of this specification provides a mapping to the TMF's MTNM 3.5 Ethernet model. The EMS-NMS interface described here in this document supersedes MEF 7.

The requirements and analysis for the management interface between an Ethernet Element Management System (EMS) and Network Management System (NMS) are provided in ITU-T Q.840.1, using the TMN interface specification methodology described in M.3020. In Q.840.1, a network view of Metro Ethernet and EoT managed entities are modeled according to a protocol-neutral information modeling approach, and the UML use case descriptions. Class diagrams and sequence diagrams are also provided for both the requirements and the analysis of this management interface.

In this Specification, the EMS is an Operations System (OS) used to manage the individual network elements (NEs) supporting Metro Ethernet services as well as the networks between them. One or more EMSs may be deployed depending on the different supplier products and geographic distribution of the network elements in the network. The NMS represents an integrated management OS across different technologies and EMSs. The NMS communicates with EMS through the EMS-NMS Interface (i.e., Q Interface) to realize its management functions.

The management functions covered in this Specification include: configuration management, performance measurement and parameters management, and alarm reporting and testing in fault management. This Specification does not cover all aspects about Ethernet management, only those related to Metro Ethernet services management are addressed. In addition this document draws upon service requirements identified in MEF, ITU-T, and IEEE documents identified in the reference section.

## 2 References

The following references contain provisions which, through reference in this text, constitute provisions of this Specification. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Specification are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below.

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#### **3** Terms and Definitions

This Specification uses the following terms.

#### 3.1 Definitions Imported from G.805

The following terms from ITU-T Recommendation G.805 [23] are used in this Specification:

- Connection
- Connection point
- Link
- Termination connection point
- Trail
- Trail termination

#### 3.2 Definitions Imported from G.809

The following terms from ITU-T Recommendation G.809 [24] are used in this Specification:

- Adaptation
- Characteristic information
- Client/server relationship
- Connectionless trail
- Flow
- Flow domain
- Flow domain flow
- Flow point
- Flow point pool
- Flow point pool link
- Flow termination
- Layer network
- Link flow



- Port
- Transport

## 3.3 Definitions Imported from ITU-T G.8010

The following terms from ITU-T Recommendation G.8010 are used in this Specification:

- ETH Link
- Traffic Conditioning Function

## 3.4 Definitions Imported from ITU-T G.8011

The following terms from ITU-T Recommendation G.8011 are used in this Specification:

- Committed Information Rate (CIR)
- Ethernet Private Line (EPL)
- Ethernet Virtual Private Line (EVPL)
- Ethernet Private LAN (EPLAN)
- Ethernet Virtual Private LAN (EVPLAN)

#### 3.5 Definitions Imported from MEF 10.1

The following terms from MEF 10.1 [3] and MEF 10.1.1 [45] are used in this Specification:

- All to One Bundling
- Bandwidth Profile
- Broadcast Service Frame
- CE-VLAN ID Preservation
- CE-VLAN ID/EVC Map
- CE-VLAN Tag
- CIR-compliant
- Circuit Emulation Service (CES)
- Class of Service (CoS)
- Color-aware
- Color-blind
- Committed Burst Size (CBS)
- Committed Information Rate (CIR)
- Customer Edge (CE)
- Dual Rate Bandwidth Profile
- Egress Frame
- EIR-compliant



- Ethernet Virtual Connection (EVC)
- Excess Burst Size (EBS)
- Excess Information Rate (EIR)
- Frame
- Frame Delay (FD)
- Frame Loss Ratio (FLR)
- Ingress Frame
- Inter-Frame Delay Variation (IFDV)
- Layer 2 Control Protocol Service Frame
- Layer 2 Control Protocol Tunneling
- Metro Ethernet Network (MEN)
- Multicast Service Frame
- Multipoint-to-Multipoint EVC
- Point-to-Point EVC
- Service Frame
- Service Level Agreement (SLA)
- Service Level Specification (SLS)
- Service Multiplexing
- Service Provider
- Single Rate Service
- Subscriber
- Unicast Service Frame
- User Network Interface (UNI)

## 3.6 Definitions Imported from ITU-T Y.1731

The following terms from ITU-T Recommendation Y.1731 are used in this Specification:

- On-Demand OAM
- Proactive OAM

## 4 Abbreviations

This Specification uses the following abbreviations:

- 1DM One-way Delay Measurement
- AIS Alarm Indication Signal
- APS Automatic Protection Switching



ASAP	Alarm Severity Assignment Profile
BER	Bit Error Rate
CBS	Committed Burst Size
CCM	Continuity Check Message
CE	Customer Edge
CES	Circuit Emulation Service
CI	Characteristic Information
CIR	Committed Information Rate
СМ	Configuration Management
CoS	Class of Service
CRC	Cyclic Redundancy Check
СТР	Connection Termination Point
DM	Delay Measurement
DMM	Delay Measurement Message
DMR	Delay Measurement Reply
EBS	Excess Burst Size
EIR	Excess Information Rate
EMS	Element Management System
EoT	Ethernet over Transport
ETH	Ethernet MAC layer network
ETH-AIS	Ethernet Alarm Indication Signal function
ETH-CC	Ethernet Continuity Check function
ETH-DM	Ethernet Delay Measurement function
ETH-LCK	Ethernet Lock Signal function
ETH-LB	Ethernet Loopback function
ETH-LM	Ethernet Loss Measurement function
ETH-LT	Ethernet Link Trace function
ETH-RDI	Ethernet Remote Defect Indication function
ETH-Test	Ethernet Test function
ETYn	Ethernet physical layer network of order n
FCS	Frame Check Sequence
FD	Flow Domain
FDFr	Flow Domain Fragment
FDX	Full Duplex
FLR	Frame Loss Ratio
FM	Fault Management
FP	Flow Point
FPP	Flow Point Pool
FS	Function Set
FTP	Flow Termination Point



GFP	Generic Framing Procedure
HDX	Half Duplex
ID	Identifier
IFDV	Inter-Frame Delay Variation
ITU-T	International Telecommunication Union – Telecommunication Standardization
Sector	
LAN	Local Area Network
LBM	Loopback Message
LBR	Loopback Reply Message
LCK	Locked
LMM	Loss Measurement Message
LMR	Loss Measurement Reply
LOC	Loss of Continuity
LTM	Link Trace Message
LTR	Link Trace Reply
MAC	Media Access Control
ME	Maintenance Entity
MEG	ME Group
MEN	Metro Ethernet Network
MEP	MEG End Point
MIB	Management Information Base
MIP	MEG Intermediate Point
MTTR	Mean Time To Restore
NE	Network Element
NMS	Network Management System
NNI	Network Node Interface
NT	Network Termination
OS	Operations System
OAM	Operation, Administration and Maintenance
P2P	Point to Point
P2MP	Point to Multi-Point
PDU	Protocol Data Unit
PHY	Physical Layer Entity
PM	Performance Management
QoS	Quality of Service
RDI	Remote Defect Indication
SLA	Service Level Agreement
SLS	Service Level Specification
SNC	Subnetwork Connection
STP	Spanning Tree Protocol
TCI	Tag Control Information

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TLV	Type, Length, and Value
TMN	Telecommunication Management Network
ТР	Termination Point
TST	Test PDU
TTL	Time to Live
TTP	Trail Termination Point
UML	Unified Modeling Language
UNI	User Network Interface
VID	VLAN ID
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
WAN	Wide Area Network

## 5 General overview

In G.8010, two layer networks are defined in the EoT network architecture:

- Ethernet MAC (ETH) Layer Network
- Ethernet PHY (ETY) Layer Network

G.805/G.809 describe a client/server relationship where client layer link connections are supported by server layer trails. The ETH layer network characteristic information can be transported through ETH links supported by trails in the ETY layer network or other path layer networks (e.g., SDH VC-n, OTN ODUk, MPLS, ATM, etc.).

This specification focuses on identifying the EMS-NMS interface management objects to support what is considered to be the essential functionality of Metro Ethernet Network (MEN) network and service management at the ETH layer over dedicated/private or shared/virtual bandwidth provided by the transport layer (SDH/SONET, PDH, ATM, MPLS, OTH, ETY, etc). The services supported by the EMS-NMS interfaces are identified in MEF 10.1.

MEF Services Phase 2 introduces the rooted multipoint connection type. In a Rooted-Multipoint EVC, one or more of the UNIs must be designated as a Root and each of the other UNIs must be designated as a Leaf. An ingress Service Frame mapped to the EVC at a Root UNI may be delivered to one or more of the other UNIs in the EVC. An ingress Service Frame mapped to the EVC at a Leaf UNI must not result in an egress Service Frame at another Leaf UNI but may result in an egress Service Frame at some or all of the Root UNIs.<sup>1</sup>

The interface profile provided in this specification identifies the managed objects (i.e. logical UML objects) needed to support Metro Ethernet services. This interface profile will be used for creating protocol specific MIBs based on CORBA, SNMP, XML, etc. This logical model based interface profile has great value in that it provides a protocol independent way of representing the information required for managing Metro Ethernet services. The goal of this specification is to provide a set of management objects that can be used to develop protocol specific models in a semantically consistent fashion.

<sup>&</sup>lt;sup>1</sup> Rooted multipoint EVC is defined in the MEF Services Phase 2 Services Attributes specification.

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This specification addresses the following functional areas of Metro Ethernet network and service management:

- Ethernet (ETH) layer Flow Point Pool (e.g., UNI) configuration and provisioning;
- ETH layer configuration and provisioning (including flow domain (subnetwork) provisioning, and link provisioning);
- ETH layer network Flow Domain Fragment (i.e. EVC) management (including set-up/modification for ETH FDFrs);
- ETH layer fault management;
- ETH layer performance monitoring;
- Management of the MAU/ETY layers ports (i.e. trail terminations).

In the Network-Level Management Architecture (see Figure 5-1), the NMS Environment interfaces to a set of subtending Element Management Systems (EMSs) which, in turn, interfaces to the Metro Ethernet NEs within its span of control. In this architecture, the NMS Environment delegates the responsibility of managing the individual elements to the EMSs, and only manages the flow domains as presented by the EMSs. Thus the EMS exposes a network view to the NMS Environment. It is also important for the EMS to expose the equipment view, especially for fault management.

The EMS shown in Figure 5-1 is used to manage the individual network elements supporting Metro Ethernet and EoT technologies. One or more systems may be required depending on the different supplier products and geographic distribution of the elements in the network. The network layer management system represents an integrated management OS environment across potentially different technologies and supplier systems. Figure 5-1 shows the EMS-NMS interface (Q interface) addressed in this Specification.



Figure 5-1 Network-Level Management Architecture

The Ethernet Services Layer, also referred to as the ETH Layer, is the specific layer network within a Metro Ethernet Network (MEN) responsible for the instantiation of Ethernet MAC oriented connectivity services and the delivery of Ethernet PDUs presented across well-defined internal and external interfaces. The ETH Layer is responsible for all service-aware aspects associated with Ethernet MAC flows, including operations,



administration, maintenance and provisioning capabilities required to support Ethernet connectivity services. As per the MEF services model (MEF 10.1 [3]), the Service Frame presented by the ETH Layer external interfaces is expected to be an Ethernet unicast, multicast or broadcast frame conforming to the IEEE 802.3-2005 frame format [32].

Figure 5-2 shows the relationship between the MEN interfaces defined in the MEF Generic Architecture Framework (MEF 4 [1]) and the ETH Layer. From the perspective of the ETH Layer, only those components of the UNI/NNI related to Ethernet service-aware functions are relevant. From a functional modeling viewpoint, the Ethernet Services Layer Network consists of topological, transport and processing entities.





#### 5.1 Network View Concepts

The Network View provides an abstraction of network resources allowing for flexibility in the management of the network. It provides a network layering abstraction, allowing multiple network technologies to be managed in an integrated fashion. The network view abstraction allows for the representation of a topological view of network resources, and the management of end-to-end connections or flows across the network. The network view abstraction resides at the Network Management Layer (NML) of TMN. The network view abstraction provides more service, flow, and connection oriented information than Element Management Layer (EML) and Element Layer (EL) nodal oriented management information models.

Network view models incorporate the concepts of layer networks, flow or subnetwork partitioning, topological view, and flow or connectivity view. These concepts allow the network view to provide an abstraction of the network being managed as an aggregate view of network resources.

A layer network domain (LND) represents an administration's view of the network resources responsible for transporting a specific type of characteristic information (e.g., IP, ETH (layer 2), ETY (ETH PHY), MPLS, SONET/SDH).

The topological view represents the network structure and topology. This view describes the flow domains or subnetworks that make up the LND, and partitioning relationships of the



flow domains or subnetworks within the LND. Flow domains or subnetworks are connected and related through Links. Links represent capacity supported by an underlying (or server) LND.

The connectivity or transport view of the network view model describes the flows (connections) through an LND, and the supporting flows (connections) through the flow domains (subnetworks) and links. This view describes how flows traverse flow domains and their partitioned components. The relationships of the flows to the supporting underlying server LND are provided through the use of link connections. Flows (connections) describe how capacity and resources are assigned to support trails through an LND.

The layer network concept provides a separation of resources and capabilities that support the transport of specific types of characteristic information (e.g., IP packets and Ethernet frames). Flow domain partitioning allows a flow domain to be partitioned into component flow domains and the links that connect them.

Connection Oriented (G.805)	Connectionless (G.809)	Metro Ethernet / EoT Entity
Subnetwork	FlowDomain (MatrixFlowDomain)	ETH_Flow_Domain
LinkEnd	FPP (FlowPointPool)	ETH_FPP
Link	FPPLink	ETH_FPP_Link
SNC (SubnetworkConnection)	FDFr (FlowDomainFragment)	ETH_FDFr_EVC
Network CTP (Connection Termination Point)	FlowPoint	ETH_Flow_Point
Network TTP (Trail Termination Point)	FlowPoint	ETH_Flow_Point MAUTransportPort

#### 5.1.1 Network Layering

Layer networks provide the logical separation of network resources that support transport for different types of characteristic information. An LND represents an administration's view of the layer network responsible for transporting a specific type of characteristic information. Layer networks may use transport resources in other layer networks. That is, an LND may act as a client LND with respect to another LND that provides transport resources, the server LND. In Figure 5-3, the IP LND uses transport resources of the ETH LND. The ETH LND in turn uses the resources of the MPLS LND; the MPLS LND in turn uses the resources of the SONET/SDH LND, and the SONET/SDH LND utilizes the physical transport resources represented in the WDM LND.



Figure 5-3 Network Layering Example

Flows, connections, resources, and network topology can be managed and represented separately for each LND. However, relationships are made between LNDs that use the transport services of other LNDs. The concept of network layering is important for separating the management concerns of different network technologies and services.

#### 5.1.2 Partitioning

Flow domains (subnetworks) are composed of flow domains (subnetworks) and links. Recursively, a flow domain (subnetwork) may be partitioned into sub-flow domains (subnetworks) and the links that connect them.



## **Figure 5-4 Partitioning Example**

Partitioning is useful in describing various management criteria under which a carrier's network might be divided. For example, the carrier's network might be partitioned along the lines of the network operations center (NOC) responsible for each flow domain or subnetwork. Within each flow domain (subnetwork) representing a NOC, flow domains (subnetworks) could be partitioned to describe the resources that are managed by a specific element management system (EMS). Again within each EMS related flow domain (subnetwork), a flow domain (subnetwork) could be used to represent the resources of a specific set of network elements (e.g., bridge).

There are many ways flow domains and subnetworks can be partitioned. The partitions should represent the business needs of a specific management interface.

#### 5.1.3 Topological Provisioning

Topological elements represent the logical topology or structure of the flow domain (subnetworks) within an LND. These elements include flow domains (subnetworks) and the



links that connect them.

The flow domain (or subnetwork) provides capacity for carrying characteristic information within an LND. Flow domains (subnetworks) can be partitioned into a set of component flow domains (subnetworks) and links. In addition to representing flow domains in its own administration as component flow domains, a carrier can represent an external carrier network as a component flow domain, allowing the carrier to maintain a complete topology including connected external networks.



**Figure 5-5 Topological Elements** 

Flow domains can be used to represent: a carrier's entire layer network; vendor-specific component flow domains of the carrier's layer network; connected external carrier flow domains; and even "atomic" flow domains (matrix flow domains) that correspond to individual NEs (bridges).

A Link is a topological component that describes a fixed topological relationship between flow domains (subnetworks), along with the capacity supported by an underlying server LND trail. Links in the client LND are supported by trails in an underlying server LND.

The termination of a Link is called a Flow Point Pool (FPP) or Link End. The FPP or Link End describes configuration information associated with an interface, such as a UNI or NNI. The FPP or Link End is associated with the trail termination of the underlying server trail used to perform adaptation and transport of the characteristic information of the client LND.

#### 5.1.4 Flow / Connection Management

Flow and connection elements are responsible for transporting characteristic information across the LND, across flow domains (subnetworks), and across Links.

A Flow Domain Fragment (FDFr) or Subnetwork Connection (SNC) (e.g., ETH Virtual Connection, ATM PVC, etc.) is a connection responsible for transporting characteristic information across a flow domain or subnetwork. If the flow domain (subnetwork) that the FDFr (SNC) traverses is partitioned, the FDFr (SNC) may be partitioned into its component FDFrs (SNCs).



## **Figure 5-6 Connection Elements**

A Subnetwork Connection is terminated at Connection Termination Points (CTPs). A Flow Domain Fragment is terminated at Flow Points (FPs). Because subnetworks may be partitioned, several Subnetwork Connection end-points may coincide at a single CTP. Likewise a single FP may represent the termination of several FDFrs from the same partitioned FDFr. The CTP (FP) represents the actual point of termination of both SNCs (FDFrs) and link connections.

## 5.1.5 Service View Concepts

The Ethernet Service View allows Subscribers to successfully plan and integrate Services into their overall networking infrastructure, allows suppliers of Customer Edge Equipment to implement capabilities into their products so that they can be used to successfully access Ethernet Services, and allows Service Providers to describe services in Service Level Specifications and provide such services at the User Network Interface (UNI).

The Ethernet Services are modeled from the point of view of the Subscriber's equipment referred to as the Customer Edge (CE) that is used to access the service at the UNI into the Provider Edge (PE). Service Attributes represent the definition of Service Level Specification.



Figure 5-7 – Ethernet Services Model [3]

The technical definition of a service is in terms of what is visible at the Customer Edge (CE) including the UNI, which is the demarcation point between the Service Provider and the Subscriber and where the CE and the Metro Ethernet Network (MEN) /EoT exchange Service Frames. In the Service View there are no assumptions about the details of the Metro Ethernet Network/EoT (e.g., it may consist of a single switch or a combination of networks based on many different technologies).

## 6 Interface Requirements

#### 6.1 **Business Level Requirements**

Q.840.1 only focuses on the management interface between NMS and EMS for Metro Ethernet and EoT, and the interface management functions associated with them. Through the interface, NMS can query and modify configuration information, and EMS can report changes in configuration, state changes, performance data, and fault information to NMS.

#### 6.1.1 Overview of Use Cases

Figure 6-1 shows the Use Case Diagram of the common management function sets according to Q.827.1.



## Figure 6-1 Common Management Function Set Overview

Figure 6-2 shows the functions involved in the Configuration management function set.





## **Figure 6-2 Configuration Management Function Set**

The use case diagram for performance management function set according to Q.827.1 is found in Figure 6-3.





## **Figure 6-3 Performance Management Function Set**

The use case diagram for Fault management function set based on Q.827.1 is shown in Figure 6-4.





## Figure 6-4 Fault Management Function Set

Q.840.1 contains UML use case diagrams that summarize the functionality and interfaces of EMS. The detailed Use Cases descriptions may be found in Q.840.1.



## **Figure 6-6 Ethernet Discovery Function Set**







## Figure 6-8 ELMI Profile Management



Figure 6-9 ETH FDFr/EVC Management

## 7 Information Model Overview

This section provides the detailed analysis of the Metro Ethernet Service / EoT EMS-NMS management interface. In the following sub-section, the related managed entities and their relationships are fully analyzed, and the diagrams in these sub-sections illustrate the static or dynamic relationships of the managed entities.

#### 7.1 Common Management Function Set



#### Figure 7-1/Q.827.1 – Inheritance diagram of common management

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Figure 7-2/Q.827.1 – Containment diagram of common management

## 7.2 Class Diagrams of Metro Ethernet Specific Management Entities

Figure 7-1, Figure 7-2, and Figure 7-3 are the inheritance diagram from ITU-T Q.840.1 of the management entities providing the topology view, connectivity view, and reference data.



## Figure 7-1/Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Topology View



## Figure 7-2/Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Connectivity View



## Figure 7-3/Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Reference Data

Figure 7-4 and Figure 7-5 are the relationship diagrams (including containment) from Q.840.1 of the network view, equipment view, and the service configuration view.



## Figure 7-4/Q.840.1 Relationship Diagram of Ethernet Network View and Equipment View





Figure 7-5/Q.840.1 Relationship Diagram of Ethernet Service Configuration Managed Entities

## 8 Metro Ethernet Service Phase 2 EMS-NMS Interface Profile

This section identifies the managed entities that apply to the Metro Ethernet Phase 2 EMS-NMS Interface along their source references. The requirements for a management interface supporting Metro Ethernet Services Phase 1 and Phase 2 are provided by the interface profile tables within this section. Table 8-1 identifies the management entities necessary to manage Phase 1 and Phase 2 Metro Ethernet Services. The performance data sets required in support of Metro Ethernet Services are described in Table 8-2. Table 8-3 describes the elements within each management entity that are required for each Phase 1 and Phase 2 Metro Ethernet Services, along with a mapping to the MEF's original EMS-NMS interface describe in MEF 7.

#### 8.1 Conventions

In this section, when specifying managed entities and their management operations, the following abbreviations are applied to indicate the modifier of attributes, notifications or operation parameters.

- M: Mandatory.
- O: Optional.
- C: Conditional.
- NA: Not applicable



In Table 8-1, each management entity is describes as being Mandatory (denoted by M) or Optional (denoted by O) with respect to Phase 1 and Phase 2 MEF services in the Metro Ethernet EMS-NMS Interface.

Management Entity	Reference	MEF 7.1 Required	
8 1		Phase 1	Phase 2
ManagedElement	Defined in M.3100	0	0
Equipment	Defined in M.3100	0	0
EquipmentHolder	Defined in M.3100	0	0
CircuitPack	Defined in M.3100	0	0
Log	Defined in X.721	0	0
AlarmRecord	Defined in X.721	0	0
EMS	Defined in Q.827.1	М	М
	Amd 1		
Alarm Severity Assignment Profile	Defined in M.3100	0	0
ETH_Flow_Domain	Defined in Q.840.1	М	М
ETH FPP (superclass)	Defined in Q.840.1	M (superclass)	M (superclass)
ETH_FPP_UNI	Defined in Q.840.1	M	M
ETH_FPP_Link	Defined in Q.840.1	0	0
ETH FDFr EVC	Defined in Q.840.1	М	М
ETH Flow Point	Defined in Q.840.1	М	М
ETHBandwidthProfile	Defined in Q.840.1	М	М
ETHServiceClassProfile	Defined in Q.840.1	М	М
ETHCoSBandwidthMapping	Defined in Q.840.1	М	М
ETHPerformanceProfile	Defined in Q.840.1	0	М
ETHCoSPerformanceMapping	Defined in Q.840.1	0	М
ELMIProfile	Defined in Q.840.1	NA	С
TransportPort	Defined in O.840.1	С	С
MAUTransportPort	Defined in O.840.1	С	С
EthMe	Defined in this	C	C
	Specification		
EthMeg	Defined in this	С	С
	Specification		
EthMp	Defined in this	С	С
1	Specification		
EthMep	Defined in this	С	С
-	Specification		
EthMip	Defined in this	С	С
	Specification		
EthMd	Defined in this	С	С
	Specification		
EthMepPeerInfo	Defined in this	С	С
	Specification		
EthOamDmCfg	Defined in this	С	С
	Specification		
EthOamDmProactiveOneWayThreshold	Defined in this	С	С
	Specification		
EthOamDmProactiveTwoWayThreshold	Defined in this	С	С
	Specification		
EthOamLmCfg	Defined in this	С	C
	Specification		
EthOamLbCfg	Defined in this	С	C
	Specification		

## **Table 8-1 Table of Required Management Entities**

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EthOamLbStats	Defined	in	this	С	С
	Specification	n			
EthOamCcCfg	Defined	in	this	С	С
	Specification	n			
EthOamCcStats	Defined	in	this	С	С
	Specification	n			
EthOamAisCfg	Defined	in	this	С	С
	Specification	n			
EthOamLtCfg	Defined	in	this	С	С
	Specification	n			
EthOamLtrStats	Defined	in	this	С	С
	Specification	n			
EthOamLckCfg	Defined	in	this	С	С
	Specification	n			
EthOamTestCfg	Defined	in	this	С	С
	Specification	n			
EthOamTestStats	Defined	in	this	C	С
	Specification	n			

In this specification, only the performance measurement parameters (grouped by performance data set) specific to Metro Ethernet services are provided. Required performance data sets for Phase 1 and Phase 2 Metro Ethernet Services are described in Table 8-2. Further information on performance management functionality can be found in section 7.3/Q.827.1. Within this logical model, Performance Data Sets simply describe the category of the performance information (the data set) along with the individual counters associated with the set. It is assumed that both current and historical counts will be made available across the EMS-NMS interface. For this logical model, the duration of the interval and amount of history to be stored are not specified. These must be specified for any management protocol specific interface and/or implementation agreement that makes use of this logical model.

Performance Data Set	Reference	MEF 7.1 Required		
		Phase 1	Phase 2	
ETH UNI Anomalies Performance Data Set	Defined in Q.840.1	М	М	
ETH UNI Traffic Performance Data Set	Defined in Q.840.1	М	М	
ETH Ingress Traffic Management	Defined in Q.840.1	М	М	
Performance Data Set				
ETH Egress Traffic Management	Defined in Q.840.1	М	М	
Performance Data Set				
ETH Congestion Discards Performance	Defined in Q.840.1	М	М	
Data Set				
ETH ELMI Performance Data Set	Defined in Q.840.1	NA	0	
MAU Termination Performance Data Set	Defined in Q.840.1	С	С	
ETH Point-to-Point EVC MEG	Defined in this	С	С	
Performance Data Set (EthMegPerfDataSet)	Specification			
ETH Maintenance Point Performance Data	Defined in this	С	С	
Set (EthMpPerfDataSet)	Specification			
ETH MEG End Point Loss Measurement	Defined in this	С	С	
On-Demand Single-Ended Data Set	Specification			
(EthOamLmOnDemandSingleEndedStats)				
ETH MEG End Point Delay Measurement	Defined in this	С	С	
On-Demand 2-Way Data Set	Specification			
(EthOamDmOnDemandTwoWayStats)				
ETH MEG End Point Delay Measurement	Defined in this	С	С	
On-Demand 1-Way Data Set	Specification			
(EthOamDmOnDemandOneWayStats)				
ETH MEG End Point Delay Measurement	Defined in this	С	С	
Proactive 1-Way Current Data Set	Specification			
(EthOamDmProactiveOneWayCurrentStats)				
ETH MEG End Point Delay Measurement	Defined in this	С	С	
Proactive 2-Way Current Data Set	Specification			
(EthOamDmProactiveTwoWayCurrentStats)				
ETH MEG End Point Delay Measurement	Defined in this	С	С	
Proactive 1-Way History Data Set	Specification			
(EthOamDmProactiveOneWayHistoryStats)				
ETH MEG End Point Delay Measurement	Defined in this	С	С	
Proactive 2-Way History Data Set	Specification			
(EthOamDmProactiveTwoWayHistoryStats)				

# **Table 8-2 Table of Required Performance Data Sets**

Table 8-3 describes the applicability of specific management entity elements (e.g., the object class, attributes, relationships, methods, and notifications) to the Metro Ethernet EMS-NMS Interface. Each element of each management entity is identified as Mandatory (denoted by M), Optional (denoted by O), Conditional (denoted by C), or not applicable (denoted by NA). A brief description and notes are provided for each element, however full descriptions may be found in ITU-T Recommendation Q.840.1. The last column of this table provides a mapping of the element to the elements in the MEF's original EMS-NMS model defined in MEF 7. The EMS-NMS interface described here in this document supersedes MEF 7.

ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity	• •			Q.840.1)	Element
ETH_Flow_	object	-	Phase 1: M	Used for establishing	ETH_Flow_Domain
 Domain	-		Phase 2: M	EVCs and	
				representing network	
				topology.	
	attribute	userLabel	Phase 1: M	Name of managing	userLabel
			Phase 2: M	organization	
	methods	setupPtToPtETH_FDFr_	Phase 1: M	Establish point to	setupPtToPtETH_F
		EVCWithFPPs	Phase 2: M	point EVC	DFr_EVCWithFPPs
		setupMultiToMultiETH_	Phase 1: M	Establish Multipoint	setupMultiToMultiE
		FDFr_EVCwithFPPs	Phase 2: M	EVC	TH_FDFr_EVCwith
					FPPs
		setupRootedToMultiET	Phase 1: NA	Establish Rooted	NONE
		H_FDFr_EVCwithFPPs	Phase 2: M	Multipoint EVC	
		releaseETH_FDFr_EVC	Phase 1: M	Release a previously	releaseETH_FDFr_
			Phase 2: M	established EVC	EVC
	relationships	Contained in EMS	Phase 1: M	EMS is the	In MEF7 FD is
			Phase 2: M	containing object for	contained under
				FD	LND
		Contains	Phase I: M	The EVCs within the	Contains
		EIH_FDFr_EVC	Phase 2: M	flow domain	EIH_FDFr_EVC
		MISMAICH	Phase I: NA	In Q.840.1	MEF / Contains
			Phase 2. NA	profiles are under	
				FMS	Contains
				LIVIS.	ETHCosProfile
		SupportingFlements:	Phase 1. O	May be associate FD	SupportingElements
		Supporting Lienents.	Phase 2: 0	with supporting	· SupportingElements
		Supportedby	1 11030 2. 0	Managed Elements	. Supported by
				and Circuit Packs	
		ETH FPPs:	Phase 1: M	the ETH FPPs (e.g.,	ETH FPPs:
		FlowDomainInterfaces	Phase 2: M	UNIs) that delineate	FlowDomainInterfa
				the Flow Domain	ces
		ETH FPP Links:	Phase 1: NA	Used to associate	ETH FPP Links:
		MemberLinks	Phase 2: NA	links within the	MemberLinks
				parent FD	
		ETH_Flow_Domains:	Phase 1: NA	Used to associate	ETH_Flow_Domain
		FlowDomainMembershi	Phase 2: NA	member FDs within	s:
		p		the parent FD	FlowDomainMembe
					rship
	notifications	objectCreation	Phase 1: M	Used for discovery	objectCreation

 Table 8-3 Table of ITU-T Q.840.1 Management Entity Elements

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management Entity	Туре		Required	(details in O.840.1)	MEF7 Element
			Phase 2: M	<u>((01011)</u>	
		objectDeletion	Phase 1: M	Used for discovery	objectDeletion
		5	Phase 2: M	5	5
		attributeValueChange	Phase 1: O	May be used to notify	attributeValueChang
			Phase 2: O	NMS of attribute	e
				changes.	
		stateChange	Phase 1: NA Phase 2: NA	Not used	NONE
ETH_FPP	object	-	Phase 1: M	Represents interfaces,	ETH_FPP
			Phase 2: M	e.g., MEF UNIs or	
				E-NNIs, at the ETH	
		(D.D.)		Layer.	
	attributes	fPPType	Phase 1: M	Indicates that the	fPP_FPPType
			Phase 2: M	ETH_FPP is a UNI,	
				SINI, E-ININI, OI Unconfigured	
		fPPSubType	Phase 1: O	For UNI set to	NONE
		n i suo iype	Phase 2: O	"MEF UNI Type 1".	TIONE
				or "MEF UNI Type"	
				2"	
		totalBWCapacity	Phase 1: M	Total BW supported	availableCapacity
			Phase 2: M	on the FPP.	
		userLabel	Phase 1: M	A string that may be	userLabel
			Phase 2: M	identifier on the FPD	
		ieee802dot3Address	Phase 1. M	IEEE 802 3 source	physAddress
		1000002400011441055	Phase 2: M	address of any non	physinaaress
				FDFr/EVC specific	
				frames that originate	
				at this FPP	
		operationalState	Phase 1: M	Indicates the current	operState
			Phase 2: M	capability of the FPP	
				to provide service.	
				disabled enabled	
		availabilityStatus	Phase 1. M	Values include:	availabilityStatus
		u vulluoint jotutuo	Phase 2: M	inTest, failed,	u vulluo integ Status
				powerOff, degraded,	
				notInstalled	
		administrativeState	Phase 1: M	The values include:	adminState
			Phase 2: M	locked or unlocked.	
				In Locked state frame	
				now inrough the FPP	
		ingressMax AssignableR	Phase 1: O	Maximum amount of	ingressMax Assigna
		W	Phase 2. O	BW assignable on the	bleBW
				FPP (aggregation of	
				links) in the Ingress	
				direction	
		egressMaxAssignableB	Phase 1: O	Maximum amount of	egressMaxAssignabl
		W	Phase 2: O	BW assignable on the	eBW
				FPP (aggregation of	
				links) in the Egress	

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
				direction	
		ingressMaxAssignableC	Phase 1: O	Per CoS Maximum	NONE
		oSBW	Phase 2: O	assignable BW on the	
				interface in the	
				Ingress direction.	
		ingressMaxAssignableC	Phase 1: O	Per CoS Maximum	NONE
		oSBW	Phase 2: O	assignable BW on the	
				interface in the egress	
		New Vister 10 and the	Dhana 1. M	direction.	No. EVO.
		maxinumvirtualConnecti	Phase 1: M Dhase 2: M	Max number of	maxinumevCs
		ons	Phase 2. M	EVCs that may be supported at the EDD	
		numConfiguradVirtualC	Dhaga 1: M	Supported at the FFF.	numConfiguradEVC
		onnections	Phase 2: M	configured EVCs at	
		officetions	T Hase 2. WI	the FPP	5
		mtuSize	Phase 1. O	Max transmission	NONE
			Phase 2: M	unit size for the FPP	
	relationships	Contained in EMS	Phase 1: M	EMS is the	In MEF7 FPP is
	1		Phase 2: M	containing object for	contained under
				FPP	LND
		Contains	Phase 1: M	FPs terminating a	Contains
		ETH_Flow_Point	Phase 2: M	EVC segment at the	ETH_Flow_Point
				FPP	
		Contains ELMI Profile	Phase 1: NA	Conditionally	NONE
			Phase 2: C	required if the FPP	
		Commentine Tlementer	Dhaga 1. O	Supports ELMI	Summartin a Elamanta
		SupportingElements.	Phase 1. 0	with supporting	: SupportingElements
		Supported by	Thase 2. O	Managed Flements	. Supported by
				and Circuit Packs	
		ETH FPP Link:	Phase 1: O	Link that is	ETH Link:
		FPPpoints	Phase 2: O	terminated by the	FPPpoints
		1		ETH FPP optionally	1
				retrievable from the	
				ETH_FPP	
		ServerTTP :	Phase 1: M	Relationship between	ServerTTP :
		Client/Server or	Phase 2: M	the FPP and the	Client/Server or
		EthTunneling		supporting TRAN	EthTunneling
				layer termination	
				(could be ETH layer	
				Transport Dort ata)	
		FTH Flow Domains	Phase 1. M	FPP is one of the	FTH Flow Domain
		FlowDomainInterfaces	Phase 2: M	FPPs that delineate	s.
			- 1000 2. 111	the associated FDs	FlowDomainInterfa
					ces
		ETHBandwidthProfile:	Phase 1: M	Ingress bandwidth	In MEF7 this
		IngressBwCharacterizati	Phase 2: M	profile for all service	relationship is on the
		on		frames at the FPP in	ETH_FPP_UNI
				the ingress direction	object.
		ETHBandwidthProfile:	Phase 1: M	Egress bandwidth	In MEF7 this
		EgressBwCharacterizatio	Phase 2: M	profile for all service	relationship is on the
		n		trames at the FPP in	ETH_FPP_UNI

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ITU-T Q.840.1	Element	Element	MEF	<b>Description/Notes</b>	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
				the ingress direction	object.
	notifications	objectCreation	Phase 1: M	Used for discovery	objectCreation
			Phase 2: M		
		objectDeletion	Phase 1: M	Used for discovery	objectDeletion
			Phase 2: M		
		attributeValueChange	Phase 1: O	May be used to notify	attribute ValueChang
			Phase 2: O	NMS of attribute	e
		stateChange	Phase 1. M	Indicates changes in	NONE
		stateChange	Phase 2. M	administrative and	NOME
			1 11050 2. 101	operational state	
ETH FPP UNI	object	-	Phase 1: M	Subclass of	ETH FPP UNI
(Subclass of			Phase 2: M	ETH FPP. Represent	
ETH_FPP.				the UNIs that provide	
ETH_FPP_UNI				MEF UNI	
inherits				functionality.	
properties,	attributes	uniIdentifier	Phase 1: M	Describes the UNI	uniIdentifier
including			Phase 2: M	within the scope of	
attributes from				the service provider	
ETH_FPP)		1	Dhass 1. M	domain.	1
		layer2ControlProtocolPr	Phase 1: M	Provide control	layer2ControlProtoc
		ocessingList	Phase 2. M	MAC address along	ofProcessingList
				with the processing	
				alternative (Discard.	
				Peer, Pass-to-FDFr	
				/EVC, Peer &	
				Pass-to- FDFr/EVC)	
		serviceMuxingIndicator	Phase 1: M	Describes if service	serviceMuxingIndic
			Phase 2: M	multiplexing is	ator
				enabled at the UNI	
		bundling	Phase 1: M	three bundling	In MEF represented
			Phase 2: M	options: yes, no and	by both
				all-to-one	bundlingIndicator
					allu allToOneIndicator
		ingressVLANAssignmen	Phase 1 · NA	Identifies VLAN-ID	NONE <sup>.</sup> Not used for
		tAll	Phase 2: NA	assigned to all ingress	MEF
				traffic	
		ingressVLANAssignmen	Phase 1: M	Identifies VLAN-ID	untaggedVLANAssi
		tUntagged	Phase 2: M	assigned to untagged	gnment
				and priority tagged	
				ingress traffic	
		ingressVLANPriorityAss	Phase 1: NA	Identifies the VLAN	NONE: Not used for
		IgnmentAll	Phase 2: NA	Priority assigned to	MEF
		ingrassVI ANDriarity Acc	Dhase 1. NA	Identifies the VI AN	NONE: Not used for
		ignmentUntagged	Phase $2 \cdot NA$	Priority assigned to	MEF
		15mmonromuggou	1 Huse 2. INA	untagged ingress	1711./1
				traffic	
		unassignedCeVlanIDList	Phase 1: O	List of unique values	unassignedCeVlanI
			Phase 2: O	that are available for	DList
				assignment as the	

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ITU-T Q.840.1 Managament	Element	Element	MEF Bequired	Description/Notes	Original MEE7
Entity	туре		Requireu	Q.840.1)	Element
				CE-VLAN ID when	
				creating new EVCs	
		nextAvailCeVlanID	Phase 1: M	Next available	NONE
			Phase 2: M	Unassigned	
		alarmStatus	Phase 1. M	Values for alarm	NONE
		alarmotatus	Phase 2: M	status include.	NONE
			1 1000 21 111	critical, major, minor,	
				indeterminate,	
				warning, pending,	
				and cleared	
	relationships	Contained in EMS	Phase 1: M	EMS is the	In MEF7 UNI is
			Phase 2: M	containing object for	contained under
		Contains	Phase 1. M	EPs terminating a	Contains
		ETH Flow Point	Phase 2: M	EVC segment at the	ETH Flow Point
			1 1000 21 111	UNI	
		Contains ELMI Profile	Phase 1: NA	Conditionally	NONE
			Phase 2: C	required if the UNI	
				supports ELMI	
		SupportingElements:	Phase 1: O	May associate UNI	SupportingElements
		SupportedBy	Phase 2: O	With supporting	: SupportedBy
				and Circuit Packs	
		ETH FPP Link:	Phase 1: O	Link that is	ETH Link:
		FPPpoints	Phase 2: O	terminated by the	FPPpoints
				UNI optionally	
				retrievable from the	
		CompanyTTD .	Dhaza 1. M	UNI object	Commentation .
		Client/Server or	Phase 1. M Phase 2: M	the UNI and the	Client/Server or
		EthTunneling	1 11030 2. 101	supporting TRAN	EthTunneling
				layer termination	
				(could be ETH layer	
				TTP for tunneling, a	
				TransportPort, etc.)	
		ETH_Flow_Domains:	Phase 1: M	UNI is one of the	ETH_Flow_Domain
		riowDomainInterfaces	Flase 2: M	the associated FDs	s. FlowDomainInterfa
					ces
		ETHBandwidthProfile:	Phase 1: M	Ingress bandwidth	ETHBandwidthProfi
		IngressBwCharacterizati	Phase 2: M	profile for all service	le:
		on		frames at the UNI in	IngressBwCharacter
				the ingress direction	Ization
		ETHBandwidthProfile:	Phase 1: M	Egress bandwidth	ETHBandwidthProfi
		n n n n n n n n n n n n n n n n n n n	Phase 2: M	frames at the UNI in	IC. ForessRwCharacteri
				the ingress direction	zation
	notifications	objectCreation	Phase 1: M	Used for discovery	objectCreation
		~	Phase 2: M		
		objectDeletion	Phase 1: M	Used for discovery	objectDeletion
			Phase 2: M		
FRROR! © The	Metro Ethernet Eo	attribute ValueChange	Phase 1: 0	Nay be used to notify	attribute Value Chang

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ITU-T Q.840.1	Element	Element	MEF De gruine d	Description/Notes	Original MEE7
Entity	Туре		Required	(details in Q.840.1)	Element
			Phase 2: O	NMS of attribute changes.	e
		stateChange	Phase 1: M	Indicates changes in	NONE
			Phase 2: M	administrative and	
ETH FPP Link	Object	_	Phase 1: O	operational state	ETH Link
	00,000		Phase 2: O	relationship between two Flow Domains	
	attributes	totalCapacity	Phase 1: M Phase 2: M	inherent bandwidth capacity of the link in both the a-to-z and	availableCapacity
			Dhara 1. M	z-to-a direction	
		userLabel	Phase 1: M Phase 2: M	provide circuit identifier	userLabel
		usageCost	Phase 1: O Phase 2: O	usage cost allocated to the Link	usageCost
	relationships	Contained in EMS	Phase 1: M Phase 2: M	EMS is the containing object for Link	In MEF7 Link is contained under LND
		ETH_FPP: FPPpoints	Phase 1: M Phase 2: M	Link that is terminated by exactly two FPPs	ETH_FPP_UNI: FPPpoints
		ETH_Flow_Domains: MemberLinks	Phase 1: M Phase 2: M	Link is a component of ETH_Flow_Domain	ETH_Flow_Domain s: MemberLinks
	notifications	objectCreation	Phase 1: M Phase 2: M	Used for discovery	objectCreation
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	objectDeletion
		attributeValueChange	Phase 1: O Phase 2: O	May be used to notify NMS of attribute changes.	attributeValueChang e
		stateChange	Phase 1: NA Phase 2: NA	Not used	stateChange
ETH_FDFr_EV C	Object	-	Phase 1: M Phase 2: M	Represents a Flow Domain Fragment or EVC which transfers information across a FD. It is formed by the association (and mappings) of Flow Points at the boundary of the Flow Domain	ETH_FDFr_EVC
	attributes	administrativeState	Phase 1: M Phase 2: M	The values include: locked or unlocked. In Locked state frame flow through the FPP is prohibited.	adminState
		operationalState	Phase 1: M Phase 2: M	Indicates the current capability of the FPP to provide service.	operState
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ITU-T Q.840.1	Element	Element	MEF	<b>Description/Notes</b>	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
				Values include:	
				disabled, enabled.	
		availabilityStatus	Phase 1: M	Values include:	availabilityStatus
			Phase 2: M	inTest, failed,	
				powerOff, degraded,	
		nrotected	Phase 1: O	Indicates if the EVC	eVCProtected
		protected	Phase $2^{\circ}$ O	is protected or not at	everiolected
			1 huse 2. 0	the ETH layer	
		userLabel	Phase 1: M	Provides additional	userLabel
			Phase 2: M	information about the	
				EVC, such as a	
				circuit identifier	
		fDFrEvcType	Phase 1: M	mp2mp, p2p, or	eVCType
			Phase 2: M	rootedMp	
		fDFrEvcName	Phase 1: M	Unique identifying	ethEVCId
			Phase 2: M	value for the ETH	
				Virtual Connection	
		uniCeVlanIdPreservation	Phase 1: M	Boolean that	uniCeVlanIdPreserv
			Phase 2: M	identifies an EVC	ation
				where the CE VLAN	
				inductional to the	
				CE VI AN IDs of the	
				corresponding ingress	
				frames	
		uniCeVlanCoSPreservati	Phase 1: M	Boolean that	uniCeVlanCoSPrese
		on	Phase 2: M	identifies an EVC	rvation
				where the CE VLAN	
				CoS user_ priority	
				bits of an egress	
				frame is identical to	
				the CE VLAN CoS	
				user_priority bits of	
				the corresponding	
			Dhaga 1. O	The menine	NONE
		maxUNIEndPoints	Phase 1: U Phase 2: M	number of UNI and	NONE
			1 Hase 2. Ivi	points of the EVC	
		mtuSize	Phase 1: O	maximum	NONE
			Phase 2: M	transmission unit size	110112
				for the EVC	
	methods	addTPsToMultiETH_FD	Phase 1: M	add endpoints to a	addTPsToMultiETH
		Fr_EVCwithFPPs	Phase 2: M	multipoint EVC	_FDFr_EVCwithFP
					Ps
		removeTPsFromMultiET	Phase 1: M	remove endpoints	removeTPsFromMu
		H_FDFr_EVC	Phase 2: M	from a multipoint	ltiETH_FDFr_EVC
				EVC	DEMONTER
			Phase I: NA	Deprecated MEF/	KEMOVED:
	relationshing	contained in	Phase 2: NA	ED is the containing	contained in
	relationships	FTH Flow Domain	Phase 7. M	object for FVC	FTH Flow Domain
		ETH Flow Points	Phase 1: M	EVC is terminated by	ETH Flow Points.
		EIII_IION_IOIIII.	1 11450 1.191	L V C 15 terminated by	EII_IIOW_IOMUS.

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ITU-T Q.840.1	Element	Element	MEF	<b>Description/Notes</b>	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
		EvcTerminating	Phase 2: M	two or more ETH_Flow_Points.	EvcTerminating
		ETH_FDFr_EVCs: FD	Phase 1: NA	EVC may be made	ETH_FDFr_EVCs:
		Fragment	Phase 2: NA	up of component FD	Composite/Compon
				Fragments / EVCs	ent EVCs
		ETHCoSPerformanceMa	Phase 1: O	Relates performance	NONE
		ppings: CoSDorfMonningCharact	Phase 2: M	for specific CoS	
		erization			
	notifications	objectCreation	Phase 1 · M	Used for discovery	objectCreation
	notifications	objectereation	Phase 2: M	cisca for discovery	objecterention
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	objectDeletion
		attributeValueChange	Phase 1: O	May be used to notify	attributeValueChang
			Phase 2: O	NMS of attribute	е
		stateChange	Phase 1: M	Indicates changes in	stateChange
			Phase 2: M	administrative and	8-
				operational state	
		communicationsAlarm	Phase 1: O	Used to indicate a	communicationsAla
			Phase 2: O	protection reroute	rm
ETH_Flow_Poi	object	-	Phase 1: M	The termination of an	ETH_Flow_Point
nt			Phase 2: M	EVC on a FPP.	
				created automatically	
				setup request	
	attributes	administrativeState	Phase 1: O	administrative state	adminState
			Phase 2: O	of a trail terminating	
				ETH_Flow_Point	
				The values include:	
				locked or unlocked.	
		operationalState	Phase 1: M	Indicates the current	operState
			Phase 2: M	capability of the FPP	
				to provide service.	
				disabled enabled	
		availabilityStatus	Phase 1. M	Values include	NONE
			Phase 2: M	inTest, failed,	
				degraded	
		alarmStatus	Phase 1: M	Values for alarm	alarmStatus
			Phase 2: M	status include:	
				critical, major, minor,	
				indeterminate,	
				warning, pending,	
		ourrentProblemList	Dhace 1 · M	Indicates problem	ourrentProblemList
		currenti robieniList	Phase 2: M	probable cause with	currenti robieniEist
			- 11450 2. 111	severity	
		ethCeVlanIDMapping	Phase 1: M	List of unique values	ethCeVlanIDMappi
		11 0	Phase 2: M	that map each	ng
				CE-VLAN ID to at	
				most one EVC.	
				Special values	

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ITU-T Q.840.1	Element	Element	MEF	<b>Description/Notes</b>	Original
Management	Туре		Required	(details in	MEF7
Entity			_	Q.840.1)	Element
				include: "Untagged",	
				"All-to-One", and	
				"AllOthers"	
		ethUNIEVCFDFrName	Phase 1: M	String administered	ethUNIEVCID
			Phase 2: M	by Service Provider	
				used to identify an	
				EVC at the UNI	
		layer2ControlProtocolPr	Phase 1: M	describes Layer 2	layer2ControlProtoc
		ocessingList	Phase 2: M	control protocols,	olDispositionList
				along disposition:	
				discard or tunnel	
		unicastServiceFrameDeli	Phase 1: M	Service frame	unicastServiceFram
		very	Phase 2: M	delivery option for	eDelivery
				Unicast Service	
				Frames: Discard,	
				Unconditionally or	
				Deliver Conditionally	
		multicostServiceFromeD	Dhase 1. M	Service frame	multicostServiceFro
		elivery	Phase 2: M	delivery option for	meDelivery
		chivery	1 Hase 2. WI	Multicast Service	meDenvery
				Frames: Discard	
				Deliver	
				Unconditionally, or	
				Deliver Conditionally	
		broadcastServiceFrameD	Phase 1: M	Service frame	broadcastServiceFra
		elivery	Phase 2: M	delivery option for	meDelivery
				Broadcast Service	
				Frames: Discard,	
				Deliver	
				Unconditionally, or	
				Deliver Conditionally	
		trailTerminating	Phase 1: M	If TRUE, describes	trailTerminating
			Phase 2: M	Flow Point as a point	
				where frame flow	
				terminates and is	
				Otherwise shall be	
				set to FAI SE	
		rootOrLeaf	Phase 1 · NA	Indicates that the	NONE
		1000012001	Phase 2: M	flow point is acting	T(OT)
				as either a root or	
				leaf.	
				If the type of EVC is	
				Point-to-Point or	
				Multipoint-to-Multip	
				oint, then the UNI	
				Type MUST equal	
				"Root."	
	relationships	Contained in ETH_FPP	Phase 1: M	FPP is the containing	Contained in
		Alama Gan 't D Cl	Phase 2: M	object for FPs	EIH_FPP
		AlarmSeverityProfile :	Phase 1: O	to assign alarm	AlarmSeverityProfil
		SeverityAssignment	Phase 2: U	seventy to specific	e

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
				alarms.	SeverityAssignment
		ETH_FDFr_EVC:	Phase 1: M	EVC that is	ETH_FDFr_EVC:
		Evelerminating	Phase 2: M	more Flow_Points	Evelerminating
		ETHCoSBandwidthMap	Phase 1: M	bandwidth for	Combines
		ping:	Phase 2: M	specific CoS in the	ETHBandwidthProfi
		CoSBWMappingCharact		ingress and egress	les:
		erization		direction	BandwidthCharacter
					IZATION AND
					CosCharacterization
		EAFProfiles:	Phase 1: O	association with	EAFProfiles:
		AdaptationCharacterizati	Phase 2: O	adaptation profiles	AdaptationCharacter
		on	1 11000 21 0	www.promerin.promee	ization
		APPLinkEnd :	Phase 1: O	association with an	APPLinkEnd :
		Client/Server	Phase 2: O	APP Layer Link End	Client/Server
		ETH_FPP_UNI:	Phase 1: O	relationship between	ETH_FPP_UNI:
		EthTunneling	Phase 2: O	the ETH_FPP_UNI	EthTunneling
				and the supporting	
				TRAN (ETH layer	
				trail termination for	
				turnering) layer	
	Notification	objectCreation	Phase 1. M	Used for discovery	objectCreation
	s	objecterention	Phase 2: M	osed for discovery	objectereation
		objectDeletion	Phase 1: M	Used for discovery	objectDeletion
			Phase 2: M		-
		attributeValueChange	Phase 1: O	May be used to notify	attributeValueChang
			Phase 2: O	NMS of attribute changes.	e
		stateChange	Phase 1: M	Indicates changes in	stateChange
			Phase 2: M	administrative and	
				operational state	
		communicationsAlarm	Phase 1: M	Indicates an alarm	communicationsAla
	1.		Phase 2: M	condition	rm
E I HBandwidth Profile	object	-	Phase 1: M	Describes traffic	E I HBandwidthProfi
rionie	attributes	hwCategoryIdentifier	Fliase 2. Ivi		le bwCategoryIdentifie
	attributes	owcategoryIdentifier	Phase I: M	Identifies the specific	r
			Phase 2: M	Bandwidth Category	-
		cir	Phase 1: M	Committed	cir
			Phase 2: M	Information Rate	
				(CIR) in bits per	
				direction of an EVC	
		chs	Phase 1. M	Committed Burst	chs
		003	Phase 2: M	Size (CBS) in bytes	005
			1 11450 2.111	for one direction of	
				an EVC.	
		eir	Phase 1: M	Excess Information	eir
			Phase 2: M	Rate (EIR) in bits per	
				second for one	
				direction of an EVC.	

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Entity	Туре		Required	(details in Q.840.1)	Element
		ebs	Phase 1: M Phase 2: M	Excess Burst Size (EBS) in bytes for one direction of an EVC.	ebs
		colorMode	Phase 1: M Phase 2: M	Color mode (CM) to be applied as "color-blind mode" or "color-aware mode". TRUE or FALSE. A value of FALSE will indicate color blind mode is in effect	colorMode
		couplingFlag	Phase 1: O Phase 2: O	coupling flag (CF) attribute, describes if yellow frames will be admitted if unused bandwidth is available. When CF is set to FALSE, the volume of the yellow service frames admitted to the network cannot exceed EIR. When CF is set to TRUE, the volume of the yellow service frames admitted to the network is bounded by CIR + EIR depending on volume of the offered green Service Frames. In both cases the burst size of the yellow service frames admitted to the network is bounded by Service frames	couplingFlag
	relationships	contained in EMS	Phase 1: M Phase 2: M	EMS is the containing object for ETHBandwidthProfil e	contained in ETH_Flow_Domain
		ETH_FPPs: BandwidthCharacterizati on	Phase 1: M Phase 2: M	Ingress bandwidth profiles that characterize FPPs in the ingress direction	ETH_FPP_UNIs: BandwidthCharacter ization
		ETHCoSBandwidthMap ping: ingressCoSBandwidthCh aracterization	Phase 1: M Phase 2: M	Mapping the ingress bandwidth profile to specific ETH service.	ETH_Flow_Points: BandwidthCharacter ization Note: Q840.1 introduces COS BW mapping

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management Entity	Туре		Required	(details in O 840 1)	MEF7 Element
				2.040.1)	object
		ETHCoSBandwidthMan	Phase 1: NA	Manning the egress	NONE
		ping:	Phase 2: M	bandwidth profile to	THOME .
		egressCoSBandwidthCh		specific ETH service	
		aracterization		1	
	notifications	objectCreation	Phase 1: M	Used for discovery	objectCreation
			Phase 2: M		
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	objectDeletion
ETHPerforman	Object	-	Phase 1: O	specifies Class of	ETHCosProfile
ceProfile			Phase 2: M	Service (CoS)	
				performance	
				parameters for EVCs	T1
	attributes	pertProfileID	Phase 1: M	identifies the specific	cosldentifier
			Phase 2. M	within this profile	
		cosEromeDelay	Phase 1: M	Frame Delay	cosDelay
		costraineDelay	Phase 2: M	objective for Service	cosDelay
			1 Hase 2. WI	Frames Frames	
		cosFrameDelayVariation	Phase 1. M	Frame Delay	cosJitter
			Phase 2: M	Variation (FDV)	••••••
				objective for Service	
				Frames	
		cosFrameLossRatio	Phase 1: M	Frame Loss Ratio	cosLoss
			Phase 2: M	objective for Service	
				Frames	
		cosAvailability	Phase 1: O	Availability objective	NONE
	1		Phase 2: M	for the EVC.	
	relationships	contained under EMS	Phase 1: M	EMS is the	contained in
			Phase 2: M	Containing object for	ETH_Flow_Domain
				ile	
		ETHCoSPerformanceMa	Phase 1 · M	Manning the	ETH Flow Point
		pping.	Phase 2: M	performance profile	CosCharacterization
		CoSPerformanceCharact		to specific ETH	O.840.1 introduces
		erization		services	mapping object
	notifications	objectCreation	Phase 1: M	Used for discovery	objectCreation
			Phase 2: M		-
		objectDeletion	Phase 1: M	Used for discovery	objectDeletion
			Phase 2: M		
ETHServiceCla	object	-	Phase 1: M	Profile of CoS,	NONE
ssProfile			Phase 2: M	defines the way to	
				classify ETH service	
	ottributes	serviceClassID	Phase 1: M	the name of a service	NONE
	attributes	ServiceClassID	Phase 2. M	class instance	NONE
		classifyType	Phase 1: M	The characteristic	NONE
		clussify type	Phase 2: M	type on which ETH	TIONE
				services are	
				classified, such as	
				VLAN ID, VLAN	
				Priority (defined in	
				IEEE 802.1p), EVC	

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
		classifyValue	Phase 1: M	Lists the	NONE
			Phase 2: M	characteristic values	
				corresponding to the	
				above classify Type to	
				identify a specific	
	relationships	contained in EMS	Phase 1. M	EMS is the	NONE
	relationships	contained in Livis	Phase 2: M	containing object for	NOME
			1 11050 2. 101	ETHServiceClassPro	
				file	
		ETHCoSBandwidthMap	Phase 1: M	To characterizes the	NONE
		ping:	Phase 2: M	CoS type at the	
		CoSCharacterization		bandwidth mapping	
		ETHCoSPerformanceMa	Phase 1: M	To characterizes the	NONE
		pping:	Phase 2: M	CoS type at the	
		CoSCharacterization		performance mapping	
	notifications	objectCreation	Phase 1: M	Used for discovery	NONE
		- this at Data ting	Phase 2: M		NONE
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	NONE
		attributeValueChange	Phase 1: O	May be used to notify	NONE
			Phase 2: O	NMS of attribute	
ETHC: CD I	-1-1		Dhana 1. M	changes.	NONE
ETHC0SBandw idthMapping	object	-	Phase 1: M Phase 2: M	handwidth of	NONE
lutinviapping			T hase 2. Wi	specified CoS	
	relationships	ETH Flow Points:	Phase 1: M	ETH Flow Points	NONE
	F-	CoSBWMappingCharact	Phase 2: M	where the bandwidth	
		erization		for specific CoS in	
				the ingress and/or	
				egress direction is	
				applied	
		ETHBandwidthProfile:	Phase 1: M	Mapping the ingress	NONE
		ingressCoSBandwidthCh	Phase 2: M	bandwidth profile to	
		TTUD 1 - 141 Dec Class	Dhara 1, NIA	specific ETH service.	NONE
		ETHBandwidthProfile:	Phase 1: NA Phase 2: M	handwidth profile to	NONE
		aracterization	T Hase 2. IVI	specific FTH service	
		ETHServiceClassProfile <sup>-</sup>	Phase 1. M	characterizes the CoS	NONE
		CoSCharacterization	Phase 2: M	type at the bandwidth	
				mapping	
	notifications	objectCreation	Phase 1: M	Used for discovery	NONE
			Phase 2: M		
		objectDeletion	Phase 1: M	Used for discovery	NONE
			Phase 2: M	Marsha 14 CO	NONE
		attribute ValueChange	Phase 1: O	May be used to notify	NONE
			Phase 2: U	changes	
FTHCoSPortor	object		Phase 1. O	Associates expected	NONE
manceManning	00,000		Phase 2: M	service	
mancemapping			1 11000 2. 111	performances of	
				specified CoS	
	attributes	cosMappingID	Phase 1: O	the name of a CoS	NONE

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ITU-T Q.840.1	Element	Element	MEF	<b>Description/Notes</b>	Original
Management Entity	Туре		Required	(details in Q.840.1)	MEF7 Element
			Phase 2: M	mapping instance	
	relationships	ETH_FDFr_EVC: CoSPerfMappingCharact erization	Phase 1: M Phase 2: M	EVC where the performance for specific CoS is applied	NONE
		ETHPerformanceProfile: CoSPerformanceCharact erization	Phase 1: M Phase 2: M	Mapping the performance profile to specific ETH services.	NONE
		ETHServiceClassProfile: CoSCharacterization	Phase 1: M Phase 2: M	To characterizes the CoS type at the bandwidth mapping	NONE
	notification	objectCreation	Phase 1: M Phase 2: M	Used for discovery	NONE
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	NONE
		attributeValueChange	Phase 1: O Phase 2: O	May be used to notify NMS of attribute changes.	NONE
ELMIProfile	object	-	Phase 1: NA Phase 2: C	Describes the ELMI attributes associated with the containing FPP. This managed entity is conditionally required if ELMI is supported.	NONE
	attributes	elmiProfileId	Phase 1: NA Phase 2: M	Identifies the specific EMLI Profile	NONE
		elmiOperationalState	Phase 1: NA Phase 2: M	Indicates the current capability of the ELMI mechanism on the FPP. Values include: disabled, enable	NONE
		elmiAdministrativeState	Phase 1: NA Phase 2: M	Values supported: Locked or Unlocked. In the Locked state the ELMI mechanism on the FPP is disabled	NONE
		elmiProtocolVersion	Phase 1: NA Phase 2: M	8-bit field that indicates the ELMI protocol version for the FPP (e.g., (0000 0001) indicates ELMI Version 1	NONE
		elmiAsyncStatusEnabled	Phase 1: NA Phase 2: M	Indicates whether or not the capability of the FPP to generate and send Asynchronous Status is enabled	NONE

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management Entity	Туре		Required	(details in Q.840.1)	MEF7 Element
		elmiMinAsyncMessageI nterval	Phase 1: NA Phase 2: M	specify minimum time interval between asynchronous messages	NONE
		elmiN393	Phase 1: NA Phase 2: M	Threshold for the Count of Consecutive Errors. Used to determine if ELMI is operational or not	NONE
		elmiT392	Phase 1: NA Phase 2: M	Represents ELMI T392 Polling Verification Timer (PVT) limit. Value of 0 indicates that polling verification is disabled.	NONE
	relationships	contained in ETH_FPP and subclasses	Phase 1: NA Phase 2: M	FPP and subclasses (e.g., UNI) are the containing objects for ELMIProfile	NONE
	notifications	objectCreation	Phase 1: NA Phase 2: M	Used for discovery	NONE
		objectDeletion	Phase 1: NA Phase 2: M	Used for discovery	NONE
		attributeValueChange	Phase 1: NA Phase 2: O	May be used to notify NMS of attribute changes.	NONE
		stateChange	Phase 1: NA Phase 2: M	Indicates changes in administrative and operational state	NONE
TransportPort	object	-	Phase 1: C Phase 2: C	Represents the underlying transport termination (e.g., DS3, SONET, SDH etc.). This object is conditionally required if the underlying server layer is not represented with another standards based object.	TransportPort
	attributes	characteristicInformation Type operationalState	Phase 1: M Phase 2: M Phase 1: M Phase 2: M	Describes the transport type Denotes the operational state of the TransportPort as working "Enabled" or not-working "Disabled".	characteristicInform ationType operState
		alarmStatus	Phase 1: M Phase 2: M	Indicates the occurrence of an abnormal condition.	alarmStatus

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management Entity	Туре		Required	(details in O.840.1)	MEF7 Element
				Values for alarm	
				status include:	
				critical, major, minor,	
				indeterminate,	
				and cleared.	
		currentProblemList	Phase 1: M	Identifies the current	currentProblemList
			Phase 2: M	existing problems (probable cause)	
				with severity	
		portId	Phase 1: M	Name of the port	portID
			Phase 2: M	represented by the	
				TransportPort. This	
				Managed Element.	
				Bay, Shelf, Drawer,	
				Slot, and Port	
		potentialCapacity	Phase 1: C	Bandwidth capacity	potentialCapacity
			Phase 2: C	that is supported by the TransportPort	
				This attribute is	
				conditional, it is	
				present if the	
				TransportPort is a	
				technology	
	relationships	contained in	Phase 1: M	ManagedElement is	In MEF7 contained
		ManagedElement	Phase 2: M	the containing object	in a i Ti
				for TransportPort	SupportingElement
					LaverNetworkDoma
					in
		AlarmSeverityProfile:	Phase 1: O	To assign alarm	AlarmSeverityProfil
		SeventyAssignment	1 11050 2. 0	alarms	SeverityAssignment
		CircuitPack:	Phase 1: M	The CircuitPack that	SupportingElements
		PortAssociation	Phase 2: M	support the	: SupportedBy,
		ClientFPP: Client/Server	Phase 1. M	Relationship between	ClientFPP.
			Phase 2: M	the TransportPort in	Client/Server
				the server layer and	
				the FPP in the client	
	notifications	objectCreation	Phase 1. M	Used for discovery	objectCreation
	nounoutons		Phase 2: M		
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	objectDeletion
		attributeValueChange	Phase 1: O	May be used to notify	attributeValueChang
			Phase 2: O	NMS of attribute	e
		stateChange	Phase 1: M	Indicates changes in	stateChange
			Phase 2: M	administrative and	
				operational state	

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity		· /: A1		Q.840.1)	Liement
		communicationsAlarm	Phase 1: M Phase 2: M	Indicates an alarm	communicationsAla
MAUTransport	object		Phase 1: C	Generically	MAUTransportPTP
Port	object		Phase 2: C	represents the ETY	
(Subclass of			1 11050 2. C	Port and the	
TransportPort				underlying transport	
MAUTransportP				termination of the	
ort inherits				Ethernet Medium	
properties,				Attachment Unit	
including				This object is	
attributes from				conditionally	
TransportPort)				required if the	
				laver is not	
				represented with	
				another standards	
				based object.	
	attributes	mauType	Phase 1: M	Identifies the MAU	таиТуре
			Phase 2: M	type. An initial set	
				of MAU types are	
		- ste ste		defined in RFC-3636	<b>G</b> (- )
		**		mauStatus from	mauStatus
				the operational State	
				inherited from	
				Transport Port	
		mauMediaAvailable	Phase 1: M	Link integrity state of	mauMediaAvailable
			Phase 2: M	the MAU Transport	
				Port. May take on	
				values as describe in	
			Dhara 1. M	RFC-3636.	
		maujabberState	Phase 1: M Phase 2: M	the MAU	maujabberState
		mauDefaultType	Phase 1: M	Identifies the default	mauDefaultType
		51	Phase 2: M	administrative	51
				baseband MAU type	
		mauMode	Phase 1: M	Full Duplex, or Auto	mode
			Phase 2: M	negotiation	
		mauAutoNegSupported	Phase 1: M	Indicates whether or	mauAutoNegSuppor
			Phase 2. M	is supported on this	lea
				MAU	
		mauTypeList	Phase 1: M	Identifies the set of	mauTypeList
			Phase 2: M	possible IEEE 802.3	<i></i>
				types of the MAU	
		mauJackTypeList	Phase 1: M	Identifies interface	mauJackTypeList
			Phase 2: M	jack types that the	
				MAU provides.	
		mauAutoNegAdminState	Phase 1: M	Allows the	mauAutoNegAdmin
			Phase 2: M	auto-negotiation	State
				to be enabled or	
				disabled	

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original MEE7
Entity	туре		Kequired	Q.840.1)	Element
		mauAutoNegRemoteSig naling	Phase 1: M Phase 2: M	Indicates whether the remote end of the link is using auto-negotiation signalling.	mauAutoNegRemot eSignaling
		mauAutoNegConfig	Phase 1: O Phase 2: O	Indicates the current status of the auto-negotiation process	mauAutoNegConfig
		mauAutoNegCapability	Phase 1: O Phase 2: O	Identifies the set of capabilities of the local auto-negotiation entity	mauAutoNegCapabi lity
		mauAutoNegCapAdverti sed	Phase 1: O Phase 2: O	Identifies the set of capabilities advertised by the local auto-negotiation entity	mauAutoNegCapAd vertised
		mauAutoNegCapReceiv ed	Phase 1: O Phase 2: O	Identifies the set of capabilities received from the remote auto-negotiation entity	mauAutoNegCapRe ceived
		mauAutoNegRemoteFau ltAdvertised	Phase 1: O Phase 2: O	Identifies any local fault indications that this MAU has detected and will advertise at the next auto-negotiation interaction	mauAutoNegRemot eFaultAdvertised
		mauAutoNegRemoteFau ltReceived	Phase 1: O Phase 2: O	Identifies any fault indications received from the far end of a link by the local auto-negotiation entity	mauAutoNegRemot eFaultReceived
	methods	mauAutoNegRestart	Phase 1: O Phase 2: O	This method will force auto-negotiation to begin link renegotiation. Based on RFC-3636 ifMauAutoNegRestar t	mauAutoNegRestart
	relationships	contained in ManagedElement or ETH_Flow_Domain	Phase 1: M Phase 2: M	ManagedElement (or ETH_Flow_Domain) is the containing object for TransportPort	contained in ManagedElement or ETH_Flow_Domain
		AlarmSeverityProfile: SeverityAssignment	Phase 1: O Phase 2: O	To assign alarm severity to specific alarms	AlarmSeverityProfil e: SeverityAssignment
ERROR! © The	Metro Ethernet Fo	CIrcuitPack:	Phase 1: M	I The CIRCUITPack that	n PAGE 49

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity		Dent Americation	D1	<b>Q.040.1</b> )	
		PortAssociation	Phase 2: M	TransportPort	PortAssociation
		ClientFPP: Client/Server	Phase 1: M	Relationship between	ClientFPP:
			Phase 2: M	the TransportPort in	Client/Server
				the server layer and	
				the FPP in the client layer	
	notifications	objectCreation	Phase 1: M Phase 2: M	Used for discovery	objectCreation
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	objectDeletion
		attributeValueChange	Phase 1: O	May be used to notify	attributeValueChang
			Phase 2: O	NMS of attribute changes.	е
		stateChange	Phase 1: M	Indicates changes in	stateChange
			Phase 2: M	administrative and operational state	
		communicationsAlarm	Phase 1: M	Indicates an alarm	communicationsAla
			Phase 2: M	condition	rm
ETH UNI	Performance	-	Phase 1: M	The set of UNI	NONE
Anomalies	data set		Phase 2: M	abnormality	
Performance				measurements	
Data Set				collected at each	
				ETH_FPP_UNI	NONE
	attribute	Undersized Frames	Phase 1: M	Number of frames,	NONE
			Phase 2. M	where the frame size	
				octets received at the	
				MEN from the UNI	
		Oversized Frames	Phase 1: M	Number of oversized	NONE
			Phase 2: M	frames (frames	
				greater than 1522	
				octets) received at the	
				MEN from the UNI.	
		Fragments	Phase 1: M	Number of	NONE
			Phase 2: M	fragmented frames	
				received at the MEN	
		ECS and Alignment	Dhasa 1 · M	Number of CPC and	NONE
		FCS and Anglinent	Phase 2: M	alignment errored	NONE
		LIIOIS	1 Hase 2. WI	frames received at the	
				MEN from the UNI.	
		Invalid CE-VLAN ID	Phase 1: M	Number of frames	NONE
			Phase 2: M	received with an	
				invalid CE-VLAN	
				ID.	
ETH UNI	Performance	-	Phase 1: M	The set of UNI traffic	NONE
Traffic	data set		Phase 2: M	measurements	
Performance				collected at each	
Data Set	ottributa	Ootota Transmitted OV	Dhaga 1: M	EIH_FPP_UNI Number of optate (rot	NONE
	aurioute	Octers Transmitted UK	Phase 2: M	including IPG) that	NUNE
			1 Huse 2. WI	the MEN sent to the	
	I	1	1		

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
				UNI	
		Unicast Frames	Phase 1: M	Number of Unicast	NONE
		Transmitted OK	Phase 2: M	Frames that the MEN	
				sent to the UNI	NONE
		Multicast Frames	Phase I: M	Number of Multicast	NONE
		Transmitted OK	Phase 2: M	Frames that the MEN	
		Broadcast Frames	Dhase 1: M	Number of Broadcast	NONE
		Transmitted OK	Phase 2: M	Frames that the MEN	NONE
			1 Hase 2. W	sent to the UNI	
		Octets Received OK	Phase 1 · M	Number of octets (not	NONE
			Phase 2: M	including IPG) that	NONE
			1 11450 2. 101	the UNI sent to the	
				MEN	
		Unicast Frames	Phase 1: M	Number of Unicast	NONE
		Received OK	Phase 2: M	Frames that the UNI	
				sent to the MEN	
		Multicast Frames	Phase 1: M	Number of Multicast	NONE
		Received OK	Phase 2: M	Frames that the UNI	
				sent to the MEN	
		Broadcast Frames	Phase 1: M	Number of Broadcast	NONE
		Received OK	Phase 2: M	Frames that the UNI	
				sent to the MEN	
ETH Ingress	Performance	-	Phase 1: M	The set of Ingress	NONE
Traffic	data set		Phase 2: M	Traffic Management	
Management				performance	
Periorinance Data Sat				ner entity (per UNI	
Data Set				per CoS per UNI,	
				EVC or per CoS per	
				EVC) basis for each	
				entity that enforces	
				traffic management at	
				Ingress direction (CE	
				to MEN).	
	attributes	ingressGreenFrameCoun	Phase 1: M	The amount of green	NONE
		t	Phase 2: M	frames sent by the	
				ingress UNI to the	
				MEN	
		ingressYellowFrameCou	Phase 1: O	The amount of	NONE
		nt	Phase 2: O	yellow frames sent by	
				the ingress UNI to	
		ingraag Dad Engena Carry	Dhaga 1: O	The amount of red	NONE
		ingressRedFrameCount	Phase 1: 0	(discorded) frames at	NONE
			r nase 2. U	the ingress UNI	
		ingressGreenOctetCount	Phase 1: O	The amount of green	NONE
		mgressereenoeiereouni	Phase 2: O	octets sent hy the	
			1 1100 2. 0	ingress UNI to the	
				MEN	
		ingressYellowOctetCoun	Phase 1: O	The amount of	NONE
		t	Phase 2: O	yellow octets sent by	
				the ingress UNI to	

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
				the MEN	
		ingressRedOctetCount	Phase 1: O	The amount of red	NONE
			Phase 2: O	(discarded) octets at	
				the ingress UNI	
ETH Egress	Performance	-	Phase 1: M	The set of Egress	NONE
Traffic	data set		Phase 2: M	Traffic Management	
Management				performance	
Performance				measurements on a	
Data Set				per entity (per UNI,	
				per CoS per UNI, per	
				EVC, or per CoS per	
				evc) basis for each	
				traffic management at	
				the Egress direction	
				(MEN to CE)	
	attributes	egressGreenFrameCount	Phase 1: M	The amount of green	NONE
			Phase 2: M	frames received by	
				the egress UNI from	
				the MEN.	
		egressYellowFrameCoun	Phase 1: O	The amount of	NONE
		t	Phase 2: O	yellow frames	
				received by the	
				egress UNI from the	
				MEN	
		egressGreenOctetCount	Phase 1: O	The amount of green	NONE
			Phase 2: O	octets received by the	
				MEN	
		egressYellowOctetCount	Phase 1. O	The amount of	NONE
		egress reno wo etereo uni	Phase 2: O	vellow octets	TIONE
				received by the	
				egress UNI from the	
				MEN	
ЕТН	Performance	-	Phase 1: M	The set of Congestion	NONE
Congestion	data set		Phase 2: M	Discards performance	
Discards				measurements on a	
Performance				per congestible	
Data Set				resource (e.g., per	
				UNI, per CoS per	
				UNI, per EVC, or	
				per CoS per EVC)	
				basis in both the	
				direction	
	attributes	greenFrameDiscards	Phase 1. M	The amount of green	NONE
	autoucs	5reeni ranici iscalus	Phase 2. M	frames discarded due	
			1 11050 2. 111	to congestion	
		vellowFrameDiscards	Phase 1: O	The amount of	NONE
		,	Phase 2: O	vellow frames	
				discarded due to	
				congestion	
		greenOctetDiscards	Phase 1: M	The amount of green	NONE

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Management EntityTypeRequired (details in Q.840.1)MEF7 ElementEntityPlase 1: M Performance Data SetPerformance dat setPhase 1: NA Performance orsPhase 1: NA Phase 1: NAIn te set of ELM1 relability and protocol error measurements eoffected due to congestionNONEETH ELM1 Performance Data SetPerformance dat set-Phase 1: NA Phase 1: NA Phase 2: OIn te set of ELM1 Phase 2: ONONEAttributessumofElmiReliabilityEr orsPhase 1: NA orsPhase 1: NA Phase 2: ONONENONEsumofElmiProtocolError ssumofElmiProtocolError sPhase 1: NA Phase 2: ONONENONEelmiNovalidSeqNumCou nt tu elmiProtocolError sPhase 1: NA Phase 2: ONONENONEelmiNovalidSeqNumCou nt columererisPhase 1: NA Phase 2: ONONENONEelmiNovalidSeqNumCou ntPhase 1: NA Phase 2: ONONENONEelmiNovalidSeqNumCou ntPhase 1: NA Phase 2: ONone of Invalid Number of Invalid Sequence Numbers Second Number of Invalid Sequence Numbers eventsNONEelmiNovalidSeqNumCou ntPhase 1: NA Phase 1: NA Nomer of Invalid Sequence Numbers eventsNONEelmiProtocolVersionCou ntPhase 1: NA Phase 2: ONone of Invalid None of Invalid Sequence Numbers eventsNONEelmiProtocolVersionCou ntPhase 1: NA Phase 2: ONone of Invalid None of Invalid Sequence Numbers eventsNONEelmiPro	ITU-T Q.840.1	Element	Element	MEF	<b>Description/Notes</b>	Original
Entity         Image: Constraint of the second	Management	Туре		Required	(details in	MEF7
Image: series of the	Entity				Q.840.1)	Element
ETH ELMI Performance Data Set         Performance data set				Phase 2: M	octets discarded due	
FTH ELMI Performance Data Set     Performance data set     Performance output     Performance data set     Performance output     Phase 1: NA Phase 2: O     The amount of voluce of ELMI Phase 2: O     NONE       attributes     attributes     sumofElmiReliabilityErr ors     Phase 1: NA protocol error measurements collected at each ETH_PP on which ETH_PP on which ETH_EPP on wh					to congestion	
ETH ELMI Performance Data Set     Performance     Performance     Performance     NONE       attributes     attributes     sumofElmiReliabilityErr ors     Phase 1: NA     The set of ELMI Phase 2: O     NONE       attributes     sumofElmiReliabilityErr ors     Phase 1: NA     Thresholded sum of ELMI Reliability and protocol error measurements collected at each ETH_EPP on wholch and enabled     NONE       sumofElmiReliabilityErr ors     Phase 1: NA     Thresholded sum of ELMI Reliability ENQURY and mvalid Sequence Numbers     NONE       sumofElmiProtocolError s     Phase 1: NA     Thresholded sum of ELMI Protocol     NONE       elmiNomreptStatusAndSt atusEnquiryCount     Phase 1: NA     Thresholded sum of ELMI Protocol     NONE       elmiNomreptStatusAndSt atusEnquiryCount     Phase 1: NA     Threscript of STATUS/STATUS     NONE       elmiNomreptStatusAndSt atusEnquiryCount     Phase 1: NA     Number of STATUS/STATUS     NONE       elmiNonceptStatusAndSt atusEnquiryCount     Phase 1: NA     Number of Invalid Sequence Numbers     NONE       elmiProtocolVersionCon nt     Phase 1: NA     Number of ELMI Phase 2: O     NONE       elmiProtocolVersionCon nt     Phase 1: NA     Number of ELMI Phase 2: O     NONE       elmiTooShortCount     Phase 1: NA     Number of ELMI Phase 2: O     NONE			yellowOctetDiscards	Phase 1: O	The amount of	NONE
ETH ELMI Performance Data Set         Performance data set				Phase 2: O	yellow octets	
ETH ELMI Performance Data Set         Performance data set         -         Phase 1: NA Phase 2: O         The set of ELMI reliability and protocol error measurements collected at each ETH_PPO a which ELMI is supported and enabled         NONE           attributes         sumofElmiReliabilityErr ors         Phase 1: NA Phase 2: O         Phase 1: NA Phase 2: O         NONE           attributes         sumofElmiReliabilityErr ors         Phase 1: NA Phase 2: O         Thresholded sum of STATUS/STATUS ENQUIRY and Invalid Sequence Numbers         NONE           sumofElmiProtocolError s         Phase 1: NA ausEnquiryCount         Phase 1: NA Phase 2: O         Thresholded sum of ELMI Protocol Errors on the FPP, including: Non-receipt of STATUS/STATUS ENQUIRY and Invalid Sequence Numbers         NONE           elmiNonreptStatusAndSt atusEnquiryCount         Phase 1: NA Phase 2: O         Number of STATUS/STATUS ENQUIRY events         NONE           elmiNonreptStatusAndSt atusEnquiryCount         Phase 1: NA Phase 2: O         Number of ELMI Phase 2: O         NONE           elmiProtocolVersionCount nt         Phase 1: NA Phase 2: O         Number of ELMI Protocol Version Errors detected at the EPP         NONE					discarded due to	
Erin ELMin       Fertorinance       Prase 1: NA       The set of ELMin       NONE         Data Set       attributes       sumofElmiReliabilityErr       Phase 2: O       Phase 1: NA       Thresholded sum of       NONE         attributes       sumofElmiReliabilityErr       Phase 2: O       Phase 2: O       Thresholded sum of       NONE         sumofElmiProtocolError       sumofElmiProtocolError       Phase 1: NA       Thresholded sum of       NONE         sumofElmiProtocolError       s       Phase 2: O       Phase 1: NA       Thresholded sum of       NONE         elmiNonreptStatusAndSt       restore EPP, including:       None       NONE       NONE         elmiNonreptStatusAndSt       Phase 2: O       Encorosin Errors, Message top errors, Information element errors       NONE         elmiNonreptStatusAndSt       Phase 2: O       Nonreceipt of STATUS/STATUS       NONE         elmiNonreptStatusAndSt       Phase 1: NA       Number of Invalid       NONE         elmiInvalidSeqNumCou       Phase 1: NA       Number of E	ети еі мі	Dorformanaa		Dhaga 1: NA	The set of ELMI	NONE
Data Set       and Set       Finde 2: 0       Finde 2: 0       Finde 2: 0       Finde 2: 0         Data Set       attributes       sumofElmiReliabilityErr ors       Phase 1: NA       Thresholded sum of ELMI Reliability       NONE         attributes       sumofElmiReliabilityErr ors       Phase 1: NA       Thresholded sum of ELMI Reliability       NONE         sumofElmiProtocolError s       Phase 1: NA       Thresholded sum of STATUS/STATUS       NONE         elmiNonreptStatusAndSt atusEnquiryCount       Phase 1: NA       Thresholded sum of STATUS/STATUS       NONE         elmiNonreptStatusAndSt atusEnquiryCount       Phase 1: NA       Thresholded sum of STATUS/STATUS       NONE         elmiNonreptStatusAndSt atusEnquiryCount       Phase 1: NA       Number of STATUS/STATUS       NONE         elmiNonreptStatusAndSt atusEnquiryCount       Phase 1: NA       Number of STATUS/STATUS       NONE         elmiProtocolVersionCou nt       Phase 1: NA       Number of Invalid Sequence Numbers       NONE         elmiProtocolVersionCout nt       Phase 1: NA       Number of ELMI Protocol Version Errors detected at the FPP       NONE         elmiProtocolVersionCout nt       Phase 1: NA       Number of ELMI Protocol Version Errors detected at the FPP       NONE	Performance	data set	-	Phase 2: 0	reliability and	NOME
attributes       sumofElmiReliabilityErr ors       Phase 1: NA Phase 2: O       Phase 1: NA Firesholded sum of ELMI Reliability Errors on the FPP, including: Non-receipt of STATUS/STATUS       NONE         sumofElmiProtocolError s       sumofElmiProtocolError s       Phase 1: NA Phase 2: O       NONE         sumofElmiProtocolError s       Phase 1: NA Phase 2: O       NONE         elmiNonrcptStatusAndSt atusEnquiryCount       Phase 1: NA Phase 2: O       NONE         elmiProtocolVersionCou nt       Phase 1: NA Phase 2: O       NUmber of Invalid Sequence Numbers events       NONE         elmiProtocolVersionCou nt       Phase 1: NA Phase 2: O       Number of ELMI Protocol Version Errors detected at the FPP       NONE         elmiTooShortCount       Phase 1: NA Phase 2: O       Number of ELMI Protocol Version Errors detected at the FPP       NONE	Data Set	data set		1 11030 2. 0	protocol error	
attributessumofElmiReliabilityErr orsPhase 1: NA Phase 2: OCollected at each ETH_FIP on which El.MI is supported and enabledattributessumofElmiReliabilityErr orsPhase 1: NA Phase 2: OThresholded sum of ELMI Reliability Errors on the FPP, including: NOn-receipt of STATUS/STATUS ENQUIRY and Invalid Sequence NumbersNONEsumofElmiProtocolError sPhase 1: NA Phase 2: OThresholded sum of ELMI Protocol Errors on the FPP, including: Protocol Version Errors, Message to shorts, Message to shorts, Message to shorts, Information element errorsNONEelmiNonreptStatusAndSt atusEnquiryCountPhase 1: NA Phase 2: ONumber of NONENONEelmiInvalidSeqNumCou ntPhase 1: NA Phase 2: ONumber of Non-receipt of STATUS/STATUS ENQUIRY eventsNONEelmiProtocolVersionCou ntPhase 1: NA Phase 2: ONumber of NONENONEelmiProtocolVersionCou ntPhase 1: NA Phase 2: ONumber of ELMI Protocol Version Errors detected at the FPPNONEelmiTooShortCountPhase 1: NA Phase 2: ONumber of ELMI Protocol Version Errors detected at the FPPNONE					measurements	
attributessumofElmiReliabilityErr orsPhase 1: NA Phase 2: OETH_FPP on which ELMI is supported and enabledattributessumofElmiReliabilityErr orsPhase 1: NA Phase 2: OThresholded sum of ELMI Reliability Errors on the FPP, including: Non-receipt of STATUS/STATUS ENQUIRY and Invalid Sequence NumbersNONEsumofElmiProtocolError sPhase 1: NA Phase 2: OThresholded sum of ELMI Protocol Errors on the FPP, including: Protocol Version Errors, Message too shorts, Message too shorts, Monte ENQUIRY eventsNONEelmiInvalidSeqNumCou ntPhase 1: NA Phase 2: ONumber of Invalid Protocol Version Errors detected at the FPPNONEelmiTooShortCountPhase 1: NA Phase 2: ONumber of ELMI NONENONEelmiTooShortCountPhase 2: O Phase 2: ONumber of ELMI Message Too Short Errors detected at the FPP					collected at each	
attributes     sumofElmiReliabilityErr ors     Phase 1: NA Phase 2: O     Thresholded sum of ELMI Reliability Errors on the FPP, including: Non-receipt of STATUS/STATUS ENQUIRY and Invalid Sequence Numbers     NONE       sumofElmiProtocolError s     Phase 1: NA s     Thresholded sum of STATUS/STATUS ENQUIRY and Invalid Sequence Numbers     NONE       elmiNonreptStatusAndSt atusEnquiryCount     Phase 1: NA Phase 2: O     Thresholded sum of ELMI Protocol Errors on the FPP, including: Protocol Errors, Message too shorts, Message too shorts, Message too shorts, STATUS/STATUS     NONE       elmiNonreptStatusAndSt atusEnquiryCount     Phase 1: NA Phase 2: O     Nonreceipt of STATUS/STATUS     NONE       elmiInvalidSeqNumCou nt     Phase 1: NA Phase 2: O     Number of Non-receipt of STATUS/STATUS     NONE       elmiProtocolVersionCou nt     Phase 1: NA Phase 2: O     Number of Invalid NONE     NONE       elmiProtocolVersionCou nt     Phase 1: NA Phase 2: O     Number of ELMI NONE     NONE       elmiProtocolVersionCou nt     Phase 1: NA Phase 2: O     Number of ELMI NONE     NONE       elmiTooShortCount     Phase 1: NA Phase 2: O     Number of ELMI NONE     NONE       elmiTooShortCount     Phase 1: NA Phase 2: O     Number of ELMI NONE     NONE					ETH_FPP on which	
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ountPhase 2: OMessage Type Errors			ount	Phase 2: O	Message Type Errors	
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uni Phase 2: O Information Element			uni	Phase 2: U	Errors (Information	

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ITU-T Q.840.1	Element	Element	MEF	Description/Notes	Original
Management	Туре		Required	(details in	MEF7
Entity				Q.840.1)	Element
MAU Termination Performance Data Set	Performance data set	-	Phase 1: C Phase 2: C	element out of sequence, Duplicate information element, Missing Mandatory information element, Mandatory information element error, Unexpected information element) detected at the FPP Conditionally required if MauTransportPort is instantiated. The set of MAU Termination performance measurements for each Transport Layer Port that represents the underlying transport termination of the Ethernet Medium Attachment	NONE
	attributes	ifMauMediaAvailableSta teExits ifMauJabberingStateEnte	Phase 1: M Phase 2: M Phase 1: M Phase 2: M	Number of time the MAU leaves the available state Number of times the MAU enters the	NONE
		15	1 11000 2. 101	iabbering state	
		ifMauFalseCarriers	Phase 1: M Phase 2: M	Number of false carrier events during idle	NONE

## 9 Ethernet Service OAM Object Definitions

This section defines a Service OAM information model based on the following inputs shown in the figure below.





## **Figure 9-1 EMS-NMS Information Model Approach**

The information model design is based on the Unified Modeling Language (UML) syntax. Use Case, Activity, and Class UML diagrams are used to present the model. In addition to the diagrams presented, detailed object tables are included to provide specifics on each object and its attributes, operations and associations/relationships.

#### 9.1 Services OAM Use Cases

This section defines the high level Fault Management and Performance Monitoring Use Cases, based on the UML Use Case diagram syntax.

#### 9.1.1 Fault Management

#### 9.1.1.1 OAM FM Use Cases





## Figure 9-2 Fault Management Use Cases

- 9.1.2 Performance Monitoring
- 9.1.2.1 OAM PM Use Cases



# Figure 9-3 Performance Monitoring Use Cases

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## 9.2 Common OAM Objects

Figure 9-3 highlights the common Ethernet Service OAM objects and their relationships to objects defined in Q.840.1, X.721 and M.3100.



# Figure 9-4 Common Service OAM Object Class Diagram

#### 9.2.1 EthMe (Maintenance Entity)

#### **Behavior:**

This object represents the Maintenance Entity (Y.1731).

Point-to-Point MEs are typically involved in different OAM domains. These MEs correspond purely at the ETH Layer. A ME is essentially an association between two maintenance points within an OAM Domain; where each maintenance point corresponds to a provisioned reference point that requires management.

Subscriber OAM Domain consists of ME typed as "Subscriber". Service Provider OAM Domain consist of ME typed as "EVC". If UNI between Subscriber and Service Provider needs to be managed, a ME typed as "UNI" can be realized.

Instances of this managed object are created automatically by the EMS when ETH\_FPPs or ETH\_FDFr\_EVCs

are created. Instances of this managed object may be created and deleted by request of the EMS.

Attributes					
Name	Description	Туре	Default Value	Qualifier	
type	This attribute describes the ME type as "Subscriber", "EVC", "UNI", or "NNI".	MaintenanceEntityType		M, R/W	
connectivityStatus	This attribute indicates if Service OAM frames can be exchanged between the MEPs of the ME in both directions. The value of partiallyActive is not supported.	ConnectivityStatusType		M, R	
<b>Operations / Methods</b>	i 				
Name	Description				
create()	This operation provides the ability	ty to dynamically create ne	w instances	of this object.	
delete()	This operation provides the ability object.	This operation provides the ability to dynamically delete existing instances of this object.			
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.				
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.				
<b>Relationships:</b>					
The EthMe object is c	ontained under ETH_Flow_Domai	<b>n</b> defined in Q.840.1.			
EthMe is associated with EthMp: <i>Maintenance</i> the Maintenance Entity EthMp: <i>Maintenance</i> respect to the Maintenance	th: <i>EndPoints</i> – The Maintenance Poin (GET, REPLACE, ADD, REMOV <i>IntermediatePoints</i> – The Maintena ance Entity. (GET, REPLACE, ADI	ts that initiate or terminate /E) ance Points that react to dia D, REMOVE)	OAM flow w gnostic OAM	with respect to A frames with	
EthMeg: ComponentA common OAM domain	MaintenanceEntities – The Mainter a are associated with the same MEG	ance Entities that belong to GET, REPLACE, ADD	o the same se , REMOVE	rvice inside a )	
Reportable Notification	ons:				
objectCreation			0		
objectDeletion			0		

## 9.2.2 EthMeg (Maintenance Entity Group)

#### **Behavior:**

This object represents the Maintenance Entity Group (Y.1731) or Maintenance Association (802.1ag). A ME Group (MEG) consists of MEs which belong to the same service inside a common OAM domain.

For a Point-to-Point EVC, a MEG contains a single ME. For a Multipoint-to-Multipoint EVC associating 'n' UNIs, a MEG contains  $n^{*}(n-1)/2$  MEs.

Instances of this managed object are created automatically by the EMS when ETH\_FPPs or ETH\_FDFr\_EVCs are created. Instances of this managed object may be created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
chassisId	This attribute indicates the Chassis ID to be sent in the Sender ID TLV for all MPs in this MEG. The format of this object is determined by the value of the ChassisIdSubtype attribute.	LldpChassisId		O, R/W
chassisIdSubtype	This attribute indicates the format of the Chassis ID to be sent in the Sender ID TLV for all MPs in this MEG. This value is meaningless if the ChassisId has a length of 0.	LldpChassisIdSubtype		O, R/W
connectivityStatus	This attribute indicates aggregate connectivity status of MEs in the MEG. The value of partiallyActive indicates at least one but not all of the MEs in the MEG have a connectivity status of inactive.	ConnectivityStatusType		M, R
connectivityStatusInterval	This attribute specifies a configurable time interval to detect a change in Connectivity Status. This attribute should be more than the network restoration time, which is dependent on the MEN technology (MEF 17 R2C). Units are milliseconds.	Integer		M, R/W

id	This attribute specifies the MEG ID (Y.1731) or MAID (802.1ag).	MegIdType		M, R/W
includeInterfaceStatusTlv	This attribute specifies if the Interface Status TLV (802.1ag) is included in OAM messages transmitted by MPs configured in this MEG.	Boolean		M, R/W
includePortStatusTlv	This attribute specifies if the Port Status TLV (802.1ag) is included in OAM messages transmitted by MPs configured in this MEG.	MegIdType		M, R/W
includeSenderIdTlv	This attribute specifies an enumerated value indicating what, if anything, is to be included in the Sender ID TLV (802.1ag) transmitted by MPs configured in this MEG.	Sender1d'1'lvPermissionType	sendIdNone	M, R/W
length	This attribute represents the MEG ID (Y.1731) or Short MA Name (802.1ag) length.	Integer		M, R/W
level	This attribute specifies the MEG Level used to distinguish between OAM frames belonging to different nested MEs. MEs belonging to the same MEG share a common MEG Level. Eight MEG Levels have been identified for the purposes of Ethernet OAM.	MegLevelType		M, R/W
format	This attribute represents the MEG ID (Y.1731) or Short MA Name (802.1ag) format.	MaintAssocNameFormat		M, R/W

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maintAssocShortName	This attribute specifies the short Maintenance Name (802.1ag). The type and format is specified by the format attribute. This attribute is meaningless if the format attribute has a value of 'iccBasedFormat'. This attribute has a length restriction of 145 octets.	HexBinary		C (M if format is based on 802.1ag MAID), R/W
perfTimeInterval	This attribute	Integer		M, R/W
	interval 'T' as defined			
	in MEF 10 (MEF 17			
	R5a and R5b). Units			
	are milliseconds.	I. ( 100	1	
ccminterval	specifies the	Interval I ype	1	IVI, R/VV
	ETH-CC and			
	ETH-RDI			
	transmission period			
	in seconds. For			
	applications the			
	default value is 1			
	second. For			
	Performance			
	Monitoring			
	default value is 100			
	ms.			
	Note: CCM Interval			
	is configured at the			
	MEG, not the MEP,			
	since all MEPs in a MEG are required to			
	have the same CCM			
	Interval.			
peerMepInfoAgingTime	This attribute defines	Integer	0	0, R/W
	a period of time after			
	which an instance in the EthMenPeerInfo			
	object is removed			
	unless the			
	EthMepPeerInfo			
	instance is updated			
	by the MEP's			
	process A value of			
	zero indicates no			
	aging will occur.			

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Operations / Metho	ods:			
Name	Description			
create()	This operation provides the ability to d object.	ynamically create new instances of this		
delete()	This operation provides the ability to d this object.	lynamically delete existing instances of		
modify()	This operation provides the ability to dy (e.g., attributes with read-write access) of	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.		
retrieve()	This operation provides the ability to existing instances of this object.	This operation provides the ability to dynamically query attribute values of existing instances of this object.		
Relationships: The EthMeg object	is contained under ETH_Flow_Domain defined in	n Q.840.1.		
EthMeg is associated	d with:			
EthMe: Component common OAM dom EthMp: RootMEP	t <i>MaintenanceEntities</i> – The Maintenance Entities ain (GET, REPLACE, ADD, REMOVE) – The Maintenance Points is the root of a multipoin	that belong to the same service inside a nt MEG. (GET, REPLACE)		
ETHCoSPerformation ADD, REMOVE). T	<b>nceMapping:</b> <i>MegCoS</i> –Indicates the performance This object is defined in Q.840.1.	e for specific CoS. (GET, REPLACE,		
<b>Reportable Notifica</b>	ations:			
objectCreation		0		
objectDeletion O				

#### 9.2.3 **EthMep (Maintenance End Point)**

#### **Behavior:**

This object represents a MEG End Point (MEP) which is a provisioned OAM reference point capable of initiating and terminating proactive OAM frames. A MEP is also capable of initiating and reacting to diagnostic OAM frames. Terminology is MEG End Point (Y.1731) or MA End Point (802.1ag).

Instances of this managed object are created automatically by the EMS when ETH\_FPPs or ETH Flow Points are created. Instances of this managed object may be created and deleted by request of the EMS.

Attributes						
Name	Description	Туре	Default Value	Oualifier		
multipointIndicator	This attribute specifies the MEP is acting as 'root' or 'leaf' for multipoint, or 'notMultipoint' if not multipoint.	MultipointIndicatorType	Vinue	M, R		

connectivityStatus	This attribute indicates the connectivity status for a MEP in an EVC MEs. An 'active' MEP Connectivity Status refers to the ability to exchange Service frames among all the UNIs of an EVC. A 'partiallyActive' MEP Connectivity Status refers to the ability to exchange Service frames among some but not all the UNIs of an EVC. An 'inactive' MEP Connectivity Status refers to the inability to exchange Service frames among any of the UNIs of an EVC.	ConnectivityStatusType	O, R/W	
primaryVid Operations / Methods:	This attribute specifies an integer indicating the Primary VID of the MEP, always one of the VIDs assigned to the MEP's MA. The value 0 indicates that either the Primary VID is that of the MEP's MA, or that the MEP's MA is associated with no VID. The Integer range is 016777215.	Integer	M, R/W	
Name	Description			
Relationships:         The EthMep object is a generalization of the EthMp object.         The EthMep object is contained under the ETH_FPP object defined in Q.840.1.         EthMep is associated with:         EthMe: MaintenanceEndPoints – The Maintenance Points that initiate or terminate OAM flow with respect to the Maintenance Entity (GET, REPLACE, ADD, REMOVE)         EthMepPeerInfo: Peer MEP List – A list of staticly configured or dynamically learned peer MEPs.				
objectCreation			0	

## 9.2.4 EthMip (Maintenance Intermediate Point)

#### **Behavior:**

This object represents a MEG Intermediate Point (MIP) which is a provisioned OAM reference point capable of reacting to diagnostic OAM frames initiated by MEPs. A MIP does not initiate proactive and diagnostic OAM frames.

Instances of this managed object are created automatically by the EMS when ETH\_FPPs or ETH\_Flow\_Points are created. Instances of this managed object may be created and deleted by request of the EMS.



Attributes				
Name	Description	Туре	Default Value	Qualifier
<b>Operations / Methods:</b>				
Name	Description			
<b>Relationships:</b>				
The EthMip object is a ge	neralization of the EthMp object.			
Reportable Notifications	:			
objectCreation			0	
objectDeletion			0	

### 9.2.5 EthMp (Maintenance Point)

<b>Behavior:</b> This object defines ETH Maintenance Points representing either a MEP or a MIP (via a subclass).				
Attributes				
Name	Description	Туре	Default Value	Qualifier
administrativeState	This attribute specifies the administrative state of the EthMp. In the Locked state Service OAM frame flow through the EthMp is prohibited.	AdminStateType		M, R/W
alarmStatus	This attribute indicates the occurrence of an abnormal condition relating to a MEP. This attribute may also function as a summary indicator of alarm conditions associated with a specific resource. It is used to indicate the existence of an alarm condition, a pending alarm condition such as threshold situations, or (when used as a summary indicator) the highest severity of active alarm conditions. When used as a summary indicator, the order of severity (from highest to lowest) is: Critical, Major, Minor, Indeterminate, Warning, Pending and cleared.	AlarmStatus (From M.3100)		M, R
asapPtr	The alarm severity assignment profile associated with the EthMp to assign alarm severity to specific alarms.	AsapPtrType		M, R/W
availabilityStatus	This attribute indicates whether the EthMp is functioning properly.	AvailStatusType		O, R

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currentProblemList	This attribute identifies the current existing problems associated with the EthMp.	AlarmList		M, R
direction	This attribute specifies the direction in which the Maintenance Association (MEP or MIP) faces on the bridge port. The value 'down' specifies the MP sends Continuity Check Messages away from the MAC Relay Entity. The value 'up' specifies the MP sends Continuity Check Messages towards the MAC Relay Entity. Refer to 802.1ag.	MpDirectionType		M, R/W
id	This attribute specifies the MEG ID as defined in Y.1731. A small integer, unique over a given Maintenance Association for identifying a specific MEP/MIP (802.1ag). None (i.e., 0 is used in 802.1ag) indicates that a MEP is not configured.	MepIdType		M, R/W
macAddress	This attribute indicates the MAC Address of the MP.	MacAddress		0, R
operationalState	This attribute indicates the operational state (current capability) of the EthMp. If the value is 'enabled' the MP is able to provide OAM capabilities.	OperStateType		M, R
type	This attribute indicates whether the MP is a MEP, MIP or none.	МрТуре		M, R
<b>Operations / Methods:</b>				
Name	Description			
create()	This operation provides the ability object.	to dynamically created	ate new instan	ces of this
delete()	This operation provides the ability to dynamically delete existing instances of this object.			
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.			
retrieve()	This operation provides the ability to instances of this object.	o dynamically query a	attribute values	of existing
<b>Relationships:</b>				

The EthMp object is contained under the ETH\_Flow\_Point defined in Q.840.1.

EthMp is associated with:

**EthMe:** *MaintenanceEndPoints* – The Maintenance Points that initiate or terminate OAM flow with respect to the Maintenance Entity (GET, REPLACE, ADD, REMOVE)

**EthMe:** *MaintenanceIntermediatePoints* – The Maintenance Points that react to diagnostic OAM frames with respect to the Maintenance Entity. (GET, REPLACE, ADD, REMOVE)

**EthMeg:** *RootMEP* – The Maintenance Points is the root of a multipoint MEG. (GET, REPLACE)


AlarmSeverityAssignmentProfile (defined in M.3100): *SeverityAssignment* – The Maintenance Point may be associated with an alarm severity assignment profile in order to assign alarm severity to specific alarms. (GET, REPLACE)

AlarmStatus (defined in M.3100): Highest*SeverityAlarm* – Indicates the highest severity alarm that may be active on the Maintenance Point (GET, REPLACE)

AlarmRecord/Log (defined in X.721): currentProblemList – Contains a list of alarms, present within a Log, that may be active on the Maintenance Point (GET, REPLACE)

Reportable Notifications:	
objectCreation	0
objectDeletion	0
stateChange	0
communicationsAlarm (ETH_AIS, ETH_RDI)	М
attributeValueChange	0

## 9.2.6 EthMd (Maintenance Domain)

Behavior:				
This object represents the N	faintenance Domain (802.1ag).			
Name	Description	Туре	Default Value	Qualifier
maintDomainNameType	This attribute specifies the type and format of the Maintenance Domain Name.	MdNameType	charString	O, R/W
maintDomainLevel	This attribute specifies the Maintenance Domain Level (802.1ag). The default value is zero.	MdLevelType	0	O, R/W
maintDomainName	This attribute specifies the Maintenance Domain Name (802.1ag). The type and format is specified by the MaintDomainNameType attribute. This attribute has a length restriction of 143 octets. The default value is a charString "DEFAULT". Each Maintenance Domain has unique name amongst all those used or available to a service provider or operator. It facilitates easy identification of administrative responsibility for each Maintenance Domain.	HexBinary		O, R/W
Operations / Methods:	Description			
	Description This approximation provides the shilltest	a demonsionaliter er	anto norre in the	and of this
create()	object.	o dynamically ci	eate new instar	ices of this

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delete()	This operation provides the ability to dynamically delete existing instances of this object.		
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.		
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.		
Relationships: The EthMd object contains zero or more EthMeg object instances.			
Reportable Notifications:			
objectCreation O			
objectDeletion	objectDeletion O		

## 9.2.7 EthMepPeerInfo (MEP Peer Information)

#### **Behavior:**

This object defines a set of attributes for storing the Maintenance End Points (MEP) identifiers or MAC addresses of the peer MEPs, as well as additional information a MEP learns about it's peers. The peer MEPs may be dynamically learned or statically provisioned.

Ethernet Maintenance EndPoint (MEP) is a provisioned OAM reference point which is capable to initiate and terminate proactive/diagnostic OAM frames. For a Point-to-Point EVC, a single peer MEP is identified by (an instance of) this object, whereas for a Multipoint-to-Multipoint EVC associating many UNIs, one or more peer MEPs are identified by (one or more instances of) this object.

This object may be recurisvely used by other objects to get the peer MEP identifiers or MAC addresses of the remote MEPs. These other objects may pertain to functions such as ContinuityCheck (CC), Loopback (LBK), Linktrace (LTR), Delay Measurement (DM) etc.

Since MEPid is unique only within the Maintenance Association (having same MAID and MD level), it is required to qualify the MEPid with the MAid.

Multicast loopback (LBMs) can be used to dynamically discover the MAC address of the remote MEP(s) on a MEG. This discovery capability can have important applicability when the local and remote MEP(s) are under different administrative domains (e.g., on the UNI).

At least one instance of this object is created automatically by the EMS when EthMp object is created. Instances of this managed object may be created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
id	This attribute specifies the MEG ID, as defined in Y.1731, of a remote peer MEP. The default value is zero.	MepIdType	0	M, R/W
macAddress	This attribute specifies the MAC Address, as defined in Y.1731, of a remote peer MEP.	MacAddress		M, R/W

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configurationType	This attribute specifies the configuration type for this peer MEP instance. A Peer MEP may be dynamically learned using OAM functions or static configuration via the EMS.	PeerMepCfgType	dynamic	O, R/W
status	This attribute indicates the status of the remote MEP to which this instance applies.	RemoteMepStatusType		M, R/W
rdi	This attribute indicates the state of the RDI bit in the last received CCM. A value of 'true' is returned for RDI=1. A value of 'false' is returned if no CCM has been received or RDI=0.	Boolean		M, R/W
portStatusTlv	This attribute indicates the Port Status TLV received in the last CCM from the remote MEP identified by this instance. The default value is returned if no CCM has been received or if the received CCM did not include a Port Status TLV.	PortStatusTlvType	notIncluded	O, R/W
interfaceStatusTlv	This attribute indicates the Interface Status TLV received in the last CCM from the remote MEP identified by this instance. The default value is returned if no CCM has been received or if the received CCM did not include an Interface Status TLV.	InterfaceStatusTlvType	notIncluded	O, R/W
chassisIdSubtype	This attribute indicates the format of the Chassis ID received in the Sender ID TLV in the last CCM received from the peer MEP indicated by this instance.	LldpChassisIdType		O, R
chassisId	This attribute indicates the Chassis ID received in the Sender ID TLV of the last CCM received from a peer MEP identified by this instance. The format of this object is determined by the value of the ChassisIdSubtype attribute.	LldpChassisId		O, R
mgtAddrDomain	This attribute indicates the TDomain that identifies the type and format of the related MgtAddr attribute, used to access the SNMP agent of the system transmitting the CCM. Received in the CCM Sender ID TLV from that system.	TDomain		O, R

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mgtAddr	This attribute indicates the TAddress that can be used to access the SNMP agent of the system transmitting the CCM, received in the CCM Sender ID TLV from that system. If the related attribute MgtAddrDomain contains the value 'zeroDotZero', this attribute should return a zero-length OCTET STRING.	TAddress		O, R
Operations / Methods:				
Name	Description			
create()	This operation provides the ability to dynamically create new instances of this object			
delete()	This operation provides the ability to dynamically delete existing instances of this object.			
modify()	This operation provides the ab (e.g., attributes with read-write a	ility to dynamically upda access) of existing instance	te configurables of this object	e attributes
retrieve()	This operation provides the abil instances of this object.	ity to dynamically query a	attribute values	of existing
<b>Relationships:</b>				
EthMepPeerInfo is contained under the EthMep object.				
Reportable Notification	ns:			
objectCreation			0	
objectDeletion			0	

## 9.3 Fault Management Objects

The following diagram illustrates the Fault Management objects (UML classes) and their relationships as defined in this specification.





Figure 9-5 Fault Management Class Diagram

## 9.3.1 Continuity Check





Figure 9-6 Continuity Check Activity Diagram

## 9.3.1.1 EthOamCcCfg (Ethernet Continuity Check Configuration)

## Behavior:

This object includes configuration attributes and operations for the proactive Ethernet OAM Fault Management and Performance Monitoring Continuity Check function (ETH-CC) as defined in Y.1731 and 802.1ag. ETH-CC can be used for the following applications:

- Used to detect loss of continuity between any pair of MEPs in a MEG.

- Used to detect unintended connectivity conditions and other defect conditions.

# MEF

The OAM PDU used for ETH-CC and ETH-RDI information is CCM. This object is part of the Fault Identification and <PM?> OAM Use Cases.

This object also includes configuration attributes for the Ethernet OAM Fault Management Remote Defect Indication function (ETH-RDI as defined in Y.1731. ETH-RDI can be used for the following applications: - Single-ended fault management: The receiving MEP detects an RDI defect condition, which gets correlated with other defect conditions in this MEP and may become a fault cause. The absence of received ETH-RDI information in a single MEP indicates the absence of defects in the entire MEG.

- Contribution to far-end performance monitoring: It reflects that there was a defect condition in the far-end which is used as an input to the performance monitoring process.

ETH-CC and ETH-RDI functions are only applicable to MEPs.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of this managed object may also created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
enabled multicastEnabled	This attribute specifies whether ETH-CC transmission is enabled. The value 'true' indicates ETH-CC transmission is enabled. The value 'false' indicates ETH-CC transmission is disabled. This attribute specifies whether a MEP uses unicast or multicast to send the ETH-CC messages (CCMs). A MEP can send ETH-CC messages to unicast or multicast MAC addresses. The value 'true' indicates multicast is enabled. The value 'false' indicates unicast is enabled.	Boolean	true	M, R/W M, R/W
priority	This attribute specifies the priority of frames with ETH-CC and ETH-RDI information. By default, the frame with ETH-CC and ETH-RDI information is transmitted with the highest priority available to the data traffic.	PriorityType		0, R/W

dropEligible	This attribute specifies the eligibility of frames with ETH-CC and ETH-RDI information to be discarded when congestion conditions are encountered. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded. This attribute may be constrained to read-only in some implementations.	Boolean	false	O, R/W
lowestPriorityDefect	This attribute specifies the lowest priority defect that is allowed to generate a fault alarm.	LowestAlarmPriType	macRemErrXcon	M, R/W
faultAlarmTime	This attribute specifies the time that defects must be present before a Fault Alarm is issued. The data type RelativeTime is constrained to 2.5 seconds through 10 seconds. The default value is 2.5 seconds.	RelativeTime	2.5 seconds	M, R/W
faultAlarmResetTime	This attribute specifies the time that defects must be absent before resetting a Fault Alarm. The data type RelativeTime is constrained to 2.5 seconds through 10 seconds. The default value is 10 seconds.	RelativeTime	10 seconds	M, R/W
Operations / Methods:				
Name	Description			
create()	This operation provides the ability to dynamically create new instances of this object			
delete()	This operation provides the ability to dynamically delete existing instances of this object.			
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.			
<b>Relationships:</b>				

The EthOamCcCfg object is contained under the EthMp object.



#### EthOamCcCfg is associated with:

**EthMp:** *MaintenanceEndPoints* – Provides a pointer to a peerMp object instance that contains a list of peer MEP identifiers. This is only required when multicastEnabled is set to unicast (false).

EthMeg: *MaintenanceEntityGroup* – For the MEG ID and the MED Level at which the MEP exists.

Reportable Notifications:	
objectCreation	0
objectDeletion	0

## 9.3.1.2 EthOamCcStats (Ethernet Continuity Check Statistics)

#### **Behavior:**

This object contains the counter and status attributes for the ETH-CC function.

Instances of this managed object are created automatically by the MEP when the ETH-CC operation is executed (e.g., an EMS enables EthOamCcCfg).

Attributes				
Name	Description	Туре	Default Value	Qualifier
numCcmOut	This attribute contains the count of the total number of CCM messages transmitted. This attribute has an Integer length of 4 octets.	Integer	0	M, R
numCcmOutOfSequenceIn	This attribute indicates the total number of out-of-sequence CCMs received from all remote MEPs. (802.1ag)	Integer	0	M, R
portStatusTlv	This attribute indicates an enumerated value of the Port status TLV to be sent in the CCM from the local MEP.	PortStatusTlvType	notIncluded	0, R
interfaceStatusTlv	This attribute indicates an enumerated value of the Interface Status TLV to be sent in the CCM from the local MEP.	InterfaceStatusTlvType	notIncluded	0, R
highestPriorityDefect	This attribute indicates the highest priority defect that has been present since the MEPs Fault Notification Generator State Machine was last in the FNG_RESET state. An integer value indicating the priority of	HighestDefectPriType		M, R

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	the defect named in the variable highestDefect			
highestDefect	An enumerated value indicating the highest priority defect among the variables xconCCMdefect, errorCCMdefect, someRMEPCCMdefect, someMACstatusDefect, and someRDIdefect, as limited by lowestPriorityDefect.	HighestDefectType		M, R
defectsPresent	See dot1agCfmMepDefects. Also add allRMEPsDead	MepDefectsBitMap		M, R
errorCcmLastFailure	This attribute indicates the last-received CCM that triggered an DefErrorCCM fault.	CcmLastFaultType		M, R
xconCcmLastFailure	This attribute indicates the last-received CCM that triggered a DefXconCCM fault.	CcmLastFaultType		M, R
Operations / Methods:				
Name	Description	1 '1' / 1 ' 11		1 0
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
Relationships: The EthOamCcStats object is contained under the EthOamCcCfg object.				
<b>Reportable Notifications:</b>				
objectCreation			0	
objectDeletion			0	

## 9.3.2 Loopback









## 9.3.2.1 EthOamLbCfg (Ethernet Loopback Configuration)

#### **Behavior:**

This object includes configuration attributes and operations for the on-demand Ethernet OAM Fault Management Loopback function (ETH-LB) as defined in Y.1731 and 802.1ag. ETH-LM can be used for the following applications:

- To verify bidirectional connectivity of a MEP with a MIP or a peer MEP.

- To perform a bidirectional in-service or out-of-service diagnostics test between a pair of peer MEPs. This includes verifying bandwidth throughput, detecting bit errors, etc.

The OAM PDU used for ETH-LB request information is LBM. The OAM PDU used for ETH-LB reply is LBR. Unicast frames carrying the LBM PDU are called Unicast LBM frames. Unicast frames carrying the LBR PDU are called Unicast LBR frames. Multicast frames carrying the LBM PDU are called as Multicast LBM frames. Multicast frames carrying the LBR PDU are called Multicast LBR frames.

This object is part of the Fault Verification OAM Use Case. This functionality is similar to a 'ping'.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of this managed object may also be created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default	
			Value	Qualifier
multicastEnabled	This attribute specifies whether a	Boolean	false	O, R/W
	MEP uses unicast or multicast to			
	send the ETH-LM messages			
	(LBM/LBR). A MEP can send			
	ETH-LM messages to unicast or			
	multicast MAC addresses. The			
	value 'true' indicates multicast is			
	enabled. The value 'false'			
	indicates unicast is enabled.			
interval	This attribute specifies the period	Integer	1	M, R/W
	between LBM transmissions in a			
	LB Session. For an LB Session,			
	the period for LBM transmission			
	is configurable in the range 0			
	(send the next LBM upon receipt			
	of last LBR) and sixty seconds			
	(60 s).			
frameSize	This attribute specifies the LBM	Integer	64	M, R/W
	frame size. For an LB Session,			
	the size of the LBM frame is			
	configurable to any Ethernet			
	frame size between 64 Bytes and			
	the maximum transmission unit			
	of the EVC. The inclusion of the			
	Data TLV in a specific LBM is			
	dependent on the frame size			
	requested. Units are Bytes.			

priority	This attribute specifies the priority of Multicast or Unicast frames with ETH-LB request information. The default value of the CoS of a LBM frame MUST be the value which yields the lowest frame loss performance for this EVC.	Priority Type		M*, R/W (* Defined in Y.1731)
dropEligible	This attribute specifies the eligibility of frames with Unicast or Multicast ETH-LB information to be discarded when congestion conditions are encountered. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded.	Boolean	false	M*, R/W (* Defined in Y.1731)
data	This attribute specifies an arbitrary element to include in the Data TLV, if the Data TLV is selected to be sent, whose length and contents are configurable at the MEP. The contents can be a test pattern and an optional checksum. Examples of test patterns include pseudo-random bit sequence, all '0' pattern, etc. For bidirectional diagnostic test application, configuration is required for a test signal generator and a test signal detector associated with the MEP. This size is constrained to 0 to 1500 octets. This attribute is optional and it's usage is currently not defined within the MEF.	TestPatternType		O, R/W
numLbmsToTx	This attribute specifies the number of LBM transmissions to perform in an LB session. This attribute is configurable in the range of 0 (repeated until aborted) through 3600.	Integer		M, R/W

lbmMsgStatus	This attribute, if 'true', indicates another Loopback request message may be transmitted. This attribute is used as a thread locking flag to ensure only one EMS can initiate an LB Session. An EMS should verify this attribute is 'true' before triggering a Loopback request message. An EMS should set this attribute to 'false' to lock out other EMSs while it performs an LB Session. Once an EMS has completed an LB Session, it should set this attribute back to 'true'.	Boolean	true	M***, R/W (*** Defined in IEEE 802.1ag)
Operations / Methods:				
Name	Description			
create()	This operation provides the ability object.	y to dynamically c	create new instan	ces of this
delete()	This operation provides the ability to dynamically delete existing instances of this object.			
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.			
abortEthOamLb()	This operation provides the ability to abort a currently running on-demand ETH-LB function.			
triggerEthOamLb()	This operation provides the ability to administratively trigger on-demand ETH-LB, based on the configured attributes as well as the NumLbms and MipMacAddr input parameters. The NumLbms input parameter specifies the number of LBMs to transmit. The MipMacAddr input parameter specifies a destination MIP MAC Address or NULL if the destination is a MEP. The default value for the number of LBM transmissions (NumLbms input parameter) in an LB session is 3. This operation blocks until the number of LBM messages, specified by NumLbms, has been transmitted.			
<b>Operation Parameters:</b>				0.110
Name	Description	Туре	Default Value	Qualifier
MipMacAddr	This input parameter specifies a destination MIP MAC Address. If the destination is a MEP, this parameter is not used (NULL) and the EthMepPeerInfo object is used instead.	MacAddress		in
NumLbms	This input parameter specifies the number of LBM messages this MEP should transmit. The default value is three.	Integer		in



М

LbmMsgResults	This return parameter indicates the result of the ETH-LB operation. A value of 'true' indicates Loopback message(s) will be (or has been) transmitted. A value of 'false' indicates Loopback message(s) will not be sent.	Boolean		out
Relationships:				
The EthOamLbCfg object	ct is contained under the EthMep obj	ect.		
<b>EthOamLbCfg</b> is associated with: <b>EthMep: MaintenanceEndPoints</b> – For the unicast or multicast peer MEP MAC Address for which the loopback is performed. <b>EthMeg: MaintenanceEntityGroup</b> – For the MEG Level at which the MEP exists.				
<b>Reportable Notifications</b>	:			
objectCreation			М	

objectDeletion

## 9.3.2.2 EthOamLbStats (Ethernet Loopback Statistics)

#### **Behavior:**

This object contains the counter and status attributes for the ETH-LB function.

Instances of this managed object are created automatically by the MEP when the ETH-LB operation is executed (e.g., an EMS initiates an LB Session).

Attributes				
Name	Description	Туре	Default Value	Qualifier
numLbrlnlnOrder	This attribute contains the count of the total number of valid, in order Loopback reply messages received.	Integer	0	M, R
numLbrlnOutofOrder	This attribute contains the count of the total number of valid, out-of-order Loopback reply messages received.	Integer	0	M**, R (** Defined in G.8021)
numLbrInBadMdsu	This attribute contains the count of the total number of Loopback reply messages received whose mac_service_data_unit did not match (except for the OpCode) that of the corresponding Loopback request message.	Integer	0	M***, R (*** Defined in CFM MIB)
numLbmInCrcErrors	This attribute contains the count of the total number of LBR messages received with CRC errors. This attribute is only applicable when the LBM/LBR messages contain the Data TLV (Test Pattern).	Integer	0	M**, R (** Defined in G.8021)

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numLbmInBerErrors	This attribute contains the count of the total number of LBR messages received with BERR errors. This attribute is only applicable when the LBM/LBR messages contain the Data TLV (Test Pattern). This counter is a subset of the numLbrlnBadMdsu counter and is included in that counter value.	Integer	0	M**, R (** Defined in G.8021)
numLbrOut	This attribute contains the count of the total number of Loopback reply messages transmitted.	Integer	0	M, R
firstLbmTransId	This attribute indicates the transaction identifier of the first Loopback request message (to be) sent. This attribute has no meaning if the attribute lbmMsgResults has a value of 'false'.	Integer		M***, R (*** Defined in CFM MIB)
nextLbmTransId	This attribute contains the next sequence number/transaction identifier to be sent in a Loopback message.	Integer		M***, R (*** Defined in CFM MIB)
<b>Operations / Methods:</b>				
Name	Description			
retrieve()	This operation provides the ability to existing instances of this object.	dynamicall	y query attribute	values of
Relationships: The EthOamLbStats object is contained under the EthOamLbCfg object.				
Reportable Notifications	:			
objectCreation			0	
objectDeletion			0	

## 9.3.3 Link Trace





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## 9.3.3.1 EthOamLtCfg (Ethernet Link Trace Configuration)

#### **Behavior:**

This object includes configuration attributes and operations for the on-demand Ethernet OAM Fault Management Link Trace function (ETH-LT) as defined in Y.1731 and 802.1ag. ETH-LT can be used for the following applications:

- Adjacent Relation Retrieval: Used to retrieve adjacency relationship between a MEP and a remote MEP or MIP. The result of running ETH-LT function is a sequence of MIPs from the source MEP until the target MIP or MEP, where each MIP and/or MEP is identified by its MAC address.

- Fault Localization: When a fault (e.g. a link and/or a device failure) or a forwarding plane loop occurs, the sequence of MIPs and/or MEP will likely be different from the expected one. Difference in the sequences provides information about the fault location.

The OAM PDU used for ETH-LT request information is LTM. The OAM PDU used for ETH-LT reply is LTR.

This object is part of the Fault Isolation OAM Use Case.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of this managed object may also be created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
priority	This attribute specifies the priority of frames with ETH-LT request information.	PriorityType		M, R/W
dropEligible	This attribute specifies the eligibility of frames with ETH-LT information to be discarded when congestion conditions are encountered. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded. This attribute may be constrained to read-only in some implementations.	Boolean	false	O, R or R/W
ttl	This attribute allows the receiver to determine if frames with ETH-LT request information can be terminated. TTL is decremented every time frames with ETH-LT request information are relayed. Frames with ETH-LT request information with TTL<=1 are not relayed.	byte	64	M, R/W
flags	This attribute specifies the flags field for LTMs transmitted by the MEP.	LtmFlagsType	useFdbO nly	M, R/W

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ItmMsgStatus	This attribute, if 'true', indicates another LinkTrace request message may be transmitted. This attribute is used as a thread locking flag to ensure only one EMS can initiate an LT Session. An EMS should verify this attribute is 'true' before triggering a Link Trace request message. An EMS should set this attribute to 'false' to lock out other EMSs while it performs an LT Session. Once an EMS has completed an LT Session, it should set this attribute back to 'true'.	Boolean	true	M, R/W
ItmEgressId	This attribute identifies the MEP Linktrace Initiator that is originating, or the Linktrace Responder that is forwarding, this LTM. This is composed of eight octets. The low-order six octets contain a 48-bit IEEE MAC address unique to the system in which the MEP Linktrace Initiator or Linktrace Responder resides. The high-order two octets contain a value sufficient to uniquely identify the MEP Linktrace Initiator or Linktrace Responder within that system. For most Bridges, the address of any MAC attached to the Bridge will suffice for the low-order six octets, and 0 for the high-order octets. In some situations, e.g., if multiple virtual Bridges utilizing emulated LANs are implemented in a single physical system, the high-order two octets can be used to differentiate among	HexBinary		M, R
lastLtmTransId	the transmitting entities. This attribute indicates the LTM transaction identifier of the last LTM transmitted.	Integer		M, R



nextLtmTransId	This attribute indicates the LTM transaction identifier/sequence number to be used in the next LTM transmitted.	Integer	M, R	
numLtrlnUnexp	This attribute indicates the total number of unexpected LTRs received.	Integer	M, R	
<b>Operations / Methods:</b>				
Name		Description		
create()		This operation provides the ability to dynamically create new instances of this object.		
delete()		This operation provides the ability to dynamically delete existing instances of this object.		
retrieve()	This operation provides the ability to dynam query attribute values of existing instances of object.		ability to dynamically dynamically disting instances of this	
modify()		This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.		
abortEthOamLt()		This operation provides the ability to abort a currently running on-demand ETH-LT function.		
triggerEthOamLt()		This operation provide administratively trigger based on the configured at MipMacAddr input parameter input parameter specifies a Address or NULL if the des This operation blocks unti- completed.	es the ability to on-demand ETH-LT, ttributes as well as the eter. The MipMacAddr destination MIP MAC tination is a MEP. il the LT Session has	
<b>Operation Parameters:</b>				

Name	Description	Туре	Default Value	Qualifier
MipMacAddr	This input parameter specifies a destination MIP MAC Address. If the destination is a MEP, this parameter is not used (NULL) and the EthMepPeerInfo object is used instead.	MacAddress		in
LtmMsgResults	This return parameter indicates the result of the ETH-LT operation. A value of 'true' indicates Link Trace message(s) will be (or has been) transmitted. A value of 'false' indicates Link Trace message(s) will not be sent.	Boolean		out

**Relationships:** 



The EthOamLtCfg object is contained under the EthMep object.

EthOamLtCfg is associated with:

**EthMp:** *MaintenanceEndPoints* – For the target MEP MAC Address for which the linktrace is performed. **EthMeg**: *MaintenanceEntityGroup* – For the MEG Level at which the MEP exists.

Reportable Notifications:	
objectCreation	М
objectDeletion	М

## 9.3.3.2 EthOamLtrStats (Ethernet Link Trace Response Statistics)

#### **Behavior:**

This object contains the LTR counter and status attributes for the ETH-LT function. Upon successfully initiating the transmission, the attributes lastLtmTransId and ltmEgressId from the EthOamLtCfg object return the information required to recover the results of the LTM from this object.

Instances of this managed object are created automatically by the MEP when the ETH-LT operation is executed (e.g., an EMS initiates an LT Session).

Attributes	Attributes				
Name	Description	Туре	Default Value	Qualifier	
ttl	This attribute indicates the TTL field value for a returned LTR.	byte		M, R	
forwarded	This attribute indicates if a LTM was forwarded by the responding MP, as returned in the 'FwdYes' flag of the flags field.	TruthValueType		M, R	
terminalMEP	This attribute indicates whether the forwarded LTM reached a MEP enclosing its MA, as returned in the Terminal MEP flag of the Flags field.	TruthValueType		M, R	
lastEgressIdTlv	This attribute contains the eight octet field holding the Last Egress Identifier returned in the LTR Egress Identifier TLV of the LTR. The Last Egress Identifier identifies the MEP Linktrace Initiator that originated, or the Linktrace Responder that forwarded, the LTM to which this LTR is the response. This is the same value as the Egress Identifier TLV of that LTM.	HexBinary		M, R	

nextEgressIdTlv	This attribute contains an eight octet field holding the Next Egress Identifier returned in the LTR Egress Identifier TLV of the LTR. The Next Egress Identifier Identifies the Linktrace Responder that transmitted this LTR, and can forward the LTM to the next hop. This is the same value as the Egress Identifier TLV of the forwarded LTM, if any. If the FwdYes bit of the Flags field is false, the contents of this field are undefined, i.e., any value can be transmitted, and the field is ignored by the receiver.	HexBinary	М	4, R
relay	This attribute contains the value returned in the Relay Action field.	LtrRelayActionType	М	1, R
chassisIdSubytpe	This attribute specifies the format of the Chassis ID returned in the Sender ID TLV of the LTR, if any. This value is meaningless if the ChassisId has a length of 0.	LldpChassisIdSubtype	M	4, R
chassisId	This attribute indicates the Chassis ID returned in the Sender ID TLV of the LTR, if any. The format of this object is determined by the value of the ChassisIdSubtype attribute.	LldpChassisId	M	1, R
mgtAddrDomain	This attribute indicates the TDomain that identifies the type and format of the related MgtAddr attribute, used to access the SNMP agent of the system transmitting the LTR. Received in the LTR Sender ID TLV from that system.	Tdomain	M	4, R
mgtAddr	This attribute indicates the TAddress that can be used to access the SNMP agent of the system transmitting the LTR, received in the LTR Sender ID TLV from that system. If the related attribute MgtAddrDomain contains the value 'zeroDotZero', this attribute should return a zero-length OCTET STRING.	Taddress	M	4, R

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ingressAction	This attribute indicates the value returned in the Ingress Action Field of the LTM. The value ingNoTIv indicates that no Reply Ingress TLV was returned in the LTM.	CfmIngressActionType	M, R
ingressMacAddr	This attribute indicates the MAC address returned in the ingress MAC address field. If the ingressAction attribute contains the value ingNoTlv, then the contents of this attribute are meaningless.	MacAddress	M, R
ingressPortIdSubytpe	This attribute indicates the format of the Ingress Port ID. If the ingressAction attribute contains the value ingNoTIv, then the contents of this attribute are meaningless.	LldpPortIdSubtype	M, R
ingressPortId	This attribute indicates the Ingress Port ID. The format of this attribute is determined by the value of the ingressPortIdSubtype object. If the ingressAction attribute contains the value ingNoTIv, then the contents of this attribute are meaningless.	LldpPortId	M, R
egressAction	This attribute indicates the value returned in the Egress Action Field of the LTM. The value egrNoTIv indicates that no Reply Egress TLV was returned in the LTM.	CfmEgressActionType	M, R
egressMacAddr	This attribute indicates the MAC address returned in the egress MAC address field. If the egressAction attribute contains the value egrNoTlv, then the contents of this attribute are meaningless.	MacAddress	M, R
egressPortIdSubtype	This attribute indicates the format of the egress Port ID. If the egressAction attribute contains the value egrNoTlv, then the contents of this attribute are meaningless.	LldpPortIdSubtype	M, R
egressPortId	This attribute contains the Egress Port ID. The format of this attribute is determined by the value of the egressPortIdSubtype attribute. If the egressAction attribute contains the value egrNoTIv, then the contents of this attribute are meaningless.	LldpPortId	M, R



organizationSpecificTlv Operations / Methods:	This attribute indicates all Organization specific TLVs returned in the LTR, if any. This attribute includes all octets including and following the TLV Length field of each TLV, concatenated together. This attribute is an octet string of zero length or includes a length of 4 to 1500 octets.	HexBinary		M, R
Name	Description			
retrieve()	This operation provides the a existing instances of this object.	bility to dynamically qu	ery attribute	values of
Relationships: The EthOamLtrStats object is contained under the EthOamLtCfg object. There may exist zero or more (0*) EthOamLtrStats object instances for each instance of the EthOamLtCfg object. EthOamLtrStats instances are associated to a particular EthOamLtCfg instance through the lastLtmTransId and ltmEgressId attributes.				

Reportable Notifications:	
objectCreation	0
objectDeletion	0



## 9.3.4 Signal Functions



**Figure 9-9 Locked Activity Diagram** 



**Figure 9-10 Test Activity Diagram** 

## 9.3.4.1 ethOamAisCfg (Ethernet Alarm Indication Signal Configuration)

#### Behavior:

This object includes configuration attributes and operations for the proactive Ethernet OAM Fault Management Alarm Indication Signal function (ETH-AIS) as defined in Y.1731. ETH-LT can be used for the following applications:

- Used to suppress alarms following detection of defect conditions (e.g., signal fail conditions when ETH-CC is enabled or AIS condition or LCK condition when ETH-CC is disabled.)

The OAM PDU used for ETH-AIS information is AIS.

This object is part of the Fault Identification OAM Use Case. This function is only applicable to MEPs.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of this managed object may also be created and deleted by request of the EMS.

### Attributes

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Name	Description	Туре	Default Value	Qualifier
enabled	This attribute specifies whether ETH-AIS transmission is enabled. The value 'true' indicates ETH-AIS transmission is enabled. The value 'false' indicates ETH-AIS transmission is disabled.	Boolean	true	M, R/W
interval	This attribute specifies the ETH-AIS transmission period. The default value is 1 frame per second.	IntervalTypeAisLck	1 s	M, R/W
priority	This attribute specifies the priority of frames with ETH-AIS information. If ETH-AIS is supported, the default value for the CoS for AIS frame MUST be the value which yields the lowest frame loss performance for this EVC.	PriorityType		0, R/W
dropEligible	This attribute specifies the eligibility of frames with ETH-AIS information to be discarded when congestion conditions are encountered. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded. This attribute may be constrained to read-only in some implementations	Boolean	false	O, R/W
<b>Operations / Methods</b>				
Name	Description			
create()	This operation provides the ability to dynamically create new instances of this object.			
delete()	This operation provides the ability to dynamically delete existing instances of this object.		nces of this	
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.		of existing	
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.			
<b>Relationships:</b>				
The EthOamAisCfg ol	oject is contained under the EthMep of	object.		
<b>EthOamAisCfg</b> is associated with: <b>EthMeg</b> : <i>MaintenanceEntityGroup</i> – For the MEG Level at which the MEP exists.				
Reportable Notification	ons:			
objectCreation			0	
objectDeletion			0	

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## 9.3.4.2 EthOamLckCfg (Ethernet Lock Signal Configuration)

#### **Behavior:**

This object includes configuration attributes and operations for the on-demand Ethernet OAM Fault Management Locked Signal function (ETH-LCK) as defined in Y.1731. ETH-LCK can be used for the following applications:

- Used to communicate the administratively locking of a MEP and consequential interruption of data traffic forwarding towards the MEP expecting this traffic. This allows a MEP receiving ETH-LCK frames to distinguish between defect conditions and an administrative locking action.

- Used by other OAM functions which require a MEP to be administratively locked, such as for out-of-service testing.

The OAM PDU used for ETH-LCK information is LCK.

This object is part of the Fault Identification, Verification and Isolation OAM Use Case. This function is only applicable to MEPs.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of this managed object may also be created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
interval	This attribute specifies the ETH-LCK transmission period. This attribute may be constrained to the same value as configured for the ETH-AIS transmission period in some implementations. The default value is 1 frame per second.	IntervalTypeAisLck	1 s	M, R/W
priority	This attribute specifies the priority of frames with ETH-LCK information.	PriorityType		0, R/W
dropEligible	This attribute specifies the eligibility of frames with ETH-LCK information to be discarded when congestion conditions are encountered. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded. This attribute may be constrained to read-only in some implementations.	Boolean	false	O, R
<b>Operations / Methods:</b>				
Name	Description			

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create()	This operation provides the ability to dynamically create new instances of this object.
delete()	This operation provides the ability to dynamically delete existing instances of this object.
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.
triggerEthOamLck()	This operation provides the ability to administratively lock or unlock, based on the lockFlag parameter, a MEP. If lockFlag is 'lock', the MEP will be administratively locked. If lockFlag is 'unlock', the MEP will be administratively unlocked if previously locked.

#### **Operation Parameters:**

Name	Description	Туре	Default Value	Qualifier
lockFlag	This input parameter specifies the locking state. If lockFlag is 'lock', the MEP will be administratively locked. If lockFlag is 'unlock', the MEP will be administratively unlocked if previously locked.	AdminStateType	None	in
<b>Relationships:</b> The <b>EthOamLekCfg</b> object is a	contained under the <b>EthMen</b> object			

cp object.

EthOamLckCfg is associated with:

EthMeg: <i>MaintenanceEntityGroup</i> – For the MEG Level at which the MEP exists.	

Reportable Notifications:	
lockEvent	0
unlockEvent	0
objectCreation	0
objectDeletion	0

#### 9.3.4.3 EthOamTestCfg (Ethernet Test Signal Configuration)

#### **Behavior:**

This object includes configuration attributes and operations for the on-demand OAM Fault Management Test function (ETH-TEST) defined in Y.1731. The OAM PDU used for ETH-TEST information is TST. This object is part of the Perform Turn Up Testing and Baselining OAM Use Case. This function is only applicable to MEPs.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of

this managed object may also be created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
interval	This attribute specifies the ETH-TEST transmission period in milliseconds. Range for this attribute is 1000-60,000 ms.	Integer	1000 ms	O, R/W
priority	This attribute specifies the priority of frames with ETH-TEST information.	PriorityType		0, R/W
dropEligible	This attribute specifies the eligibility of frames with ETH-TEST information to be discarded when congestion conditions are encountered. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded. This attribute may be constrained to read-only in some implementations.	Boolean	false	0, R
frameSize	This attribute specifies the TST frame size. Units are Bytes.	Integer	64	0, R/W
data	This attribute specifies an arbitrary element to include in the Data TLV, if the Data TLV is selected to be sent, whose length and contents are configurable at the MEP. The contents can be a test pattern and an optional checksum. Examples of test patterns include pseudo-random bit sequence, all '0' pattern, etc. For bidirectional diagnostic test application, configuration is required for a test signal generator and a test signal detector associated with the MEP.	TestPatternType	None	O, R/W

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	to 1500 octets.			
scheduledStartDateAndTime	This attribute specifies the scheduled start date/time to perform the on-demand ETH-TEST operations. The default value for this attribute is the current system date and time which represents an immediate time.	DateAndTime	Current Date and Time	0, R/W
scheduledStopDateAndTime	This attribute specifies the scheduled stop date/time to perform on-demand ETH-TEST operations. The stop date/time value should be greater than or equal to the scheduled start date/time value.	DateAndTime	None	0, R/W
relativeStartTime	This attribute specifies the relative start time, from the current system time, to perform on-demand ETH-TEST. The default value for this attribute is zero, indicating the current system time, which represents an immediate start time.	RelativeTime	Immediate	O, R/W
durationTime	This attribute specifies the duration of the Locking. The duration time can be specified as forever (represented by a zero value) or as relative time (e.g., a given number of hours, minutes, and seconds from the start time). If the duration time is relative time, then the duration time should be equal to or greater than the frame transmission period.	RelativeTime	None	O, R/W
Name	Description			
create()	This operation provides the a this object.	bility to dynamica	lly create new	instances of
delete()	This operation provides the ab this object.	ility to dynamically	<sup>,</sup> delete existing	instances of
materiana				

modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.
abortEthOamTest()	This operation provides the ability to abort a currently running on-demand ETH-Test function.
triggerEthOamTest()	This operation provides the ability to perform a diagnostic test operation, based on the isSignalRcvr parameter, on a MEP. If isSignalRcvr is 'true', the MEP will be acting in the Test Signal Receiver role. If isSignalRcvr is 'false', the MEP will be acting in the Test Signal Generator role. The useScheduledTime input parameter specifies whether to use a relative start time and duration or a scheduled start and stop time. A 'true' value indicates the scheduled start and stop time attributes will be used. A 'false' value indicates a relative start time and duration will be used. Note: for out-of-service testing, the MEP should be locked first, using the EthOamLckCfg instance.

### **Operation Parameters:**

Name	Description	Туре	Default	Qualifier
		-	Value	
isSignalRcvr	This input parameter specifies	Boolean	None	in
	whether the MEP should act as			
	a Signal Generator or Receiver.			
	A 'true' value indicates the			
	operation is being performed			
	for a MEP acting in a Test			
	Signal Receiver role. A 'false'			
	value indicates the operation is			
	being performed for a MEP			
	acting in a Test Signal			
	Generator role.			
useScheduledTime	This input parameter specifies	Boolean	False	in
	whether to use a relative start			
	time and duration or a			
	scheduled start and stop time.			
	A 'true' value indicates the			
	scheduled start and stop time			
	attributes will be used. A			
	'false' value indicates a relative			
	start time and duration will be			
	used.			

### **Relationships:**

The EthOamTestCfg object is contained under the EthMep object.

EthOamTestCfg is associated with:

EthMeg: *MaintenanceEntityGroup* – For the MEG Level at which the MEP exists.

Reportable Notifications:			
objectCreation	0		
objectDeletion	0		

## 9.3.4.4 EthOamTestStats (Ethernet Test Signal Statistics)

### **Behavior:**

This object contains the counter attributes for the ETH-Test function.

Instances of this managed object are created automatically by the Local MEP and Remote MEP when the

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ETH-Tst operation is executed (e.g. an EMS initiates a ETH-Test Session). This object is used to capture statistics for both the sending and receiving MEP.st of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
numTstIn	This attribute contains the count of the total number of TST messages received. The count is incremented when a message is received with or without errors. This attribute is only applicable to the MEP receiving ETH-Test messages.	Integer	0	0, R
numTstInOutOfOrder	This attribute contains the count of the total number of valid, out-of-order TST messages received. The count is incremented when the sequence number in the TST message received does not match the expected sequence number. This attribute is only applicable to the MEP receiving ETH-Test messages.	Integer	0	O, R
numTstInCrcErrors	This attribute contains the count of the total number of TST messages received with CRC errors. This attribute is only applicable to the MEP receiving ETH-Test messages.	Integer	0	O, R
numTstInBerErrors	This attribute contains the count of the total number of TST messages received with BER errors. The count is incremented when the bit pattern in the received TST message does not match the expected bit pattern. This attribute is only applicable to the MEP receiving ETH-Test messages.	Integer	0	0, R

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numTstOut	This attribute contains the count of the total number of TST messages transmitted. This attribute is only applicable to the MEP sending ETH-Test messages. (i.e. The MEP under Test)	Integer	0	O, R
Name	Name Description			
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
Relationships: The EthOamTestStats object is contained under the EthOamTestCfg object.				
Reportable Notifications:				
objectCreation O				
objectDeletion O				

## 9.4 Performance Monitoring Objects

The following diagrams illustrate the Performance Monitoring objects (UML classes) and their associations as defined in this specification.



Figure 9-11 Performance Monitoring Inheritance Class Diagram





## **Figure 9-12 Performance Monitoring Class Diagram**

### 9.4.1 Abstract Performance Monitoring Objects

This section defines abstract PM objects which are used by LM and DM objects through generalization (inheritance)

## 9.4.1.1 EthOamDmProactiveOneWayStats

#### **Behavior:**

This object contains the counter and measurement attributes for one-way proactive ETH-DM function. This object is not applicable for the two-way proactive or on-demand ETH-DM functions.

Attributes				
Name	Description	Туре	Default	
	-		Value	Qualifier
elapsedTime	This attribute indicates the amount of time which has elapsed in the current interval.	RelativeTime		M, R
num1DmIn	This attribute contains the count of the total number of 1DM messages received.	Integer	0	M, R
num1DmOut	This attribute contains the count of the total number of 1DM messages transmitted.	Integer	0	M, R
<b>Operations</b> / Methods:				
Name	Description			

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#### **Relationships:**

The EthOamDmProactiveOneWayStats object is an abstract object is a generalization of the EthOamDmProactiveStats object.

**Reportable Notifications:** 

## 9.4.1.2 EthOamDmProactiveStats

**Behavior:** 

This object includes measurement counters common to the proactive one-way and two-way ETH-DM operations. This object is not applicable for the on-demand ETH-DM functions.

#### Attributes

Namo	Description	Type	Dofault	
	Description	туре	Value	Qualifier
suspectIntervalFlag	This attribute indicates if there is a discontinuity in the performance measurements conducted during the measurement interval. Conditions for discontinuity include, but are not limited to, the following: 1. Per section 10.1.6.1 of [ITU-T G.7710/Y.1701], the local time-of-day clock is adjusted by at least 10 seconds. 2. The conducting of performance measurements is halted before the current measurement interval is completed. 3. A local test, failure, or reconfiguration disrupts service on the EVC.	Boolean	FALSE	M. R
avgFarEndFrameDelay	This attribute indicates the average measured far-end Frame Delay.	Integer		M (For two way needs clock synchronization), R
avgFarEndInterFrameDelayVariation	This attribute indicates the average measured far-end Inter-Frame Delay Variation.	Integer		0, R
maxFarEndFrameDelay	This attribute indicates the maximum	Integer		O (with clock synchronization),

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	measured far-end Frame Delay.		R	
maxFarEndInterFrameDelayVariation	This attribute indicates the maximum measured far-end Inter-Frame Delay Variation.	Integer	O, R	
minFarEndFrameDelay	This attribute indicates the minimum measured far-end Frame Delay.	Integer	O (With clock synchronization), R	
minFarEndInterFrameDelayVariation	This attribute indicates the minimum measured far-end Inter-Frame Delay Variation	Integer	O, R	
<b>Operations / Methods:</b>				
Name	Description			
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
reset()	This operation provides the ability to dynamically reset (to zero) attribute values of existing instances of this object.			
<b>Relationships:</b> The <b>EthOamDmProactiveStats</b> object is	an abstract object.			
Reportable Notifications:				

#### 9.4.1.3 EthOamDmProactiveTwoWayStats

# **Behavior:** This object contains the counter and measurement attributes for two-way proactive ETH-DM function. This object is not applicable for the one-way proactive or on-demand ETH-DM functions.

Attributes				
Name	Description	Туре	Default Value	Qualifier
elapsedTime	This attribute indicates the amount of time which has elapsed in the current interval.	RelativeTime		M, R
avgBidirectionalFrameDelay	This attribute indicates the average measured bidirectional Frame Delay.	Integer	0	M, R



	T1	Tates	0	
avgBidirectionalInterFrameDelayVariation	I his attribute	Integer	0	
	indicates the			
	average			
	measured			
	bidirectional			
	Inter-Frame			
	Dolov			
	Delay			
	Variation.			0, R
avgNearEndFrameDelay	This attribute	Integer	0	
	indicates the			
	average			
	measured			
	near-end			
	Frame			C (M with Clock
	Dalay			
		τ.	0	Sync), R
avgNearEndInterFrameDelayVariation	This attribute	Integer	0	
	indicates the			
	average			
	measured			
	near-end			
	Inter-Frame			
	Delay			
	Variation			OR
mayDidipationalEpamaDalay	This attribute	Integer	0	0,10
maxbidirectionalf rameDelay	indicates the	meger	0	
	indicates the			
	maximum			
	measured			
	bidirectional			
	Frame			
	Delay.			0, R
maxBidirectionalInterFrameDelavVariation	This attribute	Integer	0	
······································	indicates the	U		
	maximum			
	measured			
	hidiractional			
	Jutan Ensure			
	Inter-Frame			
	Delay			
	Variation.			0, R
maxNearEndFrameDelay	This attribute	Integer	0	
	indicates the			
	maximum			
	measured			
	near-end			
	Frame			
	Dalay			
		<b>T</b> /	0	U, K
maxNearEndInterFrameDelayVariation	This attribute	Integer	0	
	indicates the			
	maximum			
	measured			
	near-end			
	Inter-Frame			
	Delay			
	Variation			OR
I	, ununon.	1	I	, n



	This attribute	Integer	0	
minBidirectionalFrameDelay	I his attribute	Integer	0	
	indicates the			
	minimum			
	measured			
	hidirectional			
	Eromo			
	Flame			
	Delay.			0, R
minBidirectionalInterFrameDelayVariation	This attribute	Integer	0	
	indicates the			
	minimum			
	mangurad			
	bidirectional			
	Inter-Frame			
	Delay			
	Variation.			0. R
minNearEndFrameDelay	This attribute	Integer	0	
	indicates the	integer	Ũ	
	mulcates the			
	minimum			
	measured			
	near-end			O (need clock
	Frame			synchronization).
	Delay			R
minNoorEndIntorEromoDolovVoriation	This attribute	Integer	0	
minivear Englinter FrameDelay variation	indicator the	meger	0	
	indicates the			
	minimum			
	measured			
	near-end			
	Inter-Frame			
	Delay			
	Variation			
		τ.	0	Ο, Κ
numDmmOut	This attribute	Integer	0	
	contains the			
	count of the			
	total number			
	of DMM			
•				
	messages			
	messages			
	messages transmitted.	-		M, R
numDmrIn	messages transmitted. This attribute	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the count of the	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the count of the total number	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the count of the total number	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the count of the total number of DMR	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the count of the total number of DMR reply	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the count of the total number of DMR reply messages	Integer	0	M, R
numDmrIn	messages transmitted. This attribute contains the count of the total number of DMR reply messages received.	Integer	0	M, R M, R
numDmrIn Operations / Methods:	messages transmitted. This attribute contains the count of the total number of DMR reply messages received.	Integer	0	M, R M, R
numDmrIn Operations / Methods: Name	messages transmitted. This attribute contains the count of the total number of DMR reply messages received.	Integer	0	M, R M, R
numDmrIn Operations / Methods: Name	messages transmitted. This attribute contains the count of the total number of DMR reply messages received. <b>Description</b>	Integer	0	M, R M, R
numDmrIn Operations / Methods: Name	messages transmitted. This attribute contains the count of the total number of DMR reply messages received. <b>Description</b>	Integer	0	M, R M, R
numDmrIn Operations / Methods: Name Relationships:	messages transmitted. This attribute contains the count of the total number of DMR reply messages received. <b>Description</b>	Integer	0	M, R M, R
numDmrIn Operations / Methods: Name Relationships: The EthOamDmProactiveTwoWayStats of	messages transmitted. This attribute contains the count of the total number of DMR reply messages received. <b>Description</b>	Integer	o is a ger	M, R M, R eralization of the
numDmrIn         Operations / Methods:         Name         Relationships:         The EthOamDmProactiveTwoWayStats of EthOamDmProactiveStats object.	messages transmitted. This attribute contains the count of the total number of DMR reply messages received. <b>Description</b>	Integer	is a ger	M, R M, R heralization of the
numDmrIn         Operations / Methods:         Name         Relationships:         The EthOamDmProactiveTwoWayStats of EthOamDmProactiveStats object.         Reportable Notifications:	messages transmitted. This attribute contains the count of the total number of DMR reply messages received. <b>Description</b>	Integer	o is a ger	M, R M, R

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### 9.4.1.4 EthOamPerfMonCfg

Behaviour:	<u> </u>			
This object includes cor operations.	figuration attributes and operations commo	on to the ETH-D	M and ETH-I	LM OAM
Attributes				
Name	Description	Туре	Default Value	Qualifier
dropEligible	This attribute specifies the eligibility of frames with Performance Monitoring OAM message information to be discarded when congestion conditions are encountered. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded. This attribute may be constrained to read-only in some implementations.	Boolean	false	M, R/W
durationTime	This attribute specifies the duration of the Delay Measurement PM Session. The duration time can be specified as forever (represented by a zero value) or as relative time (e.g., a given number of hours, minutes, and seconds from the start time). If the duration time is relative time, then the duration time should be equal to or greater than the frame transmission period of the PM function(s) comprising the PM Solution.	RelativeTime	forever	M, R/W
enabled	This attribute specifies whether proactive Performance Monitoring OAM message transmission (OAM PDUs as specified by the 'type' attribute) is enabled. The value 'true' indicates OAM message transmission is enabled. The value 'false' indicates oam message transmission is disabled. This attribute has no meaning for on-demand Performance Monitoring.	Boolean	false	O, R/W

interval	This attribute specifies the Performance Monitoring OAM message transmission period in milliseconds. For Performance Monitoring applications the default value is 100 ms. For on-demand Performance Monitoring, this attribute would be a zero value as it is not applicable.	IntervalType	100	M, R/W
measurementInterval	This attribute specifies a measurement interval which is multiples of 5 minutes. Units	Integer	15	M, R/W
priority	This attribute specifies the priority of frames with Performance Monitoring OAM message information. The value 'true' indicates frames are eligible to be discarded. The value 'false' indicates frames are not eligible to be discarded.	PriorityType	Highest allowed on the bridge port	M, R/W
relativeStartTime	This attribute specifies the relative start time, from the current system time, to perform on-demand ETH-DM. This attribute has no meaning for proactive ETH-DM. The default value for this attribute is zero, indicating the current system time, which represents an immediate start time.	RelativeTime		O, R/W
repetitionPeriod	This attribute specifies a configurable repetition periodicity time per instance of a Delay PM Solution. The repetition periodicity time can be specified as none or in relative time (e.g., every given number of hours, minutes, and seconds from the start time). If the duration time is forever, then the repetition periodicity time should be none. If the duration time is relative time and the repetition periodicity time is relative time, then the repetition periodicity time should be equal to or greater than the duration time. The default configured repetition periodicity time is none.	RelativeTime	None	M, R/W

scheduledStartDateAndTime	This attribute specifies the scheduled start date/time to perform the on-demand Performance Monitoring OAM operations. This attribute has no meaning for proactive Performance Monitoring OAM operations. The default value for this attribute is the current system date and time.	DateAndTime	Immediate	M, R/W
scheduledStopDateAndTime	This attribute specifies the scheduled stop date/time to perform on-demand Performance Monitoring OAM operations. This attribute has no meaning for proactive Performance Monitoring OAM operations. The stop date/time value should be greater than or equal to the scheduled start date/time value.	DateAndTime		M, R/W
vlanPcp	This attribute specifies a configurable VLAN PCP for Performance Monitoring OAM message frame transmission. The default configured VLAN PCP should correspond to the CoS which yields the lowest frame delay performance for this EVC. This is not applicable if the MEG is untagged.	Integer		M, R/W
Operations / Methods:	Description			
create()	This operation provides the abil this object.	ity to dynamical	ly create new i	nstances of
delete()	This operation provides the ability to dynamically delete existing instances of this object.			
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
modify()	This operation provides the ability to dynamically update configurable attributes (e.g., attributes with read-write access) of existing instances of this object.			
Relationships:	et is an abstract object			
Departable Netifications:	ct is all abstract object.			
Reportable Notifications:				

#### 9.4.2 Loss Measurement



### Figure 9-13 On-Demand Single-Ended Loss Measurement Activity Diagram

#### 9.4.2.1 EthOamLmCfg (Ethernet Loss Measurement Configuration)

Behavior:		
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This object includes configuration attributes and operations for the single-ended on-demand and dual-ended proactive Performance Monitoring Frame Loss Measurement function (ETH-LM) defined in Y.1731. ETH-LM can be used for the following applications:

- Facilitates performing near-end and far-end frame loss measurements

- Facilitates determining unavailable time

The OAM PDU used for single-ended ETH-LM request is LMM. The OAM PDU used for single-ended ETH-LM reply is LMR. The OAM PDU used for dual-ended ETH-LM information is CCM, where the CCM transmission period is configured for the Performance Monitoring application.

This object is part of the Measure Frame Loss and Calculate Availability OAM Use Cases. This functionality is similar to a 'ping'. This function is only applicable to MEPs.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of this managed object may also be created and deleted by request of the EMS.

Attributes

Nama	Description	Type	Dofault	Qualifiar
	Description	rype	Value	Quanner
type	This attribute specifies whether single-ended on-demand or dual-ended proactive ETH-LM will be performed. If dual-ended ETH-LM is configured, the enabled attribute is used to enable or disable dual-ended ETH-LM. If single-ended ETH-LM is configured, the startTime and endTime attributes are used to trigger single-ended ETH-LM.	LossMeasType	singleEnded	M, R/W
availabilityNumConsecutiveFlrMeas	This attribute specifies a configurable number of consecutive FLR measurements to be used in evaluating the availability/unavailability status of an availability indicator per [MEF 10.1]. The number range of 1 through 10 is supported. This parameter is equivalent to the Availability parameter of 'n' as specified by [MEF 10.1].	Integer	10	M, R/W

availabilityThreshold	This attribute specifies a configurable availability threshold to be used in evaluating the availability/unavailability status of an availability indicator per [MEF 10.1]. The availability threshold range of 0.00 through 1.00 is supported. The configured availability threshold is less than or equal to the configured unavailability threshold specified by [MEF 10.1 R71]. This parameter is equivalent to the Availability parameter of 'Ca' as specified by [MEF 10.1].	float	0.50	M, R/W
unavailabilityThreshold	This attribute specifies a configurable unavailability threshold to be used in evaluating the availability/unavailability indicator per [MEF 10.1]. The unavailability threshold range of 0.00 through 1.00 is supported. The configured unavailability threshold is greater than or equal to the configured availability threshold specified by [MEF 10.1 R70]. This parameter is equivalent to the Availability parameter of 'Cu' as specified by [MEF 10.1].	float	0.50	M, R/W
<b>Operations / Methods:</b>				
Name	Description			
abortEthOamLm()	This operation provides t scheduled single-ended operation is not applicable	he ability to abo on-demand ETI to dual-ended pro	rt a currently H-LM functio pactive ETH-LM	running or on. This A.



triggerEthOamLm()	This operation provides the ability to trigger single-ended on-demand				
	or dual-ended proactive ETH-LM based on the configured values of				
	type, start date/time, and end date/time. For the dual-ended proactive				
	ETH-LM operation, the input parameter 'useScheduledTime' is				
	ignored since it only applies for the single-ended on-demand ETH-LM				
	operation.				
	This operation blocks until the LM Session has completed.				

#### **Operation Parameters:**

Name	Description	Туре	Default	Qualifier
		D 1	Value	
useScheduledTime	This input parameter specifies whether to use a relative start time and duration or a scheduled start and stop time. A 'true' value indicates the scheduled start and stop time attributes will be used. A 'false' value indicates a relative start time and duration will be used. This parameter is not applicable for the dual-ended on-demand operation.	Boolean	FALSE	in
ImmMsgResults	This return parameter indicates the result of the ETH-LM operation. A value of 'true' indicates LMM message(s) will be (or has been) transmitted. A value of 'false' indicates LMM message(s) will not be sent.	Boolean		out

The EthOamLmCfg object is contained under the EthMep object and is a generalization of the EthOamPerfMonCfg object.

#### EthOamLmCfg is associated with:

EthMep: MaintenanceEndPoints - For the unicast peer MEP MAC Address for which the frame loss measurement is performed.

EthMeg: MaintenanceEntityGroup – For the MEG Level at which the MEP exists.

Reportable Notifications:	
objectCreation	0
objectDeletion	0

#### 9.4.2.2 EthOamLmOnDemandSingleEndedStats (Ethernet Loss Measurement **On-Demand Single-Ended Statistics**)

#### **Behavior:**

This object contains the counter attributes for the single-ended on-demand ETH-LT function. This object is not applicable for the dual-ended proactive ETH-LT function.

Instances of this managed object are created automatically by the MEP when the single-ended on-demand ETH-LT operation is executed.

Attributes				
Name	Description	Туре	Default Value	Qualifier
nearEndTotTransmittedFrames	This attribute contains the total number of near-end, or egress, data frames transmitted by this MEP.	Integer	0	M, R
nearEndTotLostFrames	This attribute contains the total number of near-end, or ingress, data frames lost by this MEP.	Integer	0	M, R
nearEndTotFrameLossRatio	This attribute contains the total near-end frame loss ratio calculated by this MEP.	Integer	0	0, R
nearEndMinFrameLossRatio	This attribute contains the minimum near-end frame loss ratio calculated by this MEP.	Integer	0	0, R
nearEndMaxFrameLossRatio	This attribute contains the maximum near-end frame loss ratio calculated by this MEP.	Integer	0	0, R
nearEndAvgFrameLossRatio	This attribute contains the average near-end frame loss ratio calculated by this MEP.	Integer	0	0, R
farEndTotTransmittedFrames	This attribute contains the total number of far-end, or ingress, data frames transmitted by this MEP.	Integer	0	M, R
farEndTotLostFrames	This attribute contains the total number of far-end, or egress, data frames lost by this MEP.	Integer	0	M, R
farEndTotFrameLossRatio	This attribute contains the total far-end frame loss ratio calculated by this MEP.	Integer	0	0, R
farEndMinFrameLossRatio	This attribute contains the minimum far-end frame loss ratio calculated by this MEP.	Integer	0	0, R
farEndMaxFrameLossRatio	This attribute contains the maximum far-end frame loss ratio calculated by this MEP.	Integer	0	0, R
farEndAvgFrameLossRatio	This attribute contains the average far-end frame loss ratio calculated by this MEP.	Integer	0	0, R
farEndAvgFrameLossRatio	This attribute contains the average far-end frame loss ratio calculated by this MEP.	Integer	0	0, R
numLmmOut	This attribute contains the count of the total number of LMM frames transmitted.	Integer	0	M, R

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numLmmIn	This attribute contains the count of the total number of LMM frames received.	Integer	0	M, R	
numLmrIn	This attribute contains the count of the total number of LMR frames received.	Integer	0	M, R	
numLmrOut	This attribute contains the count of the total number of LMR frames transmitted.	Integer	0	M, R	
Operations / Methods:					
Name	Description	Description			
reset()	This operation provides the ability to dynamically reset (to zero) attribute values of existing instances of this object.				
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.				
Relationships: The EthOamLmTotalSingleEnde	dStats object is contained under the I	EthOamLı	nCfg object.		
<b>Reportable Notifications:</b>					
objectCreation			0		
objectDeletion			0		



#### 9.4.3 Delay Measurement



Figure 9-14 On-Demand 2-Way Delay Measurement Activity Diagram

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Figure 9-15 Proactive 2-Way Delay Measurement Activity Diagram

### 9.4.3.1 EthOamDmCfg (Ethernet Delay Measurement Configuration)

**Behavior:** 



This object includes configuration attributes and operations for the one-way and two-way on-demand and proactive Performance Monitoring Frame Delay Measurement function (ETH-DM) defined in Y.1731. ETH-DM can be used for the following applications:

- Facilitates performing frame delay measurements

- Facilitates performing inter-frame delay variation measurements

The OAM PDU used for one-way ETH-DM information is 1DM. The OAM PDU used for two-way ETH-DM request is DMM. The OAM PDU used for two-way ETH-DM replies is DMR.

This object is part of the Measure Frame Delay and Measure Inter-frame Delay Variation OAM Use Cases. This function is only applicable to MEPs.

The one-way ETH-DM function is initiated at the local MEP and enabled at the remote MEP.

The two-way ETH-DM function is managed only at the local MEP. The remote MEP does not need any management.

Instances of this managed object are created automatically by the EMS when EthMp is created. Instances of this managed object may also be created and deleted by request of the EMS.

Attributes				
Name	Description	Туре	Default Value	Qualifier
clockSyncFlag	This attribute specifies whether the clocks for both end points are synchronized. This attribute controls whether one-way measurements are computed.	Boolean	FALSE	O, R/W
frameSize	This attribute specifies the frame size in octets. The range of frame sizes from 64 through 2000 octets, in 4 octet increments, is supported, and the range of frame sizes from 2004 through 9600 octets, in 4 octet increments, may be supported	Integer	64	M, R/W
measBinThreshold	This attribute specifies the threshold for a measurement bin (excluding the first measurement bin). The measurement threshold for each measurement bin must be larger than the measurement threshold of the preceding measurement bin. The unit for a measurement threshold is microseconds ( $\mu$ s). The measurement threshold of the first measurement bin is fixed to 0 $\mu$ s. The default configured measurement threshold for a measurement bin should be an increment of 5000 $\mu$ s larger than the	BinThresholdType		M, R/W

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	measurement threshold of the preceding measurement bin.			
numMeasBinsPerFrame DelayInterval	This attribute specifies the number of measurement bins per measurement interval for Frame Delay measurements. The valid range of values is 310 bins.	Integer	3	M, R/W
numMeasBinsPerInterF rameDelayVariationInte rval	This attribute specifies the number of measurement bins per measurement interval for Inter-Frame Delay Variation measurements. The valid range of values is 110 bins.	Integer	1	O, R/W
type	This attribute indicates the type of delay measurement to be performed.	DelayMeasType		M, R/W
<b>Operations / Methods:</b>				
Name	]	Description		
abortEthOamDm()	,	This operation provides the currently running or schedule	ne ability ed ETH-DI	to abort a M function.
triggerEthOamLm()		This operation provides the ability to trigger single-ended on-demand or dual-ended proactive ETH-LM based on the configured values of type, start date/time, and end date/time. For the dual-ended proactive ETH-LM operation, the input parameter 'useScheduledTime' is ignored since it only applies for the single-ended on-demand ETH-LM operation. This operation blocks until the LM Session has completed.		
<b>Operation Parameters:</b>				
Name	Description	Туре	Default Value	Qualifier

useScheduledTime	This input parameter specifies whether to use a relative start time and duration or a scheduled start and stop time. A 'true' value indicates the scheduled start and stop time attributes will be used. A 'false' value indicates a relative start time and duration will be used. This parameter is not applicable for the dual-ended	Boolean	FALSE	in
dmMsgResults	on-demand operation. This return parameter indicates the result of the one-way or two-way ETH-DM operation. A value of 'true' indicates 1DM/DMM message(s) will be (or has been) transmitted. A value of 'false' indicates 1DM/DMM message(s) will not be sent.	Boolean		out
Relationships:         The EthOamDmCfg object is contained under the EthMep object and is a generalization of the EthOamPerfMonCfg object.         EthOamDmCfg is associated with:         EthMep: MaintenanceEndPoints – For the peer MEP MAC Address for which the delay measurement is performed.         EthMeg: MaintenanceEntityGroup – For the MEG Level at which the MEP exists.				
<b>Reportable Notifications:</b>				

objectCreation	0
objectDeletion	0

#### EthOamDmOnDemandOneWayStats (Ethernet Delay Measurement 9.4.3.2 **On-Demand 1-Way Statistics)**

# **Behavior:** This object contains the counter and measurement attributes for the one-way on-demand ETH-DM function. This object is not applicable for the two-way on-demand or proactive ETH-DM functions. Instances of this managed object are created automatically by the MEP when the one-way on-demand ETH-DM operation is executed. Attributes

Name	Description	Туре	Default Value	Qualifier
frameDelay	This attribute indicates the measurement for Frame Delay. This measurement requires clock synchronization between the two end-points.	Integer	0	M, R



interFrameDelayVariatio n	This attribute indicates the measurement for Inter-Frame Delay. This measurement requires clock synchronization between the two end-points.	Integer	0	M, R
num1DmIn	This attribute contains the count of the total number of 1DM messages received.	Integer	0	M, R
num1DmOut	This attribute contains the count of the total number of 1DM messages transmitted.	Integer	0	M, R
<b>Operations / Methods:</b>		•		•
Name	Description			
reset()	This operation provides the ability to dyn of existing instances of this object.	amically re	eset (to zero) attri	bute values
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
Relationships: The EthOamDmOnDemandOneWayStats object is contained under the EthOamDmCfg object.				
<b>Reportable Notifications:</b>				
objectCreation			0	
objectDeletion			0	

# 9.4.3.3 EthOamDmOnDemandTwoWayStats (Ethernet Delay Measurement On-Demand 2-Way Statistics)

#### **Behavior:**

This object contains the counter and measurement attributes for the two-way on-demand ETH-DM function. This object is not applicable for the one-way on-demand or proactive ETH-DM functions.

Instances of this managed object are created automatically by the MEP when the two-way on-demand ETH-DM operation is executed.

Attributes				
Name	Description	Туре	Default Value	Qualifier
bidirectionalFrameDelay	This attribute indicates the measured bidirectional frame delay.	Integer	0	M, R
farEndFrameDelay	This attribute indicates the far-end measurement for Frame Delay. This measurement requires clock synchronization between the two end-points.	Integer	0	M, R
nearEndFrameDelay	This attribute indicates the near-end measurement for Frame Delay. This measurement requires clock synchronization between the two end-points.	Integer	0	M, R

numDmmOut	This attribute contains the count of the total number of DMM messages transmitted.	Integer	0	M, R
numDmrIn	This attribute contains the count of the total number of DMR reply messages received.	Integer	0	M, R
<b>Operations / Methods:</b>				
Name	Description			
reset()	This operation provides the ability to dynamically reset (to zero) attribute values of existing instances of this object.			
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
Relationships: The EthOamDmOnDemandTwoWayStats object is contained under the EthOamDmCfg object.				
<b>Reportable Notifications:</b>				
objectCreation			0	
objectDeletion	ion O			

### 9.4.3.4 EthOamDmProactiveOneWayCurrentStats (Ethernet Delay Measurement Proactive 1-Way Current Statistics)

#### **Behavior:**

This object contains the counter and measurement attributes for the current interval for one-way proactive ETH-DM function. This object is not applicable for the two-way proactive or on-demand ETH-DM functions.

Instances of this managed object are created automatically by the MEP when the one-way proactive ETH-DM operation is executed.

Attributes				
Name	Description	Туре	Default	
			Value	Qualifier
binStats	This attribute specifies the bin measurements.	BinStatsType	0	M, R
<b>Operations / Methods</b>			-	
Name	Description			
Relationships: The EthOamDmProactiveOneWayCurrentStats object is contained under the EthOamDmCfg object and is a generalization of the EthOamDmProactiveOneWayStats object.				
Reportable Notification	s:			
objectCreation			0	
objectDeletion			0	

# 9.4.3.5 EthOamDmProactiveOneWayHistoryStats (Ethernet Delay Measurement Proactive 1-Way History Statistics)

**Behavior:** 

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This object contains the counter and measurement attributes for historical intervals for one-way proactive ETH-DM function. This object is not applicable for the two-way proactive or on-demand ETH-DM functions.

Instances of this managed object are created automatically by the MEP when the one-way proactive ETH-DM operation is executed and a current interval completes.

Attributes				
Name	Description	Туре	Default Value	Qualifier
binStats	This attribute specifies the bin measurements.	BinStatsType		M, R
granularityPeriod	This attribute indicates the time granularity of a measurement interval (e.g., 15 min, 24 hr).			M, R
intervalNumber	This attribute indicates which interval the measurements are applicable to. This attribute has a range of 132 to represent up to 32 historic intervals of measurement data.	Integer		M, R
timestamp	This attribute indicates the data/time of when the interval completed and is based on local time-of-day clock in UTC.	DateAndTime		M, R
<b>Operations / Methods:</b>				
Name	Description			
Relationships: The EthOamDmProactive a generalization of the Eth Reportable Notifications	veOneWayHistoryStats object is contai hOamDmProactiveOneWayStats object	ned under the Et	hOamDmCfg (	bject and is

objectCreation	0
objectDeletion	0

#### 9.4.3.6 EthOamDmProactiveTwoWayCurrentStats (Ethernet Delay Measurement Proactive 2-Way Current Statistics)

#### **Behavior:**

This object contains the counter and measurement attributes for the current interval for two-way proactive ETH-DM function. This object is not applicable for the one-way proactive or on-demand ETH-DM functions.

Instances of this managed object are created automatically by the MEP when the two-way proactive ETH-DM operation is executed.

Attributes				
Name	Description	Туре	Default Value	Qualifier
binStats	This attribute specifies the bin measurements.	BinStatsType		M, R
<b>Operations / Methods:</b>			-	
Name	Description			

Т

<b>Relationships:</b>						
The EthOamDmProactiveTwoWayCurrentStats object is contained under the EthOamDmCfg object and is a generalization of the EthOamDmProactiveTwoWayStats object.						
Reportable Notification	Reportable Notifications:					
objectCreation		0				
objectDeletion		0				

# 9.4.3.7 EthOamDmProactiveTwoWayHistoryStats (Ethernet Delay Measurement Proactive 2-Way History Statistics)

#### **Behavior:**

This object contains the counter and measurement attributes for historical intervals for two-way proactive ETH-DM function. This object is not applicable for the one-way proactive or on-demand ETH-DM functions.

Instances of this managed object are created automatically by the MEP when the two-way proactive ETH-DM operation is executed and a current interval completes.

Attributes				
Name	Description	Туре	Default Value	Qualifier
binStats	This attribute specifies the bin measurements.	BinStatsType		M, R
granularityPeriod	This attribute indicates the time granularity of a measurement interval (e.g., 15 min, 24 hr).			M, R
intervalNumber	This attribute indicates which interval the measurements are applicable to. This attribute has a range of 132 to represent up to 32 historic intervals of measurement data.	Integer		M, R
timestamp	This attribute indicates the data/time of when the interval completed and is based on local time-of-day clock in UTC.	DateAndTime		M, R
<b>Operations / Methods:</b>				
Name	Description			
<b>Relationships:</b> The <b>EthOamDmProacti</b> is a generalization of the	veTwoWayHistoryStats object is contain EthOamDmProactiveTwoWayStats ob	ined under the Et	thOamDmCfg	object and
<b>Reportable Notification</b>	s:			
objectCreation			0	
objectDeletion			0	

# 9.4.3.8 EthOamDmProactiveTwoWayThreshold (Ethernet Delay Measurement Proactive 2-Way Thresholds)

**Behavior:** 

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This object contains the list of two-way Delay Measurement threshold values for proactive Performance Monitoring.

Instances of this managed object are created automatically by the MEP when the MEP creates an instance of EthOamDmCfg.

Attributes					
Name	Description	Type	Default		
- (	2 0001-1000	- 5 P*	Value	Qualifier	
			v aluc		
thresholdList	This attribute contains the	DelayMeas I hresholdList I ype		0, R/W	
	list of threshold values to				
	be configured for two-way				
	Proactive Delay				
	Measurements.				
<b>Operations / Methods</b>	:				
Name	Description				
<b>Relationships:</b>					
The EthOamDmProa	rtiveTwoWavThreshold obje	ect has a one-to-one association w	vith the <b>EthO</b>	amDmCfg	
object		ter hus a one to one association w		lineis	
object.					
Reportable Notification	ons:				
objectCreation			0		
objectDeletion			0		

# 9.4.3.9 EthOamDmProactiveOneWayThreshold (Ethernet Delay Measurement Proactive 1-Way Thresholds)

#### **Behavior:**

This object contains the list of one-way Delay Measurement threshold values for proactive Performance Monitoring.

Instances of this managed object are created automatically by the MEP when the MEP creates an instance of EthOamDmCfg.

Attributes					
Name	Description	Туре	Default Value	Qualifier	
thresholdList	This attribute contains the list of threshold values to be configured for one-way Proactive Delay Measurements.	DelayMeasThresholdListType		O, R/W	
<b>Operations / Methods</b>	:				
Name	Description				
Relationships: The EthOamDmProactiveOneWayThreshold object has a one-to-one association with the EthOamDmCfg object.					
<b>Reportable Notification</b>	ons:				
objectCreation			0		
objectDeletion			0		

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#### 9.4.4 Function Sets

#### 9.4.4.1 Additional Performance Management Function Sets

This section defines additional managed objects specific to Performance Management statistics. Within this logical model, Performance Data Sets simply describe the category of the performance information (the data set) along with the individual counters associated with the set. It is assumed that both current and historical counts will be made available across the EMS-NMS interface. For this logical model, the duration of the interval and amount of history to be stored are not specified. These must be specified for any management protocol specific interface and/or implementation agreement that makes use of this logical model.

# 9.4.4.2 EthMegPerfDataSet (ETH Point-to-Point EVC MEG Performance Data Set)

#### **Behavior:**

This object contains the set of service OAM performance data to be collected for a Point-to-Point EVC\_MEG.

Attributes				
Name	Description	Туре	Default Value	Qualifier
availability	This attribute indicates the Availability Performance which is the percentage of time within a specified time interval during which the service is available. Integer range is 0100.	List ( <cos.>, float) thresholded</cos.>	0	O, R
frameDelayOneWay	This attribute indicates the average one way Frame Delay per CoS	List ( <cos.>, Integer) Thresholded (in ms)</cos.>	0	O, R
frameDelayTwoWay	This attribute indicates the average round trip Frame Delay per CoS.	List ( <cos.>, Integer) Thresholded (in ms)</cos.>	0	O, R
frameLossRatio	This attribute indicates the ratio of frames lost per CoS.	List ( <cos.>, float) thresholded</cos.>	0	O, R
interFrameDelayVariationOneWay	This attribute indicates the average one way Inter-Frame Delay Variation per CoS	List ( <cos.>, Integer) Thresholded (in ms)</cos.>	0	O, R

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interFrameDelayVariationTwoWay	This attribute indicates the average round trip Inter-Frame Delay Variation per CoS	List ( <cos.>, Integer) Thresholded (in ms)</cos.>	0	O, R
<b>Operations / Methods:</b>				
Name	Description			
reset()	This operation provides the ability to dynamically reset (to zero) attribute values of existing instances of this object.			
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.			
Relationships:				
The EthMegPerfDataSet object is associated with the EthMe object.				
Reportable Notifications:				
objectCreation O				
objectDeletion O				

#### EthMpPerfDataSet (ETH Maintenance Point Performance Data Set) 9443

Э.т.т.Э	Ľ
<b>Behavior:</b>	

Behavior:						
This object contains the set of service OAM performance data to be collected for each Maintenance Point						
(MEP, MIP).						
Attributes		-		0.110		
Name	Description	Туре	Default	Qualifie		
		Т. /	Value	r		
inOamFramesDiscarded	incoming frames discarded at the	Integer	0	O, K		
	MP.					
inOamFramesRx	This attribute indicates the count of incoming frames received at the MP.	Integer	0	O, R		
lossOfContinuityTimer	This attribute indicates the tiimer for loss of continuity at the MP.	Integer	0	0, R		
oamInvalidTtlErrors	This attribute indicates count of Invalid TTL errors for the MP (MEP/MIP).	Integer	0	O, R		
oamMismergeErrors	This attribute indicates the count of OAM Mismerge errors for the MP.	Integer	0	0, R		
oamUnexpectedMegLevelErro rs	This attribute indicates the count of unexpected MEG Level errors for the MP.	Integer	0	O, R		
oamUnexpectedMepErrors	This attribute indicates the count of unexpected MEP ID errors for the MP.	Integer	0	O, R		
oamUnexpectedPeriodErrors	This attribute indicates the count of Unexpected Period errors for the MP.	Integer	0	O, R		
outOamFramesDiscarded	This attribute indicates the count of outgoing frames discarded at the	Integer	0	O, R		

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	MP.				
outOamFramesTx	This attribute indicates the count of outgoing frames sent from the MP.	Integer	0	O, R	
sesErrors	This attribute indicates count of Severely Errored Seconds (SES) for the MP.	Integer	0	O, R	
totalOamFrameAnomolies	This attribute indicates the total count of Mismerge, Unexpected MEP, Unexpected MEG Level, Unexpected Period, Sequence Errors, Invalid TTL errors for the MP.Integ		0	O, R	
uasErrors	This attribute indicates the count of Unavailable Seconds (UAS) for the MP.	Integer	0	0, R	
<b>Operations / Methods:</b>			-		
Name	Description				
reset()	This operation provides the ability to values of existing instances of this obj	o dynamica ject.	ally reset (to zer	o) attribute	
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.				
Relationships:					
The EthMpPerfDataSet object is	associated with the EthMp object.				
<b>Reportable Notifications:</b>					
objectCreation			0		
objectDeletion			0		



# **APPENDIX I**

**Mapping of ITU-T Q.840.1 Objects to TMF MTNM 3.5** The table in this appendix provides a mapping between the information model presented in ITU-T Q.840.1, the Ethernet Services EMS-NMS Information Model, and the MTNM 3.5 Connectionless Network Model.

Q.840.1 Object	Туре	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH Flow Domain			FlowDomain		
ETH Flow Domain	attribute	userLabel	FlowDomain	userLabel	
ETH_Flow_Domain	operation	setupPtToPtETH_FDFr_ EVCWithFPPs	FlowDomain	createFDFr	
ETH_Flow_Domain	operation	setupMultiToMultiETH_ FDFr_EVCwithFPPs	FlowDomain	createFDFr	
ETH_Flow_Domain	operation	setupRootedtoMultiETH _FDFr_EVCwithFPPs	FlowDomain	createFDFr	
ETH_Flow_Domain	operation	releaseETH_FDFr_EVC	FlowDomain	deleteFDFr	
ETH_FPP			CPTP, PTP, FTP		
ETH_FPP	attribute	fPPType	CPTP (TP) PTP, FTP	InterfaceType	
ETH_FPP	attribute	fPPSubType	CPTP (TP) PTP, FTP	InterfaceType	
ETH_FPP	attribute	totalBWCapacity	CPTP (TP)	Layered Parameters: AvailableCapacity	
ETH_FPP	attribute	userLabel	CPTP (TP)	userLabel	
ETH_FPP	attribute	ieee802dot3Address	CPTP (TP)	Layered Parameters: PhysAddress	
ETH_FPP	attribute	operationalState	CPTP (TP)	Layered Parameters: ServiceState	
ETH_FPP	attribute	availabilityStatus	CPTP (TP)	additionalInfo: "X.721::AvailabilityS tatus"	
ETH_FPP	attribute	administrativeState	CPTP (TP)	Layered Parameters: ServiceState	
ETH_FPP	attribute	ingressMaxAssignableB W	CPTP (TP)	Layered Parameters: IngressMaxAssignab leBW	
ETH_FPP	attribute	egressMaxAssignableBW	CPTP (TP)	Layered Parameters: EgressMaxAssignabl eBW	
ETH_FPP	attribute	ingressMaxAssignableCo sBW		Not Mappable	This optional attribute is not mapped
ETH_FPP	attribute	egressMaxAssignableCos BW		Not Mappable	This optional attribute is not mapped
ETH_FPP	attribute	maxNumVirtualConnecti ons	СРТР	Layered Parameters: MaxNumFDFrs	
ETH_FPP	attribute	numConfiguredVirtualCo nnections	СРТР	Layered Parameters: NumConfiguredFDF rs	
ETH_FPP	attribute	mtuSize	СРТР	MaximumFrameSize	MTU Size does not include header, while frame size does.
ETH_FPP	attribute	alarmStatus	CPTP (TP)	additionalInfo: "M.3100::AlarmStatu s"	
ETH FPP	attribute	currentProblemList	CPTP (TP)	Get Active Alarms	Open TMF Issue
ETH FPP UNI			CPTP		
ETH FPP UNI	attribute	uniLabel	CPTP (TP)	CPTP Name	

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Q.840.1 Object	Туре	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH_FPP_UNI	attribute	layer2ControlProtocolPro cessingList	CPTP (TP)	Layered Parameters: Layer2ControlProtoc olProcessingList	
ETH_FPP_UNI	attribute	serviceMuxingIndicator	CPTP (TP)	Layered Parameters: ServiceMuxingIndica tor	
ETH_FPP_UNI	attribute	bundling	CPTP (TP)	Layered Parameters: BundlingIndicator, AllToOneIndicator	
ETH_FPP_UNI	attribute	ingressVLANAssignment All	CPTP (TP)	Layered Parameters: PVID + PVIDFrameTypes	
ETH_FPP_UNI	attribute	ingressVLANAssignment Untagged	CPTP (TP)	Layered Parameters: PVID + PVIDFrameTypes	
ETH_FPP_UNI	attribute	ingressVLANPriorityAss ignmentAll	CPTP (TP)	PortDefaultUserPriorit y+ PVIDFrameTypes	
ETH_FPP_UNI	attribute	ingressVLANPriorityAss ignmentUntagged	CPTP (TP)	PortDefaultUserPriorit y+ PVIDFrameTypes	
ETH_FPP_UNI	attribute	unassignedCeVlanIDList	СРТР	Not Mappable	This optional attribute is not mapped
ETH_FPP_UNI	attribute	nextAvailCeVlanID	СРТР	Not Mappable	This optional attribute is not mapped
ETH_Link			EncapsulationLa verLink		
ETH_Link	attribute	totalCapacity	СРТР	Layered Parameters: AvailableCapacity	Reflected on FPP (CPTP)
ETH_Link	attribute	userLabel	EncapsulationLay erLink	userLabel	
ETH_Link	attribute	usageCost	СРТР	Layered Parameters: LinkUsageCost	Reflected on FPP (CPTP)
ETH_FDFr_EVC			FlowDomainFra gment		
ETH_FDFr_EVC	attribute	administrativeState	FlowDomainFrag ment	Layered Parameters: ServiceState	
ETH_FDFr_EVC	attribute	operationalState	FlowDomainFrag ment	Layered Parameters: ServiceState	
ETH_FDFr_EVC	attribute	availabilityStatus	FlowDomainFrag ment	additionalInfo: "X.721::AvailabilityS tatus	
ETH_FDFr_EVC	attribute	protected	FlowDomainFrag ment	Not Mappable	Not Mapped Optional attribute GAP
ETH_FDFr_EVC	attribute	userLabel	FlowDomainFrag ment	userLabel	
ETH_FDFr_EVC	attribute	fDFrEvcType	FlowDomainFrag ment	Not Mappable	Not mapped. New attribute (e.g., mp2mp, p2p, rootedMp)
ETH_FDFr_EVC	attribute	fDFrEvcLabel	FlowDomainFrag ment	userLabel	EVC ID may be included in the userLabel
ETH_FDFr_EVC	attribute	linkType		Not Mappable	This optional attribute is not mapped
ETH_FDFr_EVC	attribute	uniCeVlanIdPreservation	FlowDomainFrag ment	Layered Parameters: UniCeVlanIdPreserv ation	

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Q.840.1 Object	Туре	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH_FDFr_EVC	attribute	uniCeVlanCosPreservatio n	FlowDomainFrag ment	Layered Parameters: UniCeVlanCosPreser vation	
ETH_FDFr_EVC	attribute	maxUNIEndPoints		Not Mappable	New attribute not mapped
ETH_FDFr_EVC	attribute	mtuSize		Not Mappable	Not mapped for EVC; MTU only on the FPP
ETH_FDFr_EVC	operation	addTPsToMultiETH_FD Fr EVCwithFPPs	FlowDomain	addFPsToFDFr	
ETH_FDFr_EVC	operation	removeTPsFromMultiET H FDFr EVC	FlowDomain	removeFPsFromFDF r	
ETH Flow Point			FP / CTP		
ETH_Flow_Point	attribute	administrativeState	CTP (TP)	Layered Parameters: ServiceState	
ETH_Flow_Point	attribute	operationalState	CTP (TP)	Layered Parameters: ServiceState	
ETH_Flow_Point	attribute	availabilityStatus	CTP (TP)	additionalInfo: "X.721::AvailabilityS tatus	
ETH_Flow_Point	attribute	alarmStatus	CTP (TP)	additionalInfo: "M.3100::AlarmStatu s"	
ETH_Flow_Point	attribute	currentProblemList	CTP (TP)	Get Active Alarms	Open TMF Issue
ETH_Flow_Point	attribute	ethCeVlanIDMapping	CTP (TP)	Layered Parameters: TrafficMappingFrom _Table_VID	The Traffic Mapping Table maps CE VLAN IDs to FDFrs.
ETH Flow Point	attribute	ethUNIEVCFDFrLabel	CTP (TP)	userLabel	
ETH_Flow_Point	attribute	layer2ControlProtocolPro cessingList	CTP (TP)	Layered Parameters: Layer2ControlProtoc olDispositionList	
ETH_Flow_Point	attribute	unicastServiceFrameDeli very	CTP (TP)	Layered Parameters: UnicastServiceFrame Delivery	
ETH_Flow_Point	attribute	multicastServiceFrameDe livery	CTP (TP)	Layered Parameters: MulticastServiceFra meDelivery	
ETH_Flow_Point	attribute	broadcastServiceFrameD elivery	CTP (TP)	Layered Parameters: BroadcastServiceFra meDelivery	
ETH Flow Point	attribute	trailTerminating	CTP (TP)	tpMappingMode	
ETHBandwidthProf ile (TrafficConditioner )			TC Profile (CPTP)		
ETHBandwidthProfil e	attribute	userLabel	TCProfile	userLabel	
ETHBandwidthProfil e	attribute	cir	TCProfile	Layered Parameters: IngressCIR	May be per COS
ETHBandwidthProfil e	attribute	cbs	TCProfile	Layered Parameters: IngressCBS	May be per COS
ETHBandwidthProfil e	attribute	eir	TCProfile	Layered Parameters: IngressEIR	May be per COS
ETHBandwidthProfil e	attribute	ebs	TCProfile	Layered Parameters: IngressEBS	May be per COS
ETHBandwidthProfil e	attribute	colorMode	TCProfile	Layered Parameters: IngressColorMode	May be per COS
ETHBandwidthProfil e	attribute	couplingFlag	TCProfile	Layered Parameters: IngressCouplingFlag	May be per COS
ETHPerformancePr ofile			CPTP FP	ingressCoSMapping	

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Q.840.1 Object	Туре	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETHCosProfile	attribute	userLabel			Indicated on the individual parameters
ETHCosProfile	attribute	cosFrameDelay	CPTP FP	Layered Parameters: Delay	Per COS
ETHCosProfile	attribute	cosFrameDelayVariation	CPTP FP	Layered Parameters: Jitter	Per COS
ETHCosProfile	attribute	cosFrameLossRatio	CPTP FP	Layered Parameters: Loss	Per COS
ETHCosProfile	attribute	cosAvailability		Not Mappable	This optional attribute is not mapped
ETHServiceClassPr ofile			CPTP FP		
ETHServiceClassPro file	attribute	classifyType	CPTP FP	trafficMappingFrom_ Table_VID or TrafficMappingFrom TablePriority	
ETHServiceClassPro file	attribute	classifyValue	CPTP FP	trafficMappingFrom_ Table_VID or TrafficMappingFrom TablePriority	
ETHCoSBandwidth Mapping			CPTP FP	TrafficMappingTable	
ETHCoSPerforman ceMapping			CPTP FP	ClassOfServicePara meters	
ELMIProfile				Not Mappable	New Object Not Mapped
ELMIProfile	attribute	elmiOperationalState		Not Mappable	New attribute not mapped
ELMIProfile	attribute	elmiAdministrativeState		Not Mappable	New attribute not mapped
ELMIProfile	attribute	elmiProtocolVersion		Not Mappable	New attribute not mapped
ELMIProfile	attribute	elmiAsyncStatusEnabled		Not Mappable	New attribute not mapped
ELMIProfile	attribute	elmiMinAsyncMessageIn terval		Not Mappable	New attribute not mapped
ELMIProfile	attribute	elmiN393		Not Mappable	New attribute not mapped
ELMIProfile	attribute	elmiT392		Not Mappable	New attribute not mapped
TransportPort			PhysicalTerminat ionPoint		
TransportPort	attribute	characteristicInformation Type	TP	Layer Rate	
TransportPort	attribute	operationalState	PTP	Layered Parameters: ServiceState	
TransportPort	attribute	alarmStatus	РТР	additionalInfo: "M.3100::AlarmStatu s"	
TransportPort	attribute	currentProblemList	PTP	Get Active Alarms	Open TMF Issue
TransportPort	attribute	userLabel	PTP	Layered Parameters: Location	
TransportPort	attribute	potentialCapacity	PTP	Layered Parameters: PotentialCapacity	
MAUTransportPort			РТР		
MAUTransportPort	attribute-INH	characteristicInformation Type	ТР	Layer Rate	
MAUTransportPort	attribute-INH	operationalState	PTP	Layered Parameters: ServiceState	



Q.840.1 Object	Туре	Q.840.1 Item	MTNM Object	MTNM Item	Note
MAUTransportPort	attribute-INH	alarmStatus	РТР	additionalInfo: "M.3100::AlarmStatu s"	
MAUTransportPort	attribute-INH	currentProblemList	PTP	Get Active Alarms	Open TMF Issue
MAUTransportPort	attribute-INH	userLabel	PTP	Location	
MAUTransportPort	attribute-INH	potentialCapacity	РТР	Layered Parameters: PotentialCapacity	
MAUTransportPort	attribute	таиТуре	РТР	Layered Parameters: MauType	
MAUTransportPort	attribute	mauMediaAvailable	РТР	Layered Parameters: MauMediaAvailable	
MAUTransportPort	attribute	mauJabberState	РТР	Layered Parameters: MauJabberState	
MAUTransportPort	attribute	mauDefaultType	РТР	Layered Parameters: MauDefaultType	
MAUTransportPort	attribute	mauMode	РТР	Layered Parameters: DuplexMode	
MAUTransportPort	attribute	mauAutoNegSupported	РТР	Layered Parameters: AutoNegotiation	
MAUTransportPort	attribute	mauTypeList	РТР	Layered Parameters: MauTypeList	
MAUTransportPort	attribute	mauJackTypeList	РТР	Layered Parameters: MauJackTypeList	
MAUTransportPort	attribute	mauAutoNegAdminState	РТР	Layered Parameters: MauAutoNegAdmin State	
MAUTransportPort	attribute	mauAutoNegRemoteSign aling	РТР	Layered Parameters: MauAutoNegRemote Signaling	
MAUTransportPort	attribute	mauAutoNegConfig	РТР	Layered Parameters: MauAutoNegConfig	
MAUTransportPort	attribute	mauAutoNegCapability	РТР	Layered Parameters: MauAutoNegCapabil	
MAUTransportPort	attribute	mauAutoNegCapAdverti sed	РТР	Layered Parameters: MauAutoNegCapAd vertised	
MAUTransportPort	attribute	mauAutoNegCapReceive d	РТР	Layered Parameters: MauAutoNegCapRec eived	
MAUTransportPort	attribute	mauAutoNegRemoteFaul tAdvertised	РТР	Layered Parameters: MauAutoNegRemote FaultAdvertised	
MAUTransportPort	attribute	mauAutoNegRemoteFaul tReceived	PTP	Layered Parameters: MauAutoNegRemote FaultReceived	
MAUTransportPort	operation	mauAutoNegRestart		Not Mappable	MAU Auto Negotiation Restart operation not mapped
ETH UNI			SD1-28 Perf		
Anomalies			Parameters		
Performance Data					
Set	D.C.				
ETH UNI Anomalies	Performance	Undersized Frames	SD1-28 Perf	"PMP_SUPKTS"	
PerformanceDataSet	Derforment	Oversized Errorses	Parameters	"DMD ETLE"	
ETH UNI Anomalies	Performance	Oversized Frames	SD1-28 Perf	PMP_FILE"	
FTH UNI Anomalies	Performance	Fragments	SD1-28 Porf	"PMP_SERAGS"	
PerformanceDataSet	measurement	1 raginento	Parameters		
ETH UNI Anomalies	Performance	FCS and Alignment	SD1-28 Perf	"PMP FCSE"	
PerformanceDataSet	measurement	Errors	Parameters		

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Q.840.1 Object	Туре	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH UNI Anomalies	Performance	Invalid CE-VLAN ID	SD1-28 Perf	"PMP_INVALID_C	
FTH UNI Troffic	measurement		SD1 29 Dorf	E-VLAN-ID	
Performance Data			Parameters		
ETH UNI Traffic	Performance	Octets Transmitted OK	SD1-28 Perf	"PMP_OCTECTS"	
PerformanceDataSet	measurement		Parameters		
ETH UNI Traffic	Performance	Unicast Frames	SD1-28 Perf	"PMP_UCASTPKTS	
PerformanceDataSet	measurement	Transmitted OK	Parameters	"	
ETH UNI Traffic	Performance	Multicast Frames	SD1-28 Perf	"PMP_MULTICAST	
PerformanceDataSet	measurement	Transmitted OK	Parameters	PKTS"	
ETH UNI Traffic	Performance	Broadcast Frames	SD1-28 Perf	"PMP_BROADCAS	
PerformanceDataSet	measurement	Transmitted OK	Parameters	TPKTS"	
ETH UNI Traffic	Performance	Octets Received OK	SD1-28 Perf	"PMP_OCTECTS"	
PerformanceDataSet	measurement		Parameters		
ETH UNI Traffic	Performance	Unicast Frames Received	SD1-28 Perf	"PMP_UCASTPKTS	
PerformanceDataSet	measurement	OK	Parameters		
ETH UNI Traffic	Performance	Multicast Frames	SD1-28 Perf	"PMP_MULTICAST	
PerformanceDataSet	measurement	Received OK	Parameters	PKIS"	
ETH UNI Traffic	Performance	Broadcast Frames	SD1-28 Perf	"PMP_BROADCAS	
PerformanceDataSet	measurement	Received OK	Parameters	IPKIS"	
ETH Ingress Trame			SD1-28 Peri		
Management			Parameters		
Set					
ETH Ingress Traffic	Performance	ingressGreenFrameCount	SD1-28 Perf	"PMP_INGRESS_G	
Management	measurement		Parameters	REEN FRAME CO	
PerformanceDataSet				UNT <cos>"</cos>	
ETH Ingress Traffic	Performance	ingressYellowFrameCoun	SD1-28 Perf	"PMP INGRESS Y	
Management	measurement	t	Parameters	ELLOW FRAME C	
PerformanceDataSet				OUNT <cos>"</cos>	
ETH Ingress Traffic	Performance	ingressRedFrameCount	SD1-28 Perf	"PMP INGRESS R	
Management	measurement		Parameters	ED FRAME COUN	
PerformanceDataSet				T <cos>"</cos>	
ETH Ingress Traffic	Performance	ingressGreenOctetCount	SD1-28 Perf	"PMP_INGRESS_G	
Management	measurement		Parameters	REEN_OCTET_CO	
PerformanceDataSet				UNT <cos>"</cos>	
ETH Ingress Traffic	Performance	ingressYellowOctetCount	SD1-28 Perf	"PMP_INGRESS_Y	
Management	measurement		Parameters	ELLOW_OCTET_C	
PerformanceDataSet				OUNT <cos>"</cos>	
ETH Ingress Traffic	Performance	ingressRedOctetCount	SD1-28 Perf	"PMP_INGRESS_R	
Management	measurement		Parameters	ED_OCTET_COUN	
PerformanceDataSet			CD1 00 D 0	1 <cos>"</cos>	
ETH Egress Traffic			SD1-28 Perf		
Management Derformence Date			Parameters		
Sot					
ETH Egress Traffic	Performance	egressGreenFrameCount	SD1-28 Perf	"PMP FGRESS GP	
Management	measurement	egressoreminamecoulit	Parameters	FEN FRAME COU	
PerformanceDataSet	medsurement		1 drameters	NT <cos>"</cos>	
FTH Foress Traffic	Performance	egressVellowFrameCount	SD1-28 Perf	"PMP EGRESS VE	
Management	measurement	egress renowr ramecount	Parameters	LLOW FRAME C	
PerformanceDataSet	mousurement		1 uluiletelis	OUNT <cos>"</cos>	
ETH Egress Traffic	Performance	egressGreenOctetCount	SD1-28 Perf	"PMP EGRESS GR	
Management	measurement		Parameters	EEN OCTET COU	
PerformanceDataSet				NT <cos>"</cos>	
ETH Egress Traffic	Performance	egressYellowOctetCount	SD1-28 Perf	"PMP EGRESS YE	
Management	measurement		Parameters	LLOW OCTET CO	
PerformanceDataSet				UNT <cos>"</cos>	
ETH Congestion			SD1-28 Perf		
Discards			Parameters		
<b>Performance Data</b>					
Set					

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Q.840.1 Object	Туре	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH Congestion	Performance	greenFrameDiscards	SD1-28 Perf	"PMP_GREEN_FRA	
Discards	measurement		Parameters	ME_DISCARDS <co< td=""><td></td></co<>	
PerformanceDataSet				s>"	
ETH Congestion	Performance	yellowFrameDiscards	SD1-28 Perf	"PMP_YELLOW_F	
Discards	measurement		Parameters	RAME_DISCARDS	
PerformanceDataSet	D (		GD1 20 D C	<cos>"</cos>	
ETH Congestion	Performance	greenOctetDiscards	SD1-28 Perf	"PMP_GREEN_OC	
Discards Derformen apDateSet	measurement		Parameters	IEI_DISCARDS <c< td=""><td></td></c<>	
ETU Congostion	Darformanaa	wallowOatatDiagorda	SD1 29 Darf	US-	
Discords	magurament	yenowOctetDiscards	Di-20 Pell	CTET DISCARDS	
Discalus PerformanceDataSet	measurement		Farameters	CIEI_DISCARDS	
FTH FLMI				03-	
Performance Data					
Set					
ETH ELMI	Performance	sumofElmiReliabilityErr	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement	ors	Parameters	11	not mapped
ETH ELMI	Performance	sumofElmiProtocolErrors	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement		Parameters	**	not mapped
ETH ELMI	Performance	elmiNonrcptStatusAndSt	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement	atusEnquiryCount	Parameters		not mapped
ETH ELMI	Performance	elmiInvalidSeqNumCoun	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement	t	Parameters		not mapped
ETH ELMI	Performance	elmiProtocolVersionCoun	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement	t	Parameters		not mapped
ETH ELMI	Performance	elmiTooShortCount	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement		Parameters		not mapped
ETH ELMI	Performance	elmiMessageTypeErrorC	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement	ount	Parameters		not mapped
ETH ELMI	Performance	elmiInfoElementErrorCo	SD1-28 Perf	Not Mappable	New attribute
PerformanceDataSet	measurement	unt	Parameters		not mapped
MAU Iermination			SD1-28 Perf		
Performance Data			Parameters		
MAIL Termination	Derformance	ifMauMadia AvailableStat	SD1 28 Parf	"DMD IE MALL ME	
PerformanceDataSet	measurement	eExits	DI-20 I CII		
I enformanceDataSet	measurement	CLARS	1 drameters	STATE EXITS"	
MAU Termination	Performance	ifMauJabberingStateEnte	SD1-28 Perf	"PMP IF MAU JA	
PerformanceDataSet	measurement	rs	Parameters	BBERING STATE	
				ENTERS"	
MAU Termination	Performance	ifMauFalseCarriers	SD1-28 Perf	"PMP_IF_MAU_FA	
PerformanceDataSet	measurement		Parameters	LSE_CARRIERS"	

### APPENDIX II Informational: State Management Mapping

The logical MIB described in this document makes use of the state model from ITU-T X.731. To help in mapping operational state information from SNMP based models to the Q.840.1 EMS-NMS model, this appendix provides a mapping between the ifOperStatus from IETF RFC2863 and ITU-T X.731's Operational State and Availability Status. The following table provides a mapping between the IETF RFC2863 ifOperStatus and ITU-T X.731 Operational State and the supplemental Availability Status. The Q.840.1 model uses the X.731 Operational State in cases where a "working" or "Enabled" / "not-working" or "Disabled" state is needed. In cases where, in addition to the "Enabled" / "Disabled" states, supplemental status information is needed, such as a "degraded" and/or an "in-test" state, X.731 Availability Status is used along with Operational State.

IETF RFC2863	ITU-T X.731	ITU-T X.731
ifOperStatus	<b>Operational State</b>	Availability Status
up(1)	Enabled	
down(2)	Disabled	Failed
	Disabled	Power off
	Disabled	Off-Line
testing(3)	Enabled	In Test
unknown(4)	Enabled	
dormant(5)	Enabled or Disabled	Off Duty
notPresent(6)	Disabled	Not Installed
lowerLayerDown(7)	Disabled	Dependency
-	Enabled	Degraded

Also note that in Q.840.1 the ITU-T X.731 Administrative State ("locked" or "unlocked") is used where a configurable administrative state needs to be reflected. The mapping between ITU-T X.731 Administrative State and IETF RFC2863 ifAdminStatus is direct for the "up" and "down" states. The RFC2863 ifAdminStatus of "up" is mapped to X.731 Administrative State of "unlocked". The RFC2863 ifAdminStatus of "down" is mapped to the X.731 Administrative State of "locked".

## APPENDIX III Data Type Definitions

This Appendix defines a set of data types for use in defining the attributes within the managed objects.

### **III.1** Primitive

Data Type Name	Description	Base Type	Permitted Values	Reference
AsapPtrType	The data type for a pointer to Alarm Severity Assignment Profile as defined in M.3100			M.3100
CcmLastFaultType	This data type represents an octet string of length 11522 and indicates the last received CCM which triggered a fault.			
HexBinary	This data type represents a string of octets. Equivalent to OCTET STRING in MIB syntax.	String		
LldpChassisId	This data type represents an octet string of length 1255. Defined in IEEE 802.1 LLDP-MIB.			IEEE 802.1 LLDP-MIB
LldpPortId	This data type represents an octet string of length 1255. Defined in IEEE 802.1 LLDP-MIB.			IEEE 802.1 LLDP-MIB
MacAddress	This data type represents an 802 MAC address of 6 octets represented in the canonical order defined by IEEE 802.1a.			RFC 2579
MdLevelType	This data type represents a MD Level (802.1ag) and is an unsigned byte with values 0 to 7. Higher numbers correspond to higher Maintenance Domains, those with the greatest physical reach, with the highest values for customers' CFM PDUs. Lower numbers correspond to lower Maintenance Domains, those with more limited physical reach, with the lowest values for CFM PDUs protecting single bridges or physical links.			IEEE 802.1ag

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MegIdType	This data type represents a MEGID (Y.1731) and is an octet string with length of 48 octets.		Y.1731
MegLevelType	This data type represents a MEG Level (Y.1731) and is an unsigned byte with values 0 to 7.		Y.1731
MepIdType	This data type represents a MEPID (Y.1731) and is a short integer (2 octets) of 13 bits with 3 leading zeros.		Y.1731
PriorityType	This data type represents a frame priority and is represented as an integer in the range 07.		Y.1731
Taddress	This data type denotes a transport service address and is represented by an octet string of length 1255. Defined in RFC 2579.		RFC 2579
Tdomain	This data type denotes a kind of transport service and is represented by an Object Identifier. Defined in RFC 2579.		RFC 2579

### **III.2 Enumeration**

Data Type Name	Description	Base Type	Permitted Values	Reference
AdminStateType		Enumeration	lock, unlock	
AlarmStatus	Alarm Status as defined in M.3100.	Enumeration	cleared, indeterminate, warning, minor, major, critical, pending	M.3100
AvailStatusType		Enumeration	notInstalled, inTest, failed, degraded	
CfmEgressActionType		Enumeration	egrNoTlv, egrOk, egrDown, egrBlocked, egrVid	IEEE 802.1ag

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CfmIngressActionType		Enumeration	ingNoTlv, ingOk, ingDown, ingBlocked, ingVid	IEEE 802.1ag
ConnectivityStatusType		Enumeration	active, partiallyActive, inactive	
DelayMeasCounterTyp e	This enumeration data type defines an enumerated list of Delay Measurement counter types. All counters are assumed to be two-way unless indicated otherwise.	Enumeration	15minAvgBiDirecti onalFd, 15minMaxBiDirecti onalFd, 15minAvgNearEnd Fdv, 15minMaxNearEnd Fdv, 15minAvgFarEndF dv, 24hrAvgBiDirectio nalFd, 24hrAvgBiDirectio nalFd, 24hrAvgNearEndF dv, 24hrAvgNearEndF dv, 24hrMaxNearEndF dv, 24hrMaxFarEndFd v, 24hrMaxRarEndFd v, 24hrMaxRarEndFd v, 24hrMaxRarEndFd v, 24hrAvgFarEndFdv , 24hrAvgFarEndFdv v, 24hrAvgFarEndFdv v, 24hrAvgFarEndFdv v, 24hrAvgFarEndFdv v, 24hrAvgFarEndFd v, 24hrAvgFarEndFdv v, 24hrAvgFarEndFdv v, 24hrAvgFarEndFdv v, 24hrAvgFarEndFdv	
DelayMeasType		Enumeration	twoWayOnDemand , twoWayProactive, oneWayOnDemand , oneWayProactive	
HighestDefectPriType	An enumerated value, equal to the contents of the variable highestDefect indicating the highest-priority defect that has been present since the MEP Fault Notification Generator State Machine was last in the FNG_RESET state (802.1ag). The value 'none' is used for no defects so that additional higher priority values can be added, if needed, at a later time, and so that these values correspond with those in LowestAlarmPriType.	Enumeration	none, defRDICCM, defMACstatus, defRemoteCCM, defErrorCCM, defXconCCM	IEEE 802.1ag
------------------------	---	-------------	---	-----------------
HighestDefectType	This enumeration data type represents an enumerated value indicating the highest priority defect.	Enumeration	xconCCmdefect, errorCCMdefect, someRMEPCCMde fect, someMACstatusDe fect, someREDIdefect	IEEE 802.1ag
InterfaceStatusTlvType		Enumeration	notincluded, up, down, testing, unknown, dormat, notPresent, lowerLayerDown	IEEE 802.1ag
IntervalType	This enumeration data type defines the CCM interval (transmission period).	Enumeration	3.33 ms, 10 ms, 0 ms, 100 ms, 1 sec, 10 sec, 1 min, 10 min	Y.1731
IntervalTypeAisLck	This enumeration data type defines the AIS/LCK interval (transmission period for a frame).	Enumeration	1 sec, 1 min	G.8021

LldpChassisIdSubtype	Defined in IEEE 802.1 LLDP-MIB.	Enumeration	chassisComponent, interfaceAlias, portComponent, macAddress, networkAddress, interfacename, local	IEEE 802.1 LLDP-MIB
LldpPortIdSubtype	Defined in IEEE 802.1 LLDP-MIB.	Enumeration	interfaceAlias, portComponent, macAddress, networkAddress, interfaceName, agentCircuitId, local	IEEE 802.1 LLDP-MIB
LossMeasType		Enumeration	singleEnded, dualEnded	
LowestAlarmPriType	This enumeration data type represents an integer value specifying the lowest priority defect that is allowed to generate a Fault Alarm (802.1ag).	Enumeration	allDef, macRemErrXcon, remErrXcon, errXcon, xcon, noXcon	IEEE 802.1ag
LtmFlagsType		Enumeration	useFdbOnly	IEEE 802.1ag
LtrRelayActionType		Enumeration	rlyHit, rlyFdb, rlyMpdb	IEEE 802.1ag
MaintAssocNameForm at	MEG ID Type/Format as defined in Y.1731 or Maintenance Association Name Type/Format as defined in 802.1ag.	Enumeration	primaryVid, charString, unsignedInt16, rfc2865VpnID, iccBasedFormat	Y.1731, IEEE 802.1ag
MaintenanceEntityType		Enumeration	subscriber, evc, uni, nni	
MdNameType	Maintenance Domain Name Type as defined in 802.1ag.	Enumeration	none, dnsLikeName, macAddressAndUi nt, charString	IEEE 802.1ag
MepDefectsBitMap	A MEP can detect and report a number of defects, and multiple defects can be present at the same time (e.g., Bit Field syntax).	Enumeration	bDefRDICCM, bDefMACstatus, bDefRemoteCCM, bDefErrorCCM, bDefXconCCOM	IEEE 802.1ag
MpDirectionType		Enumeration	down, up	
МрТуре		Enumeration	none, mep, mip	

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MultipointIndicatorTyp e		Enumeration	root, leaf, notMultipoint	
OperStateType	Based on [IETF RFC 3635] and [IETF RFC 2863] ifOperStatus.	Enumeration	disabled, enabled	
PeerMepCfgType		Enumeration	dynamic, static	
PortStatusTlvType		Enumeration	notincluded, blocked, up	IEEE 802.1ag
RemoteMepStatusType	This enumeration data type defines different status values for a remote MEP based on 802.1ag.	Enumeration	failed, idle, ok, start	IEEE 802.1ag
SenderIdTlvPermission Type	This enumeration data type indicates what, if anything, is to be included in the Sender ID TLV transmitted in CCMs, LBMs, LTMs, and LTRs.	Enumeration	sendIdNone, SendIdChassis, sendIdManage, sendIdChassisMana ge, sendIdDefer	IEEE 802.1ag
TestPatternType	This enumeration data type indicates the type of test pattern to be sent in an OAM PDU Data TLV.	Enumeration	Null signal without CRC-32, Null signal with CRC-32, PRBS 2^31-1 without CRC-32, PRBS 2^31-1 with CRC-32	G.8021
TruthValueType	This enumeration data type defines a Boolean value.	Enumeration	false, true	RFC 2579

## **III.3** Complex

Data Type:	AlarmList		
Description			
This complex data ty	pe represents a set of AlarmRecord insta	inces. AlarmRecord is	defined in X.721.
Attributes			
Name	Description	Base Type	Permited Values
alarm	This attribute is an instance of an AlarmRecord.	AlarmRecord	See Data Type definition from X.721
id	This attribute represents a unique identifier for an alarm instance.	Integer	Any
Data Type:	BinStatsType		
Description			
This complex data type represents a set of one or more bin number and bin count pairs.			
Attributes			



Name	Description	Base Type	Permited Values
binNumber	This attribute indicates which bin the measurements are applicable to.	Integer	Any
binCount	This attribute indicates a 32-bit counter reflecting the number of measurements which fell within this measurement bin.	Integer	Any
Data Type:	BinThresholdType		
This complex data type re	epresents a set of one or more bin thr	eshold and bin number pa	irs.
Attributes			
Name	Description	Base Type	Permited Values
binNumber	This attribute specifies the bin number for the configured threshold.	Integer	Any
threshold	This attribute specifies the bin threshold value for the specified bin number. Units are microseconds.	Integer	Any
Data Type:	DataAndTime		
Description			
This complex data type re	epresents an abstract, or scheduled, c	late and time.	
Attributes		<b>.</b>	
Name	Description	Base Type	Permited Values
day	This attribute represents the day portion with a valid range of 07 where the value 0 indicates the current day, 1 represents Monday and 7 represents Sunday.	Integer	07
hour	This attribute represents the hours portion with a valid range of 024	Integer	024
minute	This attribute represents the minutes portion with a valid range of 059.	Integer	059
second	This attribute represents the seconds portion with a valid range of 059.	Integer	059
Data Type:	DelayMeasThresholdListT	уре	
<b>Description</b> This complex data type defines a counter type with associated threshold values. This data type is used for defining both 1-way and 2-way Delay Measurement Counter types.			
Attributes			
Name	Description	Base Type	Permited Values
clearThreshold	This attribute indicates the value at which a given threshold will be cleared. This is not applicable for PM counters	Integer	Any

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	based on maximum thresholds.		
counterType	This attribute indicates the type of counter for which threshold value has been specified.	DelayMeasCounterType	See Data Type definition
crossThreshold	This attribute indicates the value at which a threshold set alarm condition will be generated.	Integer	Any
Data Type:	Relative Time		
An example value is	es a duration of forever. 6:10:30 which represents a relative time	of 6 hours, 10 minutes and	30 seconds.
Name	Description	Base Type	Permited Values
hours	This attribute represents the hours portion of RelativeTime with a valid range of 024	Integer	024
minutes	This attribute represents the minutes portion of RelativeTime with a valid range of 059.	Integer	059
seconds	This attribute represents the seconds portion of RelativeTime with a valid range of 059.	Integer	059

## APPENDIX IV Protocol Specific SNMP MIB Object Mappings

This Appendix maps the objects and their attributes, as defined within this document, to IEEE SNMP MIB objects as defined in [42] and [49]. Performance Monitoring objects and attributes do not map to the IEEE SNMP MIBs and are therefore not included.

MEF-7.1 Object/Attribute	802.1ag (v1) Mapping IEEE8021-CFM-MIB [42]	802.1ag (v2) Mapping IEEE8021-CFM-V2-MIB [49]
EthMeg		
id		ieee8021CfmMaComponentId
level		ieee8021CfmStackMdLevel
connectivityStatus		
connectivityStatusInterval		
perfTimeInterval		
maintAssocNameType	dot1agCfmMaintAssocNameType	
maintAssocShortName	dot1agCfmMaNetName	
chassisIdSubtype	dot1agCfmMepDbChassisIdSubtype	
chassisId	dot1agCfmMepDbChassisId	
includeSenderIdTlv		ieee8021CfmMaCompIdPermission
includePortStatusTlv	dot1agCfmMepDbPortStatusTlv	
includeInterfaceStatusTlv	dot1agCfmMepDbInterfaceStatusTlv	
ccmInterval	dot1agCfmMaNetCcmInterval	
peerMepInfoAgingTime		
EthMe		
type		
connectivityStatus		
EthOamMd		
maintDomainNameType	dot1agCfmMdIndex	
maintDomainLevel	dot1agCfmMdMdLevel	ieee8021CfmStackMdLevel
maintDomainName	dot1agCfmMdName	
EthMp		
id		ieee8021CfmStackMepId
type		
administrativeState	dot1agCfmMepActive	
operationalState		
availabilityStatus		
direction	dot1agCfmMepDirection	ieee8021CfmStackDirection
macAddress	dot1agCfmMepMacAddress	ieee8021CfmStackMacAddress
alarmStatus		
asapPtr		
currentProblemList		
EthMepPeerInfo		
id	dot1agCfmMepDbRMepIdentifier	



macAddress	dot1agCfmMepDbMacAddress	
configurationType		
status	dot1agCfmMepDbRMepState	
rdi	dot1agCfmMepDbRdi	
portStatusTlv	dot1agCfmMepDbPortStatusTlv	
interfaceStatusTlv	dot1agCfmMepDbInterfaceStatusTlv	
chassisIdSubtype	dot1agCfmMepDbChassisIdSubtype	
chassisId	dot1agCfmMepDbChassisId	
mgtAddrDomain	dot1agCfmMepDbManAddressDomain	
mgtAddr	dot1agCfmMepDbManAddress	
EthMep		
multipointIndicator		
connectivityStatus		
primaryVid	dot1agCfmMepPrimaryVid	ieee8021CfmVlanPrimarySelector
EthMip		
•		
EthOamLckCfg		
interval		
priority		
dropEligible		
EthOamLbCfg		
multicastEnabled		
interval		
frameSize		
priority	dot1agCfmMepTransmitLbmVlanPriority	
dropEligible	dot1agCfmMepTransmitLbmVlanDropEnable	
data	dot1agCfmMepTransmitLbmDataTlv	
numLbmsToTx	dot1agCfmMepTransmitLbmMessages	
lbmMsgStatus		
EthOamLbStats		
numLbrInInOrder	dot1agCfmMepLbrIn	
numLbrInOutOfOrder	dot1agCfmMepLbrInOutOfOrder	
numLbrInBadMsdu	dot1agCfmMepLbrBadMsdu	
numLbrInCrcErrors		
numLbrInBerErrors		
numLbrOut	dot1agCfmMepLbrOut	
firstLbmTransId		
nextLbmTransId	dot1agCfmMepNextLbmTransId	
EthOamAisCfg		
enabled		
interval		
priority		
dropEligible		
EthOamCcCfg		
enabled	dot1agCfmMepCciEnabled	

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multicastEnabled		
priority	dot1agCfmMepCcmLtmPriority	
dropEligible		
lowestPriorityDefect	dot1agCfmMepLowPrDef	
faultAlarmTime		
faultAlarmResetTime		
EthOamCcStats		
numCcmOut	dot1agCfmMepCciSentCcms	
numCcmOutOfSequence	dot1agCfmMepCcmSequenceErrors	
portStatusTly	dot1agCfmMepDbPortStatusTly	
interfaceStatusTly	dot1agCfmMepDbInterfaceStatusTly	
highestPriorityDefect	dot1agCfmMenHighestPrDefect	
highestDefect		
defectsPresent	dot1agCfmMenDefects	
ErrorComLastEailure	dot1agCfmMenErrorCcmLastEailure	
xconCcmI astFailure	dot1agCfmMenXconCcmI astFailure	
EthOomL tCfg		
etilOamLtCig	dot log Cfm Mon Com I tm Drionity	
dronElicible	No MID: Fixed value	
	No MID, Fixed value	
tlags	dot lagCfmMep I ransmitLtmFlags	
ItmMsgStatus	dot lagCfmMep I ransmitLtmStatus	
ItmEgressId	dotlagCfmMepTransmitLtmEgressIdentifier	
lastLtmTransId	dot1agCfmMepTransmitLtmSeqNumber	
nextLtmTransId	dotlagCfmMepLtmNextSeqNumber	
numLtrInUnexp	dotlagCfmMepUnexpLtrIn	
EthOamLtrStats		
ttl	dotlagCfmLtrTtl	
forwarded	dot1agCfmLtrForwarded	
terminalMep	dot1agCfmLtrTerminalMep	
lastEgressIdTlv	dot1agCfmLtrLastEgressIdentifier	
nextEgressIdTlv	dot1agCfmLtrNextEgressIdentifier	
relay	dot1agCfmLtrRelay	
chassisIdSubtype	dot1agCfmLtrChassisIdSubtype	
chassisId	dot1agCfmLtrChassisId	
mgtAddrDomain	dot1agCfmLtrManAddressDomain	
mgtAddr	dot1agCfmLtrManAddress	
ingressAction	dot1agCfmLtrIngress	
ingressMacAddr	dot1agCfmLtrIngressMac	
ingressPortIdSubtype	dot1agCfmLtrIngressPortIdSubtype	
ingressPortId	dot1agCfmLtrIngressPortId	
egressAction	dot1agCfmLtrEgress	
egressMacAddr	dot1agCfmLtrEgressMac	
egressPortIdSubtype	dot1agCfmLtrEgressPortIdSubtype	
egressPortId	dot1agCfmLtrEgressPortId	
organizationSpecificTlv	dot1agCfmLtrOrganizationSpecificTlv	
EthOamTestCfg		

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interval	
priority	
dropEligible	
frameSize	
data	
scheduledStartDateAndTime	
scheduledStopDateAndTime	
relativeStartTime	
durationTime	
EthOamTestStats	
numTstIn	
numTstInOutOfOrder	
numTstInCrcErrors	
numTstInBerErrors	
numTstOut	