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
CM	Configuration Management
CoS	Class of Service
CRC	Cyclic Redundancy Check
CTP	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 Sector	International Telecommunication Union – Telecommunication Standardization
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

TLV	Type, Length, and Value
TMN	Telecommunication Management Network
TP	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.[1]

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.

[1] Rooted multipoint EVC is defined in the MEF Services Phase 2 Services Attributes specification.

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.

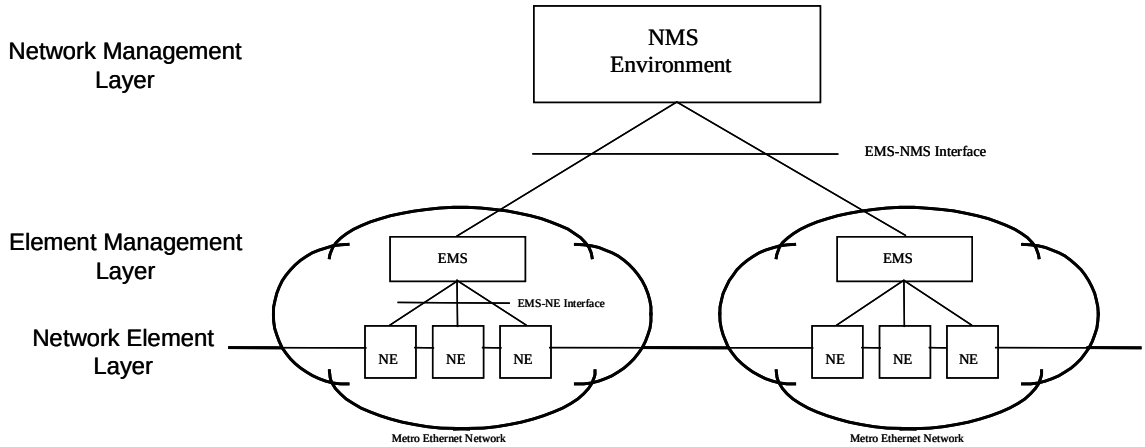

Figure 5-1 Network-Level Management Architecture

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.

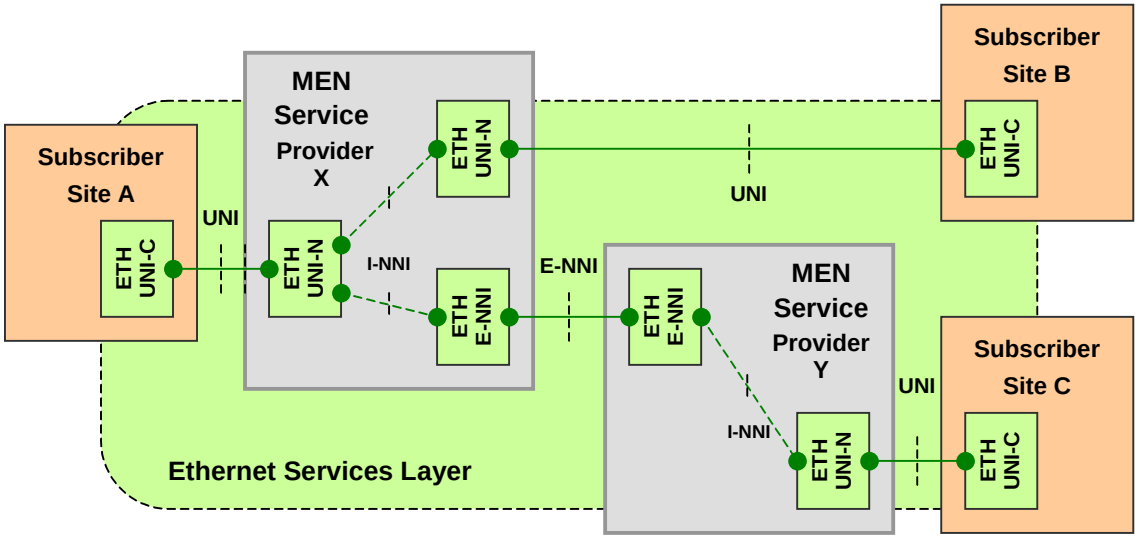

Figure 5-2 ETH Layer Interfaces and Reference Points

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.

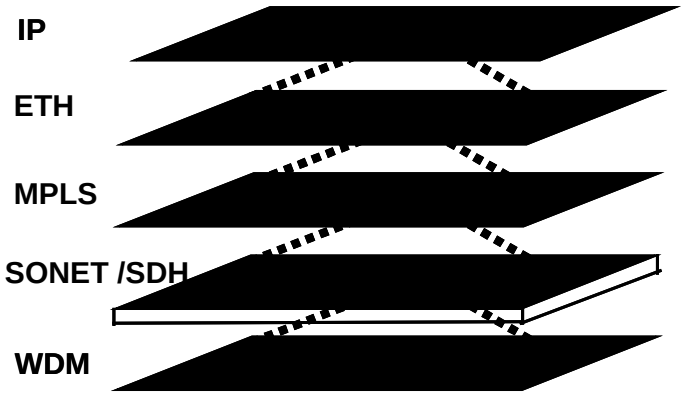

Figure 5-3 Network Layering Example

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.

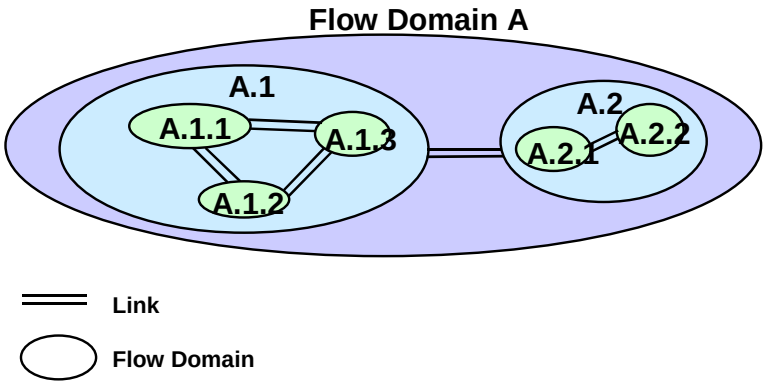

Figure 5-4 Partitioning Example

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.

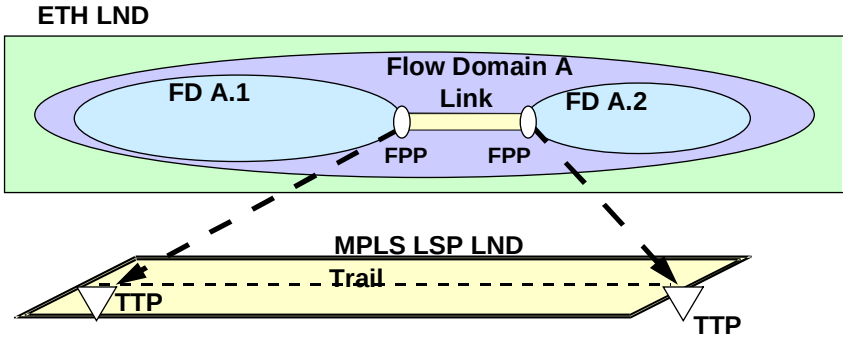

Figure 5-5 Topological Elements

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).

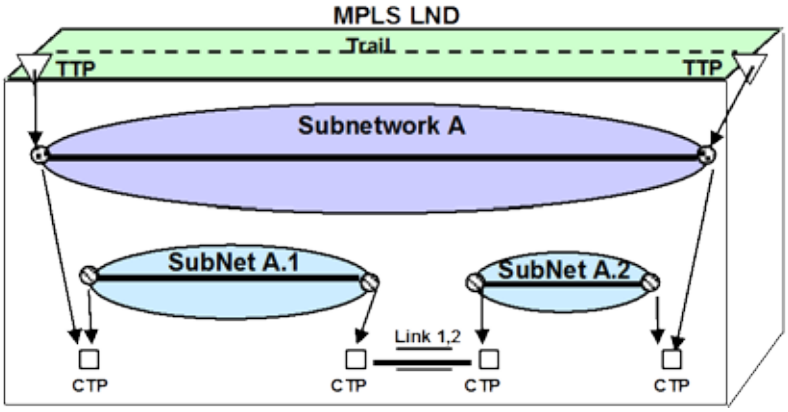

Figure 5-6 Connection Elements

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.

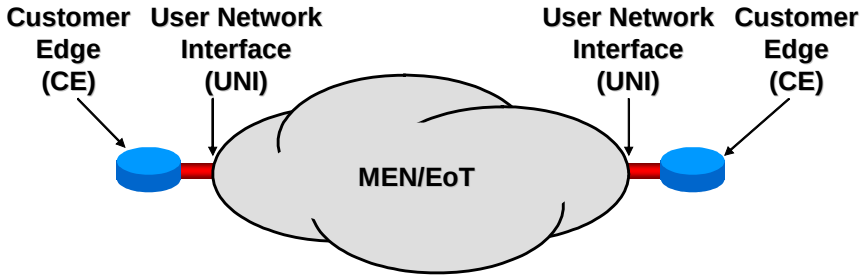

Figure 5-7 – Ethernet Services Model [3]

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.

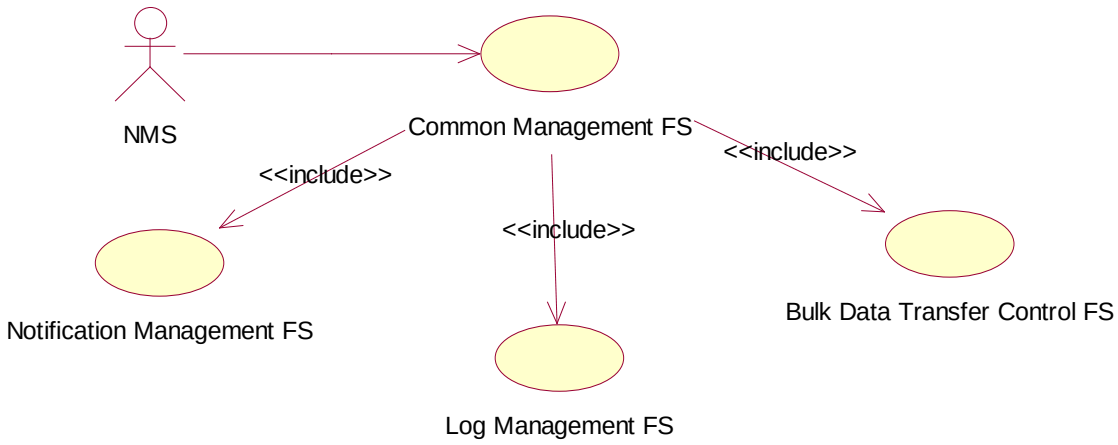

Figure 6-1 Common Management Function Set Overview

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

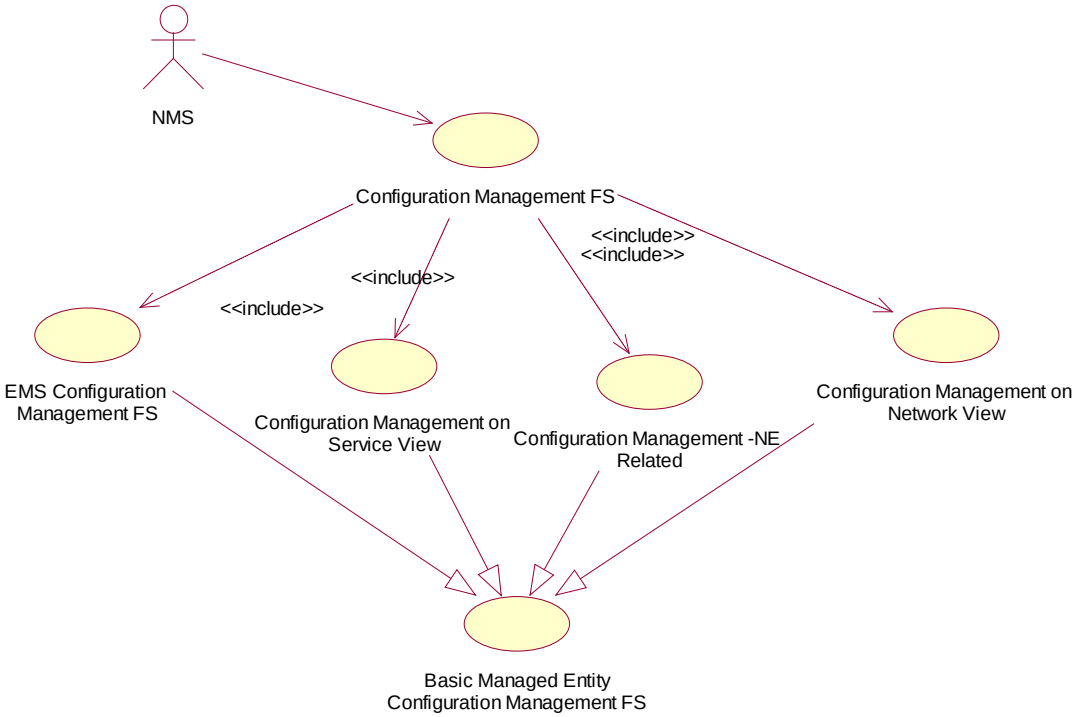

Figure 6-2 Configuration Management Function Set

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

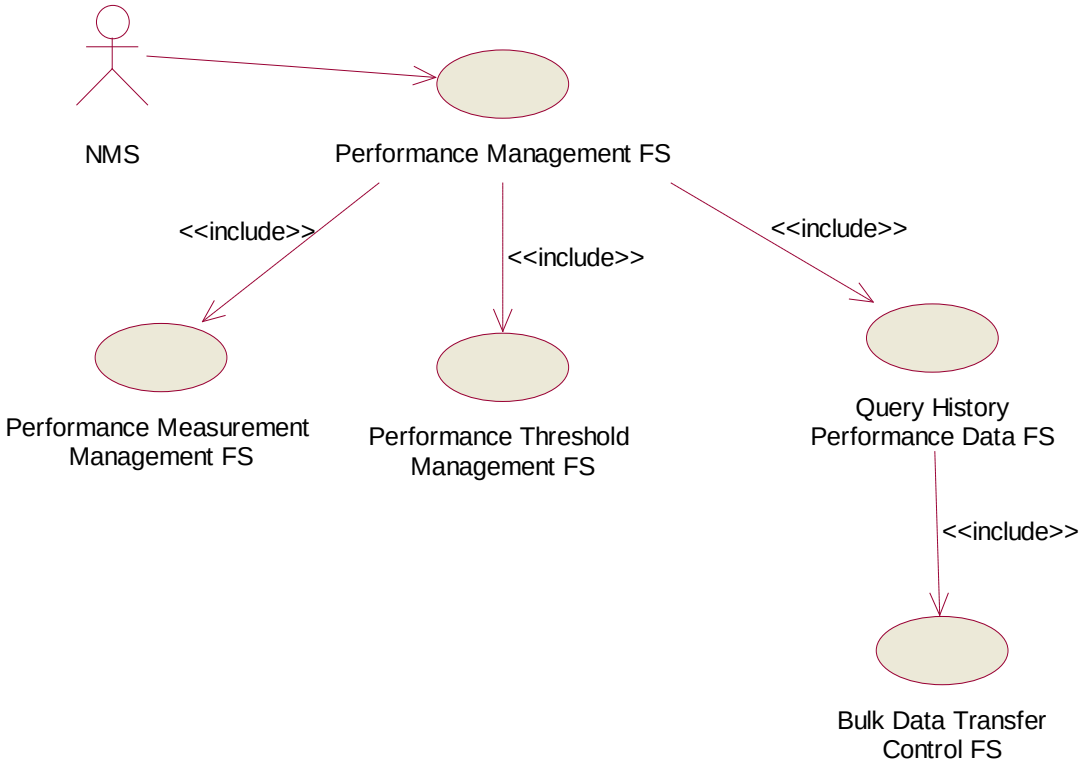

Figure 6-3 Performance Management Function Set

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

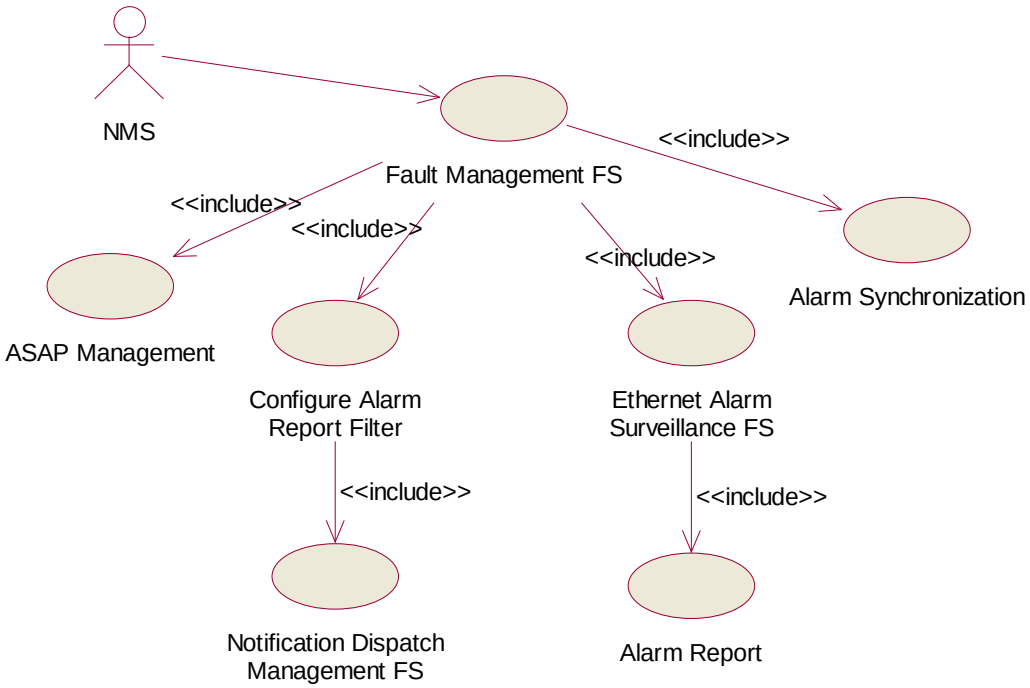

Figure 6-4 Fault Management Function Set

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.

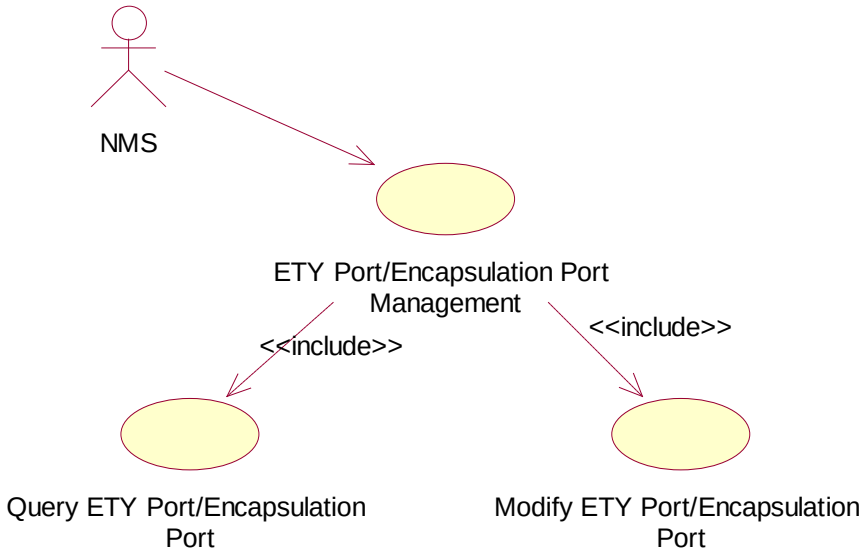

Figure 6-5 ETY Port Management Function Set

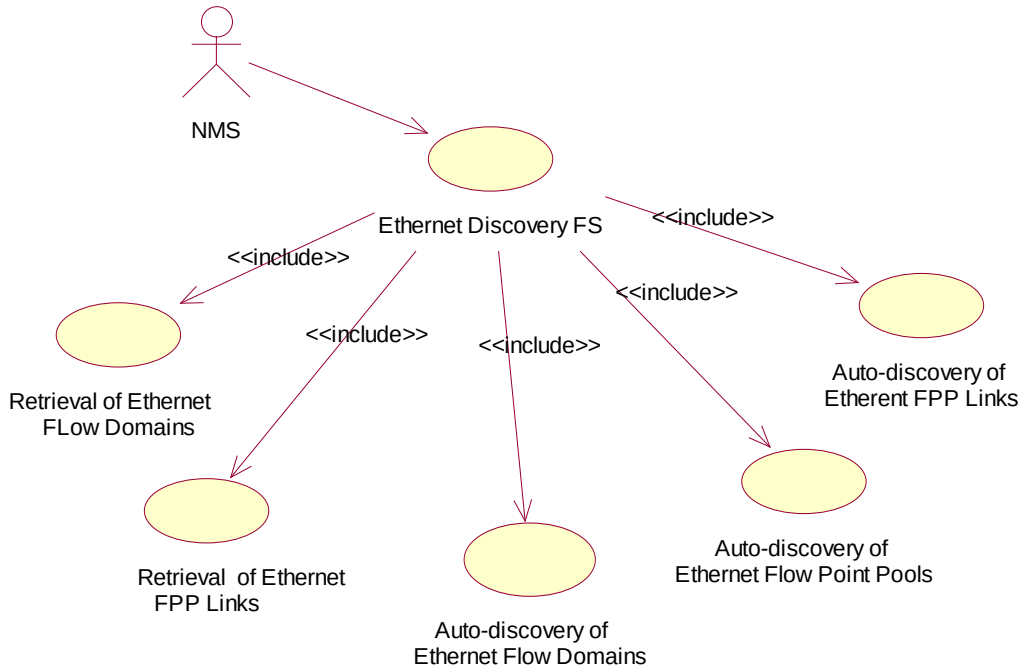

Figure 6-6 Ethernet Discovery Function Set

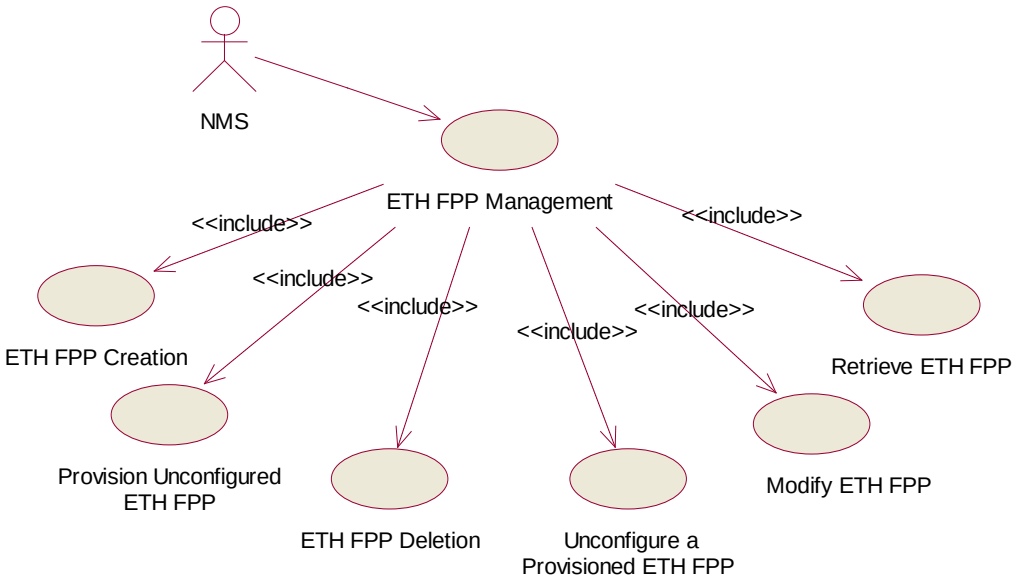

Figure 6-7 ETH Flow Point Pool Management

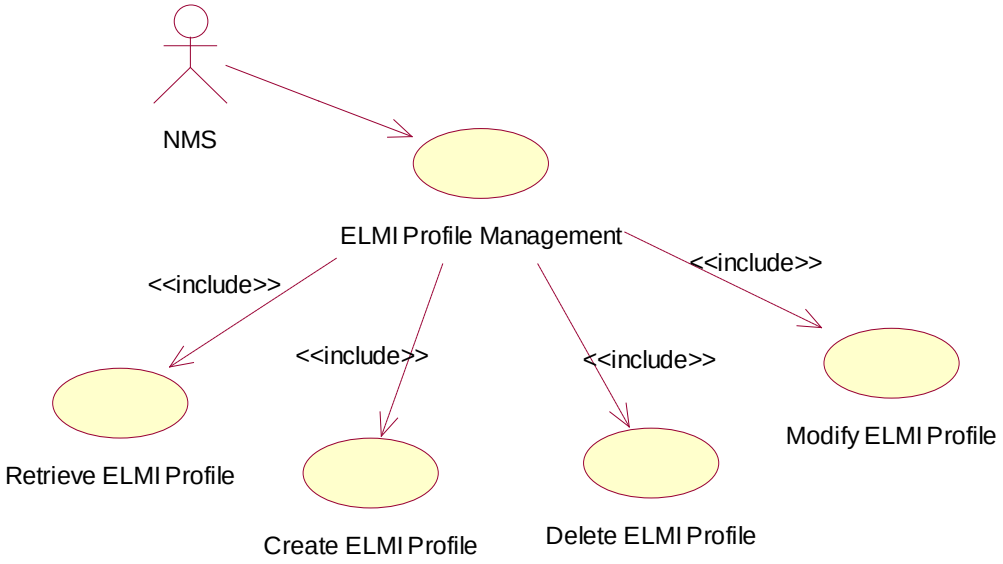

Figure 6-8 ELMI Profile Management

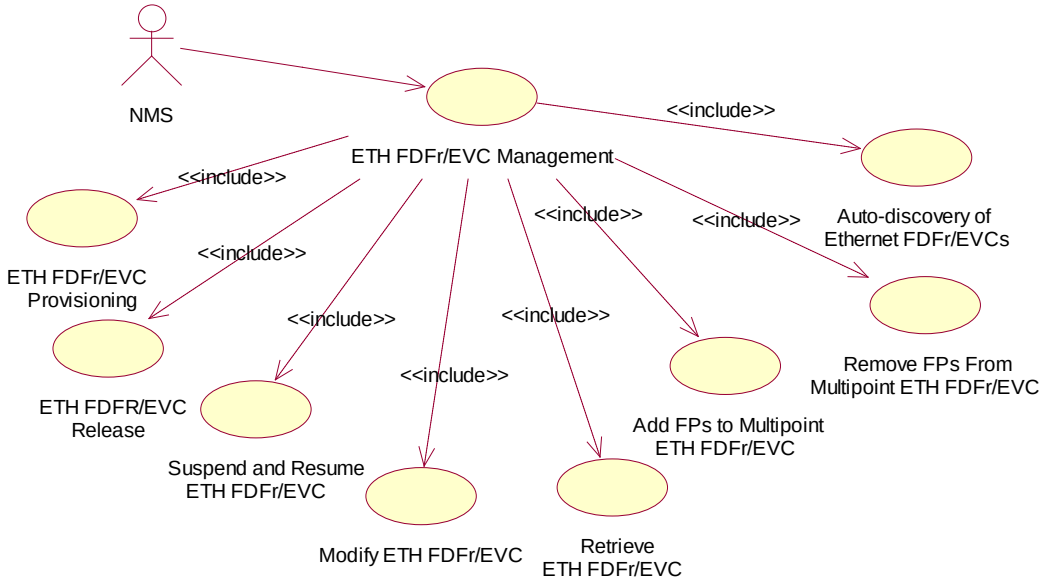

Figure 6-9 ETH FDFr/EVC Management

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

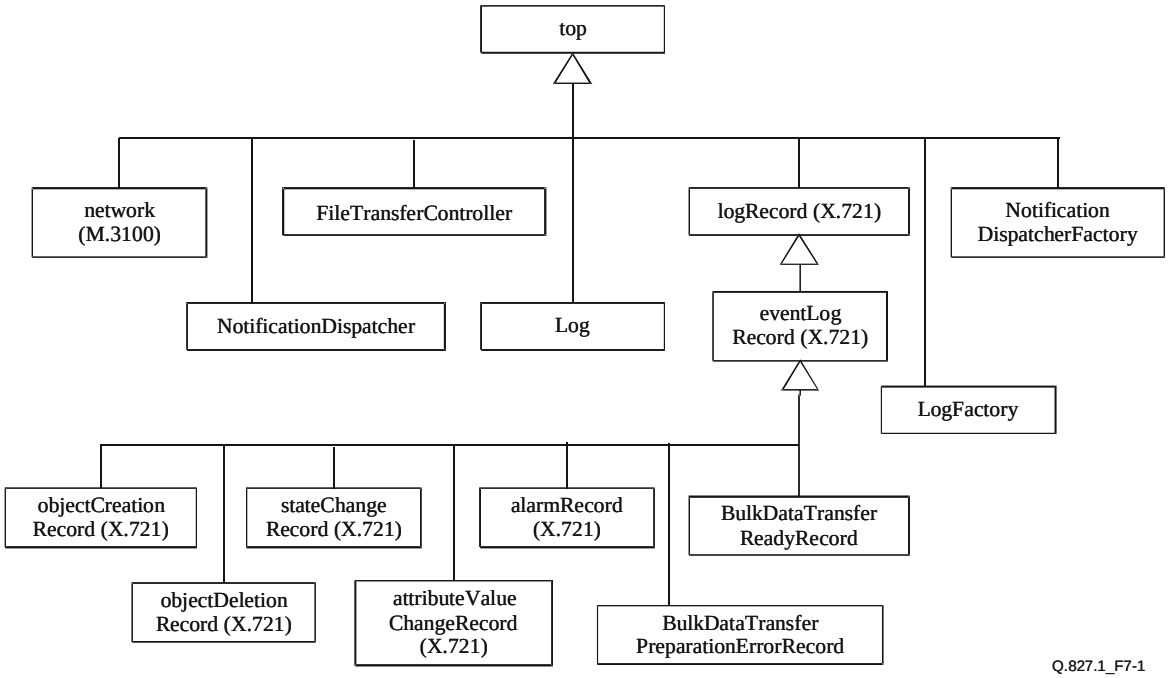

Figure 7-1/Q.827.1 – Inheritance diagram of common management

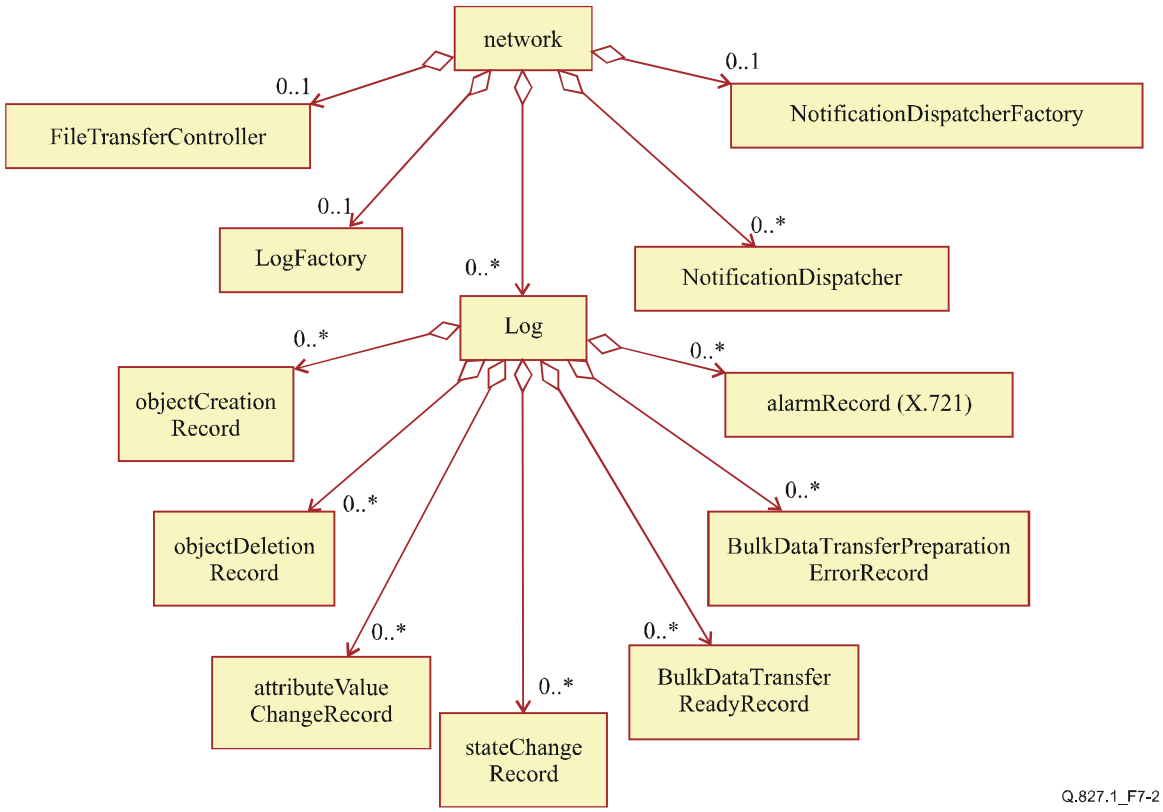

Figure 7-2/Q.827.1 – Containment diagram of common management

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.

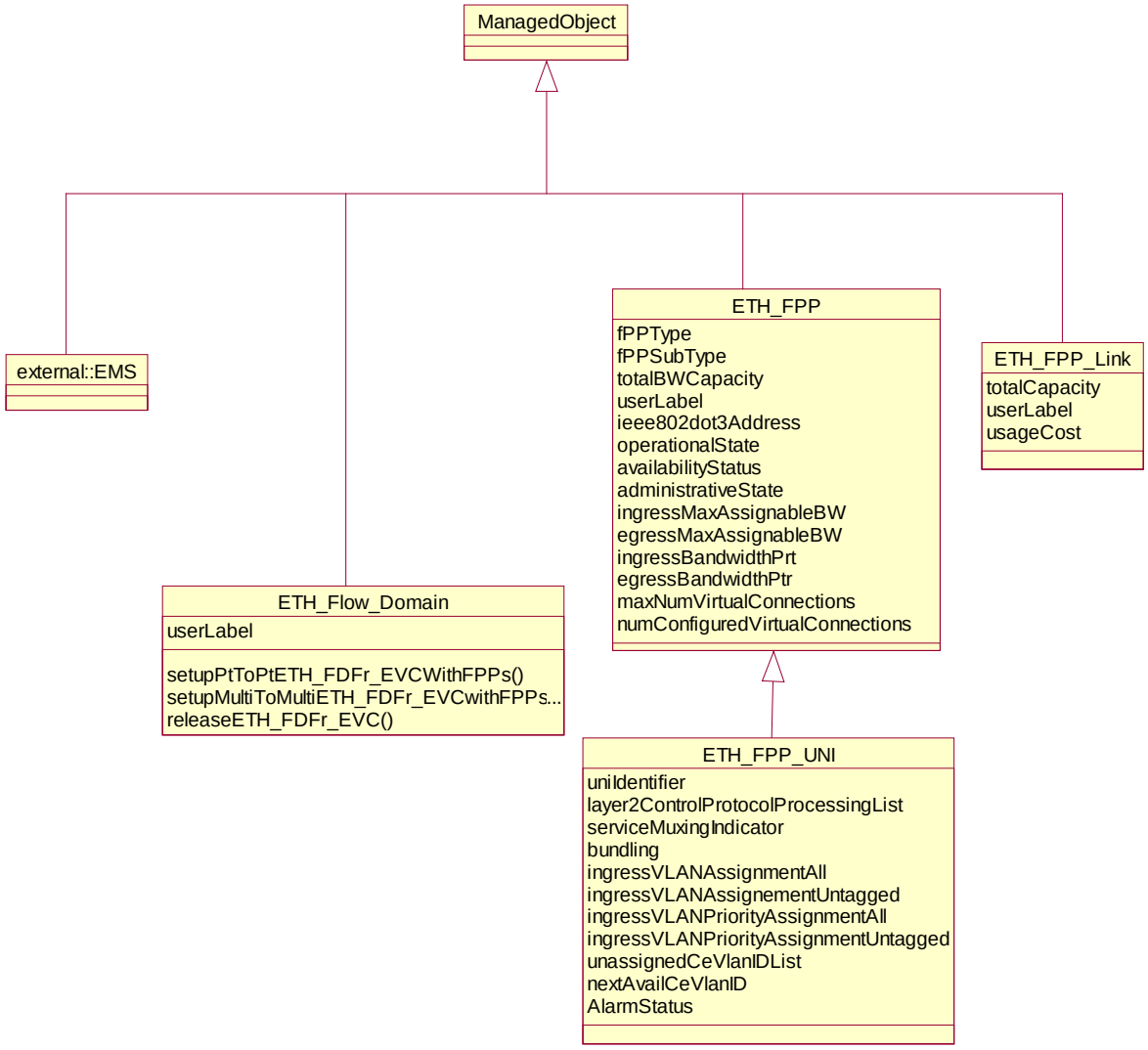

Figure 7-1/Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Topology View

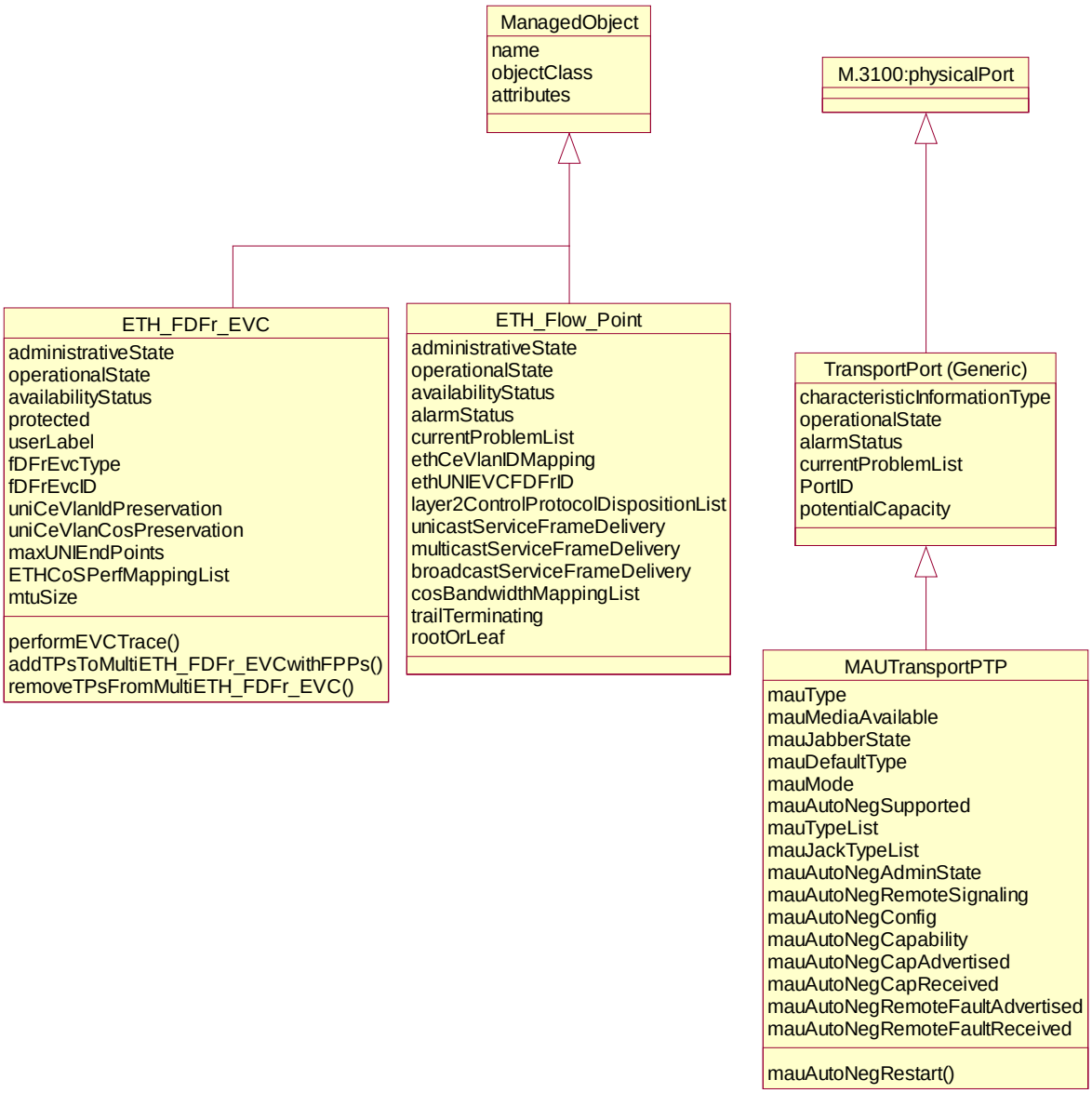

Figure 7-2/Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Connectivity View

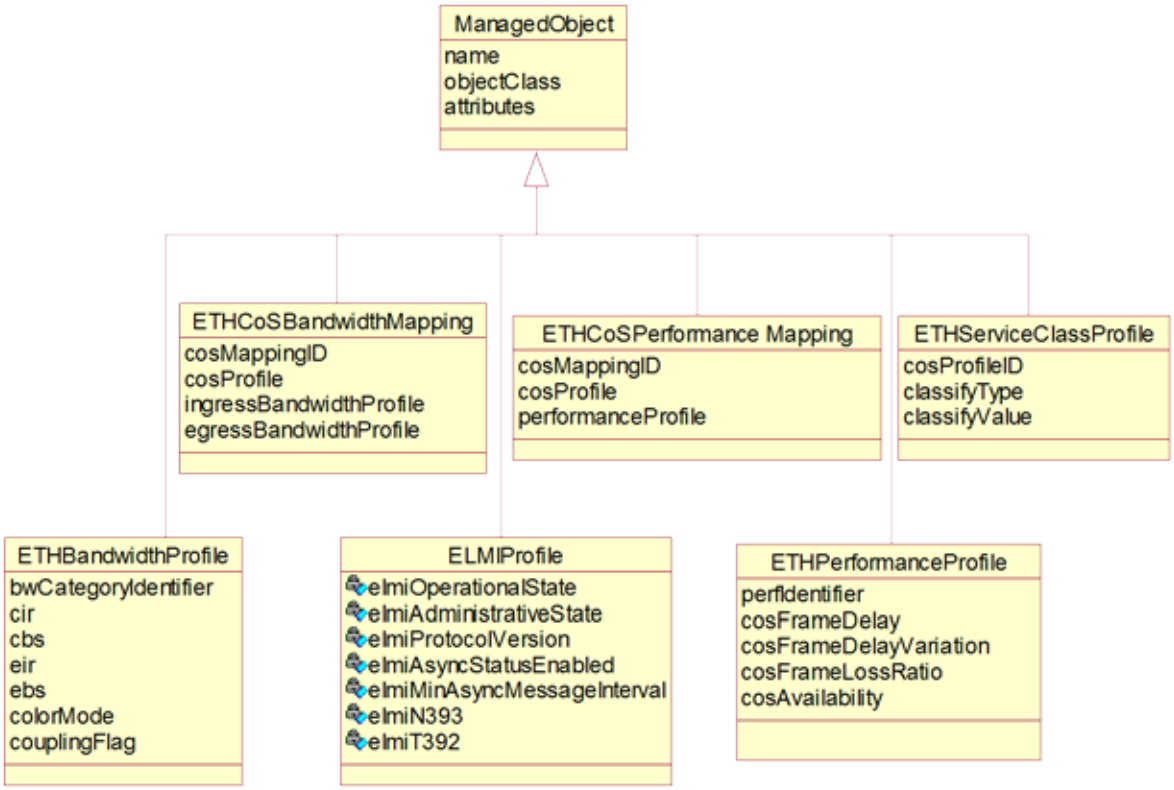

Figure 7-3/Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Reference Data

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.

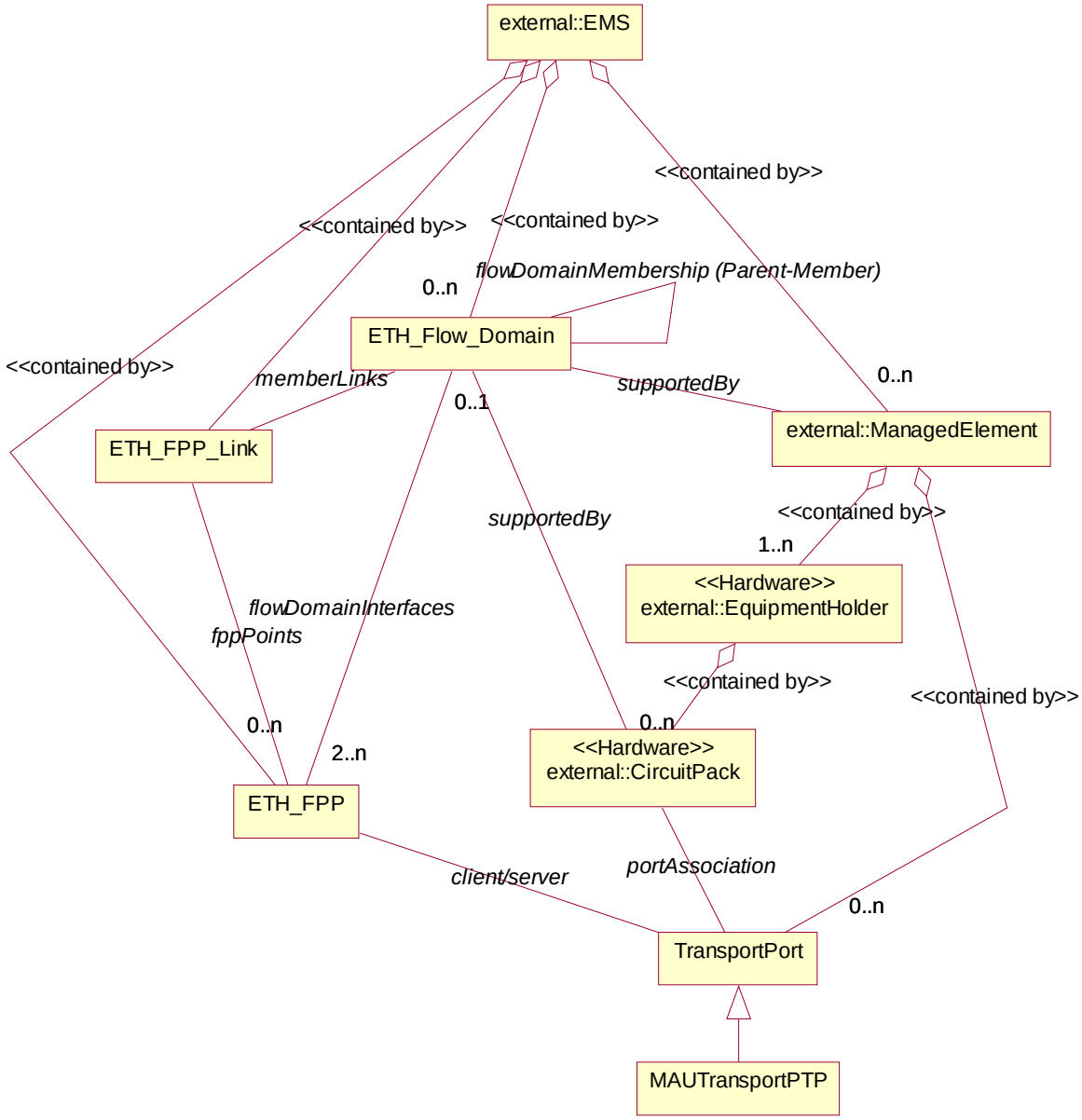

Figure 7-4/Q.840.1 Relationship Diagram of Ethernet Network View and Equipment View

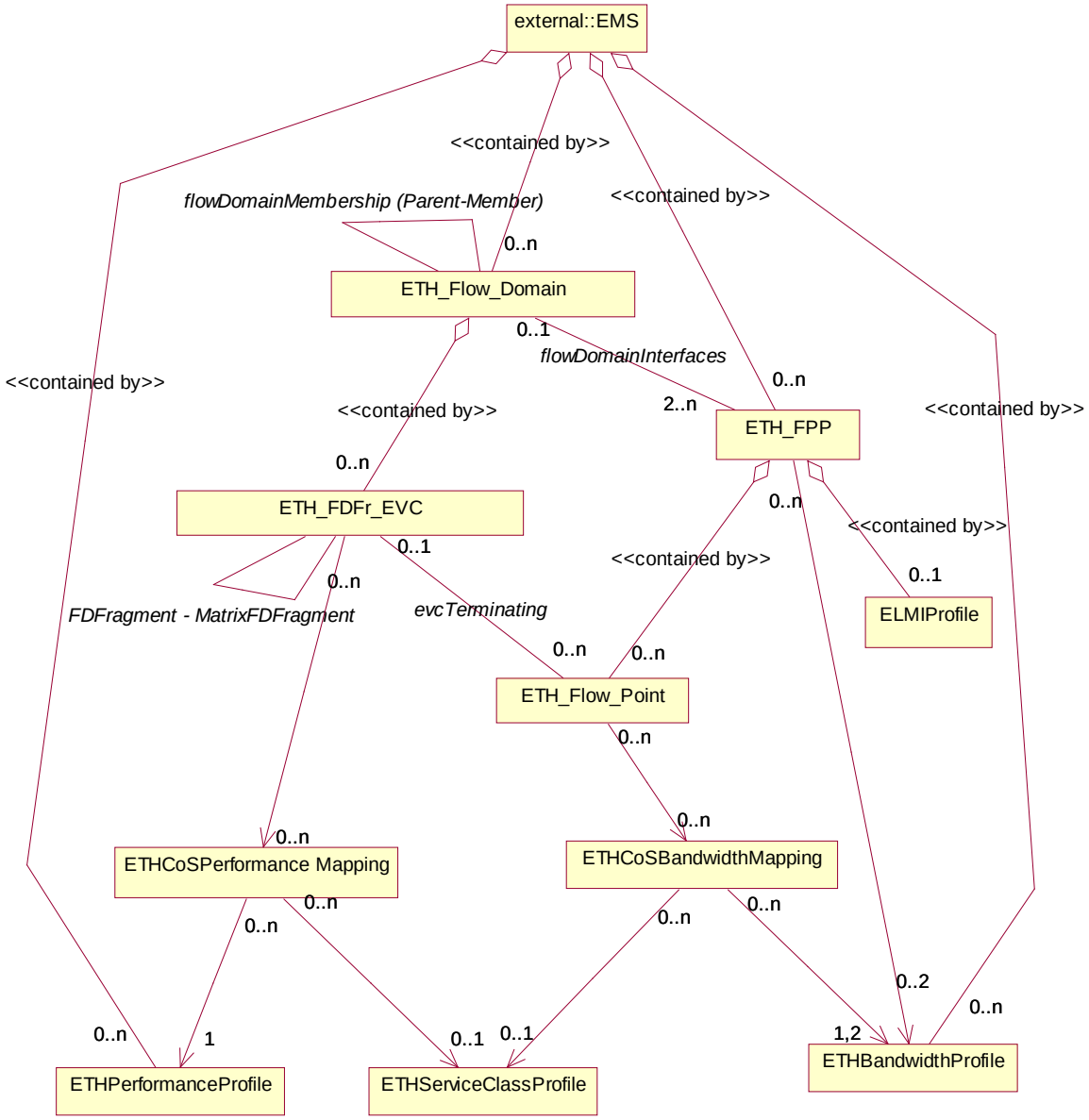

Figure 7-5/Q.840.1 Relationship Diagram of Ethernet Service Configuration Managed Entities

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.

Table 8-1 Table of Required Management Entities

Management Entity	Reference	MEF 7.1 Required	
		Phase 1	Phase 2
ManagedElement	Defined in M.3100	O	O
Equipment	Defined in M.3100	O	O
EquipmentHolder	Defined in M.3100	O	O
CircuitPack	Defined in M.3100	O	O
Log	Defined in X.721	O	O
AlarmRecord	Defined in X.721	O	O
EMS	Defined in Q.827.1 Amd 1	M	M
Alarm Severity Assignment Profile	Defined in M.3100	O	O
ETH_Flow_Domain	Defined in Q.840.1	M	M
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	O	O
ETH_FDFr_EVC	Defined in Q.840.1	M	M
ETH_Flow_Point	Defined in Q.840.1	M	M
ETHBandwidthProfile	Defined in Q.840.1	M	M
ETHServiceClassProfile	Defined in Q.840.1	M	M
ETHCoSBandwidthMapping	Defined in Q.840.1	M	M
ETHPerformanceProfile	Defined in Q.840.1	O	M
ETHCoSPerformanceMapping	Defined in Q.840.1	O	M
ELMIProfile	Defined in Q.840.1	NA	C
TransportPort	Defined in Q.840.1	C	C
MAUTransportPort	Defined in Q.840.1	C	C
EthMe	Defined in this Specification	C	C
EthMeg	Defined in this Specification	C	C
EthMp	Defined in this Specification	C	C
EthMep	Defined in this Specification	C	C
EthMip	Defined in this Specification	C	C
EthMd	Defined in this Specification	C	C
EthMepPeerInfo	Defined in this Specification	C	C
EthOamDmCfg	Defined in this Specification	C	C
EthOamDmProactiveOneWayThreshold	Defined in this Specification	C	C
EthOamDmProactiveTwoWayThreshold	Defined in this Specification	C	C
EthOamLmCfg	Defined in this Specification	C	C
EthOamLbCfg	Defined in this Specification	C	C

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

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.

Table 8-2 Table of Required Performance Data Sets

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

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.

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

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
ETH_Flow_ Domain	object	-	Phase 1: M Phase 2: M	Used for establishing EVCs and representing network topology.	ETH_Flow_Domain
	attribute	userLabel	Phase 1: M Phase 2: M	Name of managing organization	userLabel
	methods	setupPtToPtETH_FDFr_ EVCWithFPPs	Phase 1: M Phase 2: M	Establish point to point EVC	setupPtToPtETH_F DFr_EVCWithFPPs
		setupMultiToMultiETH_ FDFr_EVCwithFPPs	Phase 1: M Phase 2: M	Establish Multipoint EVC	setupMultiToMultiE TH_FDFr_EVCwith FPPs
		setupRootedToMultiET H_FDFr_EVCwithFPPs	Phase 1: NA Phase 2: M	Establish Rooted Multipoint EVC	NONE
		releaseETH_FDFr_EVC	Phase 1: M Phase 2: M	Release a previously established EVC	releaseETH_FDFr_ EVC
	relationships	Contained in EMS	Phase 1: M Phase 2: M	EMS is the containing object for FD	In MEF7 FD is contained under LND
		Contains ETH_FDFr_EVC	Phase 1: M Phase 2: M	The EVCs within the flow domain	Contains ETH_FDFr_EVC
		MISMATCH	Phase 1: NA Phase 2: NA	In Q.840.1 containment of these profiles are under EMS.	MEF 7 Contains ETHBandwidthProfi le Contains ETHCosProfile
		SupportingElements: SupportedBy	Phase 1: O Phase 2: O	May be associate FD with supporting Managed Elements and Circuit Packs	SupportingElements : SupportedBy
		ETH_FPPs: FlowDomainInterfaces	Phase 1: M Phase 2: M	the ETH_FPPs (e.g.. UNIs) that delineate the Flow Domain	ETH_FPPs: FlowDomainInterfa ces
		ETH_FPP_Links: MemberLinks	Phase 1: NA Phase 2: NA	Used to associate links within the parent FD	ETH_FPP_Links: MemberLinks
		ETH_Flow_Domains: FlowDomainMembershi p	Phase 1: NA Phase 2: NA	Used to associate member FDs within the parent FD	ETH_Flow_Domain s: FlowDomainMembe rship
	notifications	objectCreation	Phase 1: M	Used for discovery	objectCreation

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
			Phase 2: M		
		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.	attributeValueChange
		stateChange	Phase 1: NA Phase 2: NA	Not used	NONE
ETH_FPP	object	-	Phase 1: M Phase 2: M	Represents interfaces, e.g., MEF UNIs or E-NNIs, at the ETH Layer.	ETH_FPP
	attributes	fPPType	Phase 1: M Phase 2: M	Indicates that the ETH_FPP is a UNI, SNI, E-NNI, or Unconfigured	fPP_FPPType
		fPPSubType	Phase 1: O Phase 2: O	For UNI set to: “MEF UNI Type 1”, or “MEF UNI Type 2”	NONE
		totalBWCapacity	Phase 1: M Phase 2: M	Total BW supported on the FPP.	availableCapacity
		userLabel	Phase 1: M Phase 2: M	A string that may be used for circuit identifier on the FPP	userLabel
		ieee802dot3Address	Phase 1: M Phase 2: M	IEEE 802.3 source address of any non FDFr/EVC specific frames that originate at this FPP	physAddress
		operationalState	Phase 1: M Phase 2: M	Indicates the current capability of the FPP to provide service. Values include: disabled, enabled.	operState
		availabilityStatus	Phase 1: M Phase 2: M	Values include: inTest, failed, powerOff, degraded, notInstalled	availabilityStatus
		administrativeState	Phase 1: M Phase 2: M	The values include: locked or unlocked. In Locked state frame flow through the FPP is prohibited.	adminState
		ingressMaxAssignableBW	Phase 1: O Phase 2: O	Maximum amount of BW assignable on the FPP (aggregation of links) in the Ingress direction	ingressMaxAssignableBW
		egressMaxAssignableBW	Phase 1: O Phase 2: O	Maximum amount of BW assignable on the FPP (aggregation of links) in the Egress	egressMaxAssignableBW

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				direction	
		ingressMaxAssignableCoSBW	Phase 1: O Phase 2: O	Per CoS Maximum assignable BW on the interface in the Ingress direction.	NONE
		ingressMaxAssignableCoSBW	Phase 1: O Phase 2: O	Per CoS Maximum assignable BW on the interface in the egress direction.	NONE
		maxNumVirtualConnections	Phase 1: M Phase 2: M	Max number of EVCs that may be supported at the FPP.	maxNumEVCs
		numConfiguredVirtualConnections	Phase 1: M Phase 2: M	Number of currently configured EVCs at the FPP	numConfiguredEVCs
		mtuSize	Phase 1: O Phase 2: M	Max transmission unit size for the FPP	NONE
	relationships	Contained in EMS	Phase 1: M Phase 2: M	EMS is the containing object for FPP	In MEF7 FPP is contained under LND
		Contains ETH_Flow_Point	Phase 1: M Phase 2: M	FPs terminating a EVC segment at the FPP	Contains ETH_Flow_Point
		Contains ELMI Profile	Phase 1: NA Phase 2: C	Conditionally required if the FPP supports ELMI	NONE
		SupportingElements: SupportedBy	Phase 1: O Phase 2: O	May associate FPP with supporting Managed Elements and Circuit Packs	SupportingElements : SupportedBy
		ETH_FPP_Link: FPPpoints	Phase 1: O Phase 2: O	Link that is terminated by the ETH_FPP optionally retrievable from the ETH_FPP	ETH_Link: FPPpoints
		ServerTTP : Client/Server or EthTunneling	Phase 1: M Phase 2: M	Relationship between the FPP and the supporting TRAN layer termination (could be ETH layer TTP for tunneling, a TransportPort, etc.)	ServerTTP : Client/Server or EthTunneling
		ETH_Flow_Domains: FlowDomainInterfaces	Phase 1: M Phase 2: M	FPP is one of the FPPs that delineate the associated FDs	ETH_Flow_Domains: FlowDomainInterfaces
		ETHBandwidthProfile: IngressBwCharacterization	Phase 1: M Phase 2: M	Ingress bandwidth profile for all service frames at the FPP in the ingress direction	In MEF7 this relationship is on the ETH_FPP_UNI object.
		ETHBandwidthProfile: EgressBwCharacterization	Phase 1: M Phase 2: M	Egress bandwidth profile for all service frames at the FPP in	In MEF7 this relationship is on the ETH_FPP_UNI

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				the ingress direction	object.
	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.	attributeValueChange
		stateChange	Phase 1: M Phase 2: M	Indicates changes in administrative and operational state	NONE
ETH_FPP_UNI (Subclass of ETH_FPP. ETH_FPP_UNI inherits properties, including attributes from ETH_FPP)	object	-	Phase 1: M Phase 2: M	Subclass of ETH_FPP. Represent the UNIs that provide MEF UNI functionality.	ETH_FPP_UNI
	attributes	uniIdentifier	Phase 1: M Phase 2: M	Describes the UNI within the scope of the service provider domain.	uniIdentifier
		layer2ControlProtocolProcessingList	Phase 1: M Phase 2: M	Provide control protocol destination MAC address along with the processing alternative (Discard, Peer, Pass-to-FDFr /EVC, Peer & Pass-to- FDFr/EVC)	layer2ControlProtocolProcessingList
		serviceMuxingIndicator	Phase 1: M Phase 2: M	Describes if service multiplexing is enabled at the UNI	serviceMuxingIndicator
		bundling	Phase 1: M Phase 2: M	three bundling options: yes, no and all-to-one	In MEF represented by both bundlingIndicator and allToOneIndicator
		ingressVLANAssignmentAll	Phase 1: NA Phase 2: NA	Identifies VLAN-ID assigned to all ingress traffic	NONE: Not used for MEF
		ingressVLANAssignmentUntagged	Phase 1: M Phase 2: M	Identifies VLAN-ID assigned to untagged and priority tagged ingress traffic	untaggedVLANAssignment
		ingressVLANPriorityAssignmentAll	Phase 1: NA Phase 2: NA	Identifies the VLAN Priority assigned to all ingress traffic	NONE: Not used for MEF
		ingressVLANPriorityAssignmentUntagged	Phase 1: NA Phase 2: NA	Identifies the VLAN Priority assigned to untagged ingress traffic	NONE: Not used for MEF
		unassignedCeVlanIDList	Phase 1: O Phase 2: O	List of unique values that are available for assignment as the	unassignedCeVlanIDList

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				CE-VLAN ID when creating new EVCs	
		nextAvailCeVlanID	Phase 1: M Phase 2: M	Next available unassigned CE-VLAN ID	NONE
		alarmStatus	Phase 1: M Phase 2: M	Values for alarm status include: critical, major, minor, indeterminate, warning, pending, and cleared	NONE
	relationships	Contained in EMS	Phase 1: M Phase 2: M	EMS is the containing object for UNI	In MEF7 UNI is contained under LND
		Contains ETH_Flow_Point	Phase 1: M Phase 2: M	FPs terminating a EVC segment at the UNI	Contains ETH_Flow_Point
		Contains ELMI Profile	Phase 1: NA Phase 2: C	Conditionally required if the UNI supports ELMI	NONE
		SupportingElements: SupportedBy	Phase 1: O Phase 2: O	May associate UNI with supporting Managed Elements and Circuit Packs	SupportingElements : SupportedBy
		ETH_FPP_Link: FPPpoints	Phase 1: O Phase 2: O	Link that is terminated by the UNI optionally retrievable from the UNI object	ETH_Link: FPPpoints
		ServerTTP : Client/Server or EthTunneling	Phase 1: M Phase 2: M	Relationship between the UNI and the supporting TRAN layer termination (could be ETH layer TTP for tunneling, a TransportPort, etc.)	ServerTTP : Client/Server or EthTunneling
		ETH_Flow_Domains: FlowDomainInterfaces	Phase 1: M Phase 2: M	UNI is one of the FPPs that delineate the associated FDs	ETH_Flow_Domains: FlowDomainInterfaces
		ETHBandwidthProfile: IngressBwCharacterization	Phase 1: M Phase 2: M	Ingress bandwidth profile for all service frames at the UNI in the ingress direction	ETHBandwidthProfile: IngressBwCharacterization
		ETHBandwidthProfile: EgressBwCharacterization	Phase 1: M Phase 2: M	Egress bandwidth profile for all service frames at the UNI in the ingress direction	ETHBandwidthProfile: EgressBwCharacterization
	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

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
			Phase 2: O	NMS of attribute changes.	e
		stateChange	Phase 1: M Phase 2: M	Indicates changes in administrative and operational state	NONE
ETH_FPP_Link	Object	-	Phase 1: O Phase 2: O	represents topological relationship between two Flow Domains	ETH_Link
	attributes	totalCapacity	Phase 1: M Phase 2: M	inherent bandwidth capacity of the link in both the a-to-z and z-to-a direction	availableCapacity
		userLabel	Phase 1: M Phase 2: M	A text string that may 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_Domains: 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.	attributeValueChange
		stateChange	Phase 1: NA Phase 2: NA	Not used	stateChange
ETH_FDFr_EVC	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

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				Values include: disabled, enabled.	
		availabilityStatus	Phase 1: M Phase 2: M	Values include: inTest, failed, powerOff, degraded, notInstalled	availabilityStatus
		protected	Phase 1: O Phase 2: O	Indicates if the EVC is protected or not at the ETH layer	eVCProtected
		userLabel	Phase 1: M Phase 2: M	Provides additional information about the EVC, such as a circuit identifier	userLabel
		fDFrEvcType	Phase 1: M Phase 2: M	mp2mp, p2p, or rootedMp	eVCType
		fDFrEvcName	Phase 1: M Phase 2: M	Unique identifying value for the ETH Virtual Connection	ethEVCId
		uniCeVlanIdPreservation	Phase 1: M Phase 2: M	Boolean that identifies an EVC where the CE VLAN IDs of egress frames are identical to the CE VLAN IDs of the corresponding ingress frames	uniCeVlanIdPreservation
		uniCeVlanCoSPreservation	Phase 1: M Phase 2: M	Boolean that identifies an EVC 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 ingress frame	uniCeVlanCoSPreservation
		maxUNIEndPoints	Phase 1: O Phase 2: M	The maximum number of UNI end points of the EVC	NONE
		mtuSize	Phase 1: O Phase 2: M	maximum transmission unit size for the EVC	NONE
	methods	addTPsToMultiETH_FDFr_EVCwithFPPs	Phase 1: M Phase 2: M	add endpoints to a multipoint EVC	addTPsToMultiETH_FDFr_EVCwithFPPs
		removeTPsFromMultiETH_FDFr_EVC	Phase 1: M Phase 2: M	remove endpoints from a multipoint EVC	removeTPsFromMultiETH_FDFr_EVC
			Phase 1: NA Phase 2: NA	Deprecated MEF7 performEVCTrace	REMOVED: performEVCTrace
	relationships	contained in ETH_Flow_Domain	Phase 1: M Phase 2: M	FD is the containing object for EVC	contained in ETH_Flow_Domain
		ETH_Flow_Points:	Phase 1: M	EVC is terminated by	ETH_Flow_Points:

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
		EvcTerminating	Phase 2: M	two or more ETH_Flow_Points.	EvcTerminating
		ETH_FDFr_EVCs: FD Fragment	Phase 1: NA Phase 2: NA	EVC may be made up of component FD Fragments / EVCs	ETH_FDFr_EVCs: Composite/Component EVCs
		ETHCoSPerformanceMappings: CoSPerfMappingCharacterization	Phase 1: O Phase 2: M	Relates performance for specific CoS	NONE
	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.	attributeValueChange
		stateChange	Phase 1: M Phase 2: M	Indicates changes in administrative and operational state	stateChange
		communicationsAlarm	Phase 1: O Phase 2: O	Used to indicate a protection reroute	communicationsAlarm
ETH_Flow_Point	object	-	Phase 1: M Phase 2: M	The termination of an EVC on a FPP. Created automatically as a result of a EVC setup request.	ETH_Flow_Point
	attributes	administrativeState	Phase 1: O Phase 2: O	administrative state of a trail terminating ETH_Flow_Point The values include: locked or unlocked.	adminState
		operationalState	Phase 1: M Phase 2: M	Indicates the current capability of the FPP to provide service. Values include: disabled, enabled.	operState
		availabilityStatus	Phase 1: M Phase 2: M	Values include: inTest, failed,, degraded	NONE
		alarmStatus	Phase 1: M Phase 2: M	Values for alarm status include: critical, major, minor, indeterminate, warning, pending, and cleared	alarmStatus
		currentProblemList	Phase 1: M Phase 2: M	Indicates problem probable cause with severity	currentProblemList
		ethCeVlanIDMapping	Phase 1: M Phase 2: M	List of unique values that map each CE-VLAN ID to at most one EVC. Special values	ethCeVlanIDMapping

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				include: “Untagged”, “All-to-One”, and “AllOthers”	
		ethUNIEVCFDFrName	Phase 1: M Phase 2: M	String administered by Service Provider used to identify an EVC at the UNI	ethUNIEVCID
		layer2ControlProtocolProcessingList	Phase 1: M Phase 2: M	describes Layer 2 control protocols, along disposition: discard or tunnel	layer2ControlProtocolDispositionList
		unicastServiceFrameDelivery	Phase 1: M Phase 2: M	Service frame delivery option for Unicast Service Frames: Discard, Deliver Unconditionally, or Deliver Conditionally	unicastServiceFrameDelivery
		multicastServiceFrameDelivery	Phase 1: M Phase 2: M	Service frame delivery option for Multicast Service Frames: Discard, Deliver Unconditionally, or Deliver Conditionally	multicastServiceFrameDelivery
		broadcastServiceFrameDelivery	Phase 1: M Phase 2: M	Service frame delivery option for Broadcast Service Frames: Discard, Deliver Unconditionally, or Deliver Conditionally	broadcastServiceFrameDelivery
		trailTerminating	Phase 1: M Phase 2: M	If TRUE, describes Flow Point as a point where frame flow terminates and is adapted to APP layer. Otherwise shall be set to FALSE.	trailTerminating
		rootOrLeaf	Phase 1: NA Phase 2: M	Indicates that the flow point is acting as either a root or leaf. If the type of EVC is Point-to-Point or Multipoint-to-Multipoint, then the UNI Type MUST equal “Root.”	NONE
	relationships	Contained in ETH_FPP	Phase 1: M Phase 2: M	FPP is the containing object for FPs	Contained in ETH_FPP
		AlarmSeverityProfile : SeverityAssignment	Phase 1: O Phase 2: O	to assign alarm severity to specific	AlarmSeverityProfile :

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				alarms.	SeverityAssignment
		ETH_FDFr_EVC: EvcTerminating	Phase 1: M Phase 2: M	EVC that is terminated by two or more Flow_Points	ETH_FDFr_EVC: EvcTerminating
		ETHCoSBandwidthMapping: CoSBWMappingCharacterization	Phase 1: M Phase 2: M	bandwidth for specific CoS in the ingress and egress direction	Combines ETHBandwidthProfiles: BandwidthCharacterization AND ETHCosProfiles: CosCharacterization
		EAFProfiles: AdaptationCharacterization	Phase 1: O Phase 2: O	association with adaptation profiles	EAFProfiles: AdaptationCharacterization
		APPLinkEnd : Client/Server	Phase 1: O Phase 2: O	association with an APP Layer Link End	APPLinkEnd : Client/Server
		ETH_FPP_UNI: EthTunneling	Phase 1: O Phase 2: O	relationship between the ETH_FPP_UNI and the supporting TRAN (ETH layer trail termination for tunneling) layer termination point	ETH_FPP_UNI: EthTunneling
	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.	attributeValueChange
		stateChange	Phase 1: M Phase 2: M	Indicates changes in administrative and operational state	stateChange
		communicationsAlarm	Phase 1: M Phase 2: M	Indicates an alarm condition	communicationsAlarm
ETHBandwidthProfile	object	-	Phase 1: M Phase 2: M	Describes traffic parameters for EVC	ETHBandwidthProfile
	attributes	bwCategoryIdentifier	Phase 1: M Phase 2: M	Identifies the specific Bandwidth Category	bwCategoryIdentifier
		cir	Phase 1: M Phase 2: M	Committed Information Rate (CIR) in bits per second for one direction of an EVC	cir
		cbs	Phase 1: M Phase 2: M	Committed Burst Size (CBS) in bytes for one direction of an EVC.	cbs
		eir	Phase 1: M Phase 2: M	Excess Information Rate (EIR) in bits per second for one direction of an EVC.	eir

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 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 EBS	couplingFlag
	relationships	contained in EMS	Phase 1: M Phase 2: M	EMS is the containing object for ETHBandwidthProfile	contained in ETH_Flow_Domain
		ETH_FPPs: BandwidthCharacterization	Phase 1: M Phase 2: M	Ingress bandwidth profiles that characterize FPPs in the ingress direction	ETH_FPP_UNIs: BandwidthCharacterization
		ETHCoSBandwidthMapping: ingressCoSBandwidthCharacterization	Phase 1: M Phase 2: M	Mapping the ingress bandwidth profile to specific ETH service.	ETH_Flow_Points: BandwidthCharacterization Note: Q840.1 introduces COS BW mapping

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
					object
		ETHCoSBandwidthMapping: egressCoSBandwidthCharacterization	Phase 1: NA Phase 2: M	Mapping the egress bandwidth profile to specific ETH service	NONE
	notifications	objectCreation	Phase 1: M Phase 2: M	Used for discovery	objectCreation
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	objectDeletion
ETHPerformanceProfile	Object	-	Phase 1: O Phase 2: M	specifies Class of Service (CoS) performance parameters for EVCs	ETHCosProfile
	attributes	perfProfileID	Phase 1: M Phase 2: M	identifies the specific CoS Value described within this profile	cosIdentifier
		cosFrameDelay	Phase 1: M Phase 2: M	Frame Delay objective for Service Frames. Frames	cosDelay
		cosFrameDelayVariation	Phase 1: M Phase 2: M	Frame Delay Variation (FDV) objective for Service Frames	cosJitter
		cosFrameLossRatio	Phase 1: M Phase 2: M	Frame Loss Ratio objective for Service Frames	cosLoss
		cosAvailability	Phase 1: O Phase 2: M	Availability objective for the EVC.	NONE
	relationships	contained under EMS	Phase 1: M Phase 2: M	EMS is the containing object for ETHPerformanceProfile	contained in ETH_Flow_Domain
		ETHCoSPerformanceMapping: CoSPerformanceCharacterization	Phase 1: M Phase 2: M	Mapping the performance profile to specific ETH services	ETH_Flow_Point: CosCharacterization Q.840.1 introduces mapping object
	notifications	objectCreation	Phase 1: M Phase 2: M	Used for discovery	objectCreation
		objectDeletion	Phase 1: M Phase 2: M	Used for discovery	objectDeletion
ETHServiceClassProfile	object	-	Phase 1: M Phase 2: M	Profile of CoS, defines the way to classify ETH service and a definite CoS	NONE
	attributes	serviceClassID	Phase 1: M Phase 2: M	the name of a servce class instance	NONE
		classifyType	Phase 1: M Phase 2: M	The characteristic type on which ETH services are classified, such as VLAN ID, VLAN Priority (defined in IEEE 802.1p) , EVC	NONE

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
		classifyValue	Phase 1: M Phase 2: M	Lists the characteristic values corresponding to the above classifyType to identify a specific service class	NONE
	relationships	contained in EMS	Phase 1: M Phase 2: M	EMS is the containing object for ETHServiceClassProfile	NONE
		ETHCoSBandwidthMapping: CoSCharacterization	Phase 1: M Phase 2: M	To characterizes the CoS type at the bandwidth mapping	NONE
		ETHCoSPerformanceMapping: CoSCharacterization	Phase 1: M Phase 2: M	To characterizes the CoS type at the performance mapping	NONE
	notifications	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
ETHCoSBandwidthMapping	object	-	Phase 1: M Phase 2: M	indicates the bandwidth of specified CoS	NONE
	relationships	ETH_Flow_Points: CoSBWMappingCharacterization	Phase 1: M Phase 2: M	ETH_Flow_Points where the bandwidth for specific CoS in the ingress and/or egress direction is applied	NONE
		ETHBandwidthProfile: ingressCoSBandwidthCharacterization	Phase 1: M Phase 2: M	Mapping the ingress bandwidth profile to specific ETH service.	NONE
		ETHBandwidthProfile: egressCoSBandwidthCharacterization	Phase 1: NA Phase 2: M	Mapping the egress bandwidth profile to specific ETH service.	NONE
		ETHServiceClassProfile: CoSCharacterization	Phase 1: M Phase 2: M	characterizes the CoS type at the bandwidth mapping	NONE
	notifications	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
ETHCoSPerformanceMapping	object	-	Phase 1: O Phase 2: M	Associates expected service performances of specified CoS	NONE
	attributes	cosMappingID	Phase 1: O	the name of a CoS	NONE

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
			Phase 2: M	mapping instance	
	relationships	ETH_FDFr_EVC: CoSPerfMappingCharacterization	Phase 1: M Phase 2: M	EVC where the performance for specific CoS is applied	NONE
		ETHPerformanceProfile: CoSPerformanceCharacterization	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

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
		elmiMinAsyncMessageInterval	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	characteristicInformationType	Phase 1: M Phase 2: M	Describes the transport type	characteristicInformationType
		operationalState	Phase 1: M Phase 2: M	Denotes the operational state of the TransportPort as working “Enabled” or not-working “Disabled”.	operState
		alarmStatus	Phase 1: M Phase 2: M	Indicates the occurrence of an abnormal condition.	alarmStatus

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				Values for alarm status include: critical, major, minor, indeterminate, warning, pending, and cleared.	
		currentProblemList	Phase 1: M Phase 2: M	Identifies the current existing problems (probable cause), with severity	currentProblemList
		portId	Phase 1: M Phase 2: M	Name of the port represented by the TransportPort. This attribute describes the Managed Element, Bay, Shelf, Drawer, Slot, and Port	portID
		potentialCapacity	Phase 1: C Phase 2: C	Bandwidth capacity that is supported by the TransportPort. This attribute is conditional, it is present if the TransportPort is a rate adaptive technology	potentialCapacity
	relationships	contained in ManagedElement	Phase 1: M Phase 2: M	ManagedElement is the containing object for TransportPort	In MEF7 contained in SupportingElement or LayerNetworkDomain
		AlarmSeverityProfile: SeverityAssignment	Phase 1: O Phase 2: O	To assign alarm severity to specific alarms	AlarmSeverityProfile: SeverityAssignment
		CircuitPack: PortAssociation	Phase 1: M Phase 2: M	The CircuitPack that support the TransportPort	SupportingElements: SupportedBy, PortAssociation
		ClientFPP: Client/Server	Phase 1: M Phase 2: M	Relationship between the TransportPort in the server layer and the FPP in the client layer	ClientFPP: Client/Server
	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.	attributeValueChange
		stateChange	Phase 1: M Phase 2: M	Indicates changes in administrative and operational state	stateChange

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
		communicationsAlarm	Phase 1: M Phase 2: M	Indicates an alarm condition	communicationsAlarm
MAUTransport Port (Subclass of TransportPort MAUTransportPort inherits properties, including attributes from TransportPort)	object	-	Phase 1: C Phase 2: C	Generically represents the ETY Port and the underlying transport termination of the Ethernet Medium Attachment Unit This object is conditionally required if the underlying server layer is not represented with another standards based object.	MAUTransportPTP
	attributes	mauType	Phase 1: M Phase 2: M	Identifies the MAU type. An initial set of MAU types are defined in RFC-3636	mauType
		**		mauStatus from MEF7 is covered by the operationalState inherited from Transport Port	mauStatus
		mauMediaAvailable	Phase 1: M Phase 2: M	Link integrity state of the MAU Transport Port. May take on values as describe in RFC-3636.	mauMediaAvailable
		mauJabberState	Phase 1: M Phase 2: M	The jabbering state of the MAU.	mauJabberState
		mauDefaultType	Phase 1: M Phase 2: M	Identifies the default administrative baseband MAU type	mauDefaultType
		mauMode	Phase 1: M Phase 2: M	Full Duplex, or Auto negotiation	mode
		mauAutoNegSupported	Phase 1: M Phase 2: M	Indicates whether or not auto-negotiation is supported on this MAU	mauAutoNegSupported
		mauTypeList	Phase 1: M Phase 2: M	Identifies the set of possible IEEE 802.3 types of the MAU	mauTypeList
		mauJackTypeList	Phase 1: M Phase 2: M	Identifies interface jack types that the MAU provides.	mauJackTypeList
		mauAutoNegAdminState	Phase 1: M Phase 2: M	Allows the auto-negotiation function of the MAU to be enabled or disabled	mauAutoNegAdminState

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
		mauAutoNegRemoteSignaling	Phase 1: M Phase 2: M	Indicates whether the remote end of the link is using auto-negotiation signalling.	mauAutoNegRemoteSignaling
		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	mauAutoNegCapability
		mauAutoNegCapAdvertised	Phase 1: O Phase 2: O	Identifies the set of capabilities advertised by the local auto-negotiation entity	mauAutoNegCapAdvertised
		mauAutoNegCapReceived	Phase 1: O Phase 2: O	Identifies the set of capabilities received from the remote auto-negotiation entity	mauAutoNegCapReceived
		mauAutoNegRemoteFaultAdvertised	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	mauAutoNegRemoteFaultAdvertised
		mauAutoNegRemoteFaultReceived	Phase 1: O Phase 2: O	Identifies any fault indications received from the far end of a link by the local auto-negotiation entity	mauAutoNegRemoteFaultReceived
	methods	mauAutoNegRestart	Phase 1: O Phase 2: O	This method will force auto-negotiation to begin link renegotiation. Based on RFC-3636 ifMauAutoNegRestart	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	AlarmSeverityProfile: SeverityAssignment
		CircuitPack:	Phase 1: M	The CircuitPack that	SupportingElements

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
		PortAssociation	Phase 2: M	support the TransportPort	: SupportedBy, PortAssociation
		ClientFPP: Client/Server	Phase 1: M Phase 2: M	Relationship between the TransportPort in the server layer and the FPP in the client layer	ClientFPP: Client/Server
	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.	attributeValueChange
		stateChange	Phase 1: M Phase 2: M	Indicates changes in administrative and operational state	stateChange
		communicationsAlarm	Phase 1: M Phase 2: M	Indicates an alarm condition	communicationsAlarm
ETH UNI Anomalies Performance Data Set	Performance data set	-	Phase 1: M Phase 2: M	The set of UNI abnormality measurements collected at each ETH_FPP_UNI	NONE
	attribute	Undersized Frames	Phase 1: M Phase 2: M	Number of frames, where the frame size was smaller than 64 octets, received at the MEN from the UNI	NONE
		Oversized Frames	Phase 1: M Phase 2: M	Number of oversized frames (frames greater than 1522 octets) received at the MEN from the UNI.	NONE
		Fragments	Phase 1: M Phase 2: M	Number of fragmented frames received at the MEN from the UNI.	NONE
		FCS and Alignment Errors	Phase 1: M Phase 2: M	Number of CRC and alignment errored frames received at the MEN from the UNI.	NONE
		Invalid CE-VLAN ID	Phase 1: M Phase 2: M	Number of frames received with an invalid CE-VLAN ID.	NONE
ETH UNI Traffic Performance Data Set	Performance data set	-	Phase 1: M Phase 2: M	The set of UNI traffic measurements collected at each ETH_FPP_UNI	NONE
	attribute	Octets Transmitted OK	Phase 1: M Phase 2: M	Number of octets (not including IPG) that the MEN sent to the	NONE

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				UNI	
		Unicast Frames Transmitted OK	Phase 1: M Phase 2: M	Number of Unicast Frames that the MEN sent to the UNI	NONE
		Multicast Frames Transmitted OK	Phase 1: M Phase 2: M	Number of Multicast Frames that the MEN sent to the UNI	NONE
		Broadcast Frames Transmitted OK	Phase 1: M Phase 2: M	Number of Broadcast Frames that the MEN sent to the UNI	NONE
		Octets Received OK	Phase 1: M Phase 2: M	Number of octets (not including IPG) that the UNI sent to the MEN	NONE
		Unicast Frames Received OK	Phase 1: M Phase 2: M	Number of Unicast Frames that the UNI sent to the MEN	NONE
		Multicast Frames Received OK	Phase 1: M Phase 2: M	Number of Multicast Frames that the UNI sent to the MEN	NONE
		Broadcast Frames Received OK	Phase 1: M Phase 2: M	Number of Broadcast Frames that the UNI sent to the MEN	NONE
ETH Ingress Traffic Management Performance Data Set	Performance data set	-	Phase 1: M Phase 2: M	The set of Ingress Traffic Management performance measurements on a per entity (per UNI, per CoS per UNI, per EVC, or per CoS per EVC) basis for each entity that enforces traffic management at Ingress direction (CE to MEN).	NONE
	attributes	ingressGreenFrameCount	Phase 1: M Phase 2: M	The amount of green frames sent by the ingress UNI to the MEN	NONE
		ingressYellowFrameCount	Phase 1: O Phase 2: O	The amount of yellow frames sent by the ingress UNI to the MEN	NONE
		ingressRedFrameCount	Phase 1: O Phase 2: O	The amount of red (discarded) frames at the ingress UNI	NONE
		ingressGreenOctetCount	Phase 1: O Phase 2: O	The amount of green octets sent by the ingress UNI to the MEN	NONE
		ingressYellowOctetCount	Phase 1: O Phase 2: O	The amount of yellow octets sent by the ingress UNI to	NONE

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				the MEN	
		ingressRedOctetCount	Phase 1: O Phase 2: O	The amount of red (discarded) octets at the ingress UNI	NONE
ETH Egress Traffic Management Performance Data Set	Performance data set	-	Phase 1: M Phase 2: M	The set of Egress Traffic Management performance measurements on a per entity (per UNI, per CoS per UNI, per EVC, or per CoS per EVC) basis for each entity that enforces traffic management at the Egress direction (MEN to CE).	NONE
	attributes	egressGreenFrameCount	Phase 1: M Phase 2: M	The amount of green frames received by the egress UNI from the MEN.	NONE
		egressYellowFrameCount	Phase 1: O Phase 2: O	The amount of yellow frames received by the egress UNI from the MEN	NONE
		egressGreenOctetCount	Phase 1: O Phase 2: O	The amount of green octets received by the egress UNI from the MEN	NONE
		egressYellowOctetCount	Phase 1: O Phase 2: O	The amount of yellow octets received by the egress UNI from the MEN	NONE
ETH Congestion Discards Performance Data Set	Performance data set	-	Phase 1: M Phase 2: M	The set of Congestion Discards performance measurements on a per congestible resource (e.g., per UNI, per CoS per UNI, per EVC, or per CoS per EVC) basis in both the ingress and egress direction	NONE
	attributes	greenFrameDiscards	Phase 1: M Phase 2: M	The amount of green frames discarded due to congestion	NONE
		yellowFrameDiscards	Phase 1: O Phase 2: O	The amount of yellow frames discarded due to congestion	NONE
		greenOctetDiscards	Phase 1: M	The amount of green	NONE

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
			Phase 2: M	octets discarded due to congestion	
		yellowOctetDiscards	Phase 1: O Phase 2: O	The amount of yellow octets discarded due to congestion	NONE
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_FPP on which ELMI is supported and enabled	NONE
	attributes	sumofElmiReliabilityErrors	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
		sumofElmiProtocolErrors	Phase 1: NA Phase 2: O	Thresholded sum of ELMI Protocol Errors on the FPP, including: Protocol Version Errors, Message too shorts, Message type errors, Information element errors	NONE
		elmiNonrcptStatusAndStatusEnquiryCount	Phase 1: NA Phase 2: O	Number of Non-receipt of STATUS/STATUS ENQUIRY events	NONE
		elmiInvalidSeqNumCount	Phase 1: NA Phase 2: O	Number of Invalid Sequence Numbers events	NONE
		elmiProtocolVersionCount	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 Message Too Short Errors detected at the FPP	NONE
		elmiMessageTypeErrorCount	Phase 1: NA Phase 2: O	Number of ELMI Message Type Errors detected at the FPP	NONE
		elmiInfoElementErrorCount	Phase 1: NA Phase 2: O	Number of ELMI Information Element Errors (Information	NONE

ITU-T Q.840.1 Management Entity	Element Type	Element	MEF Required	Description/Notes (details in Q.840.1)	Original MEF7 Element
				element out of sequence, Duplicate information element, Missing Mandatory information element, Mandatory information element error, Unexpected information element) detected at the FPP	
MAU Termination Performance Data Set	Performance data set	-	Phase 1: C Phase 2: C	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 Unit.	NONE
	attributes	ifMauMediaAvailableStateExits	Phase 1: M Phase 2: M	Number of time the MAU leaves the available state	NONE
		ifMauJabberingStateEnters	Phase 1: M Phase 2: M	Number of times the MAU enters the jabbering state	NONE
		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.

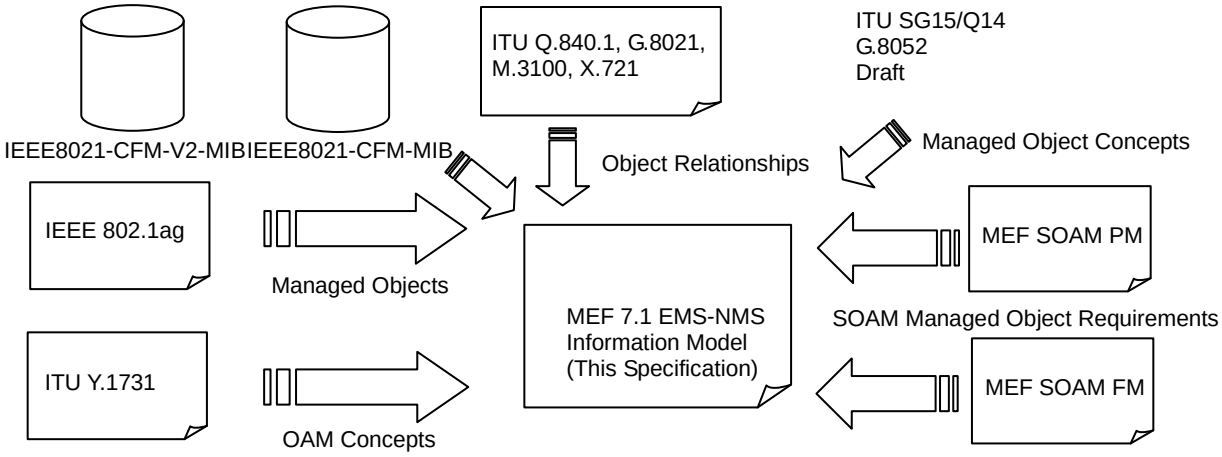

Figure 9-1 EMS-NMS Information Model Approach

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

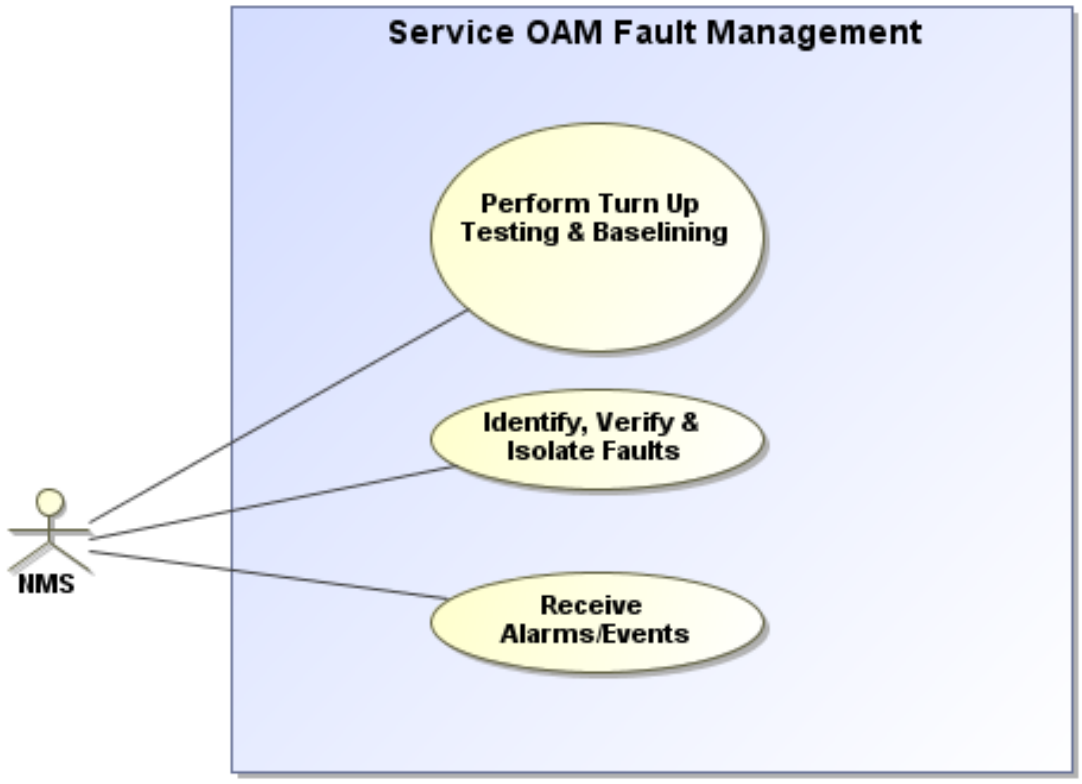

Figure 9-2 Fault Management Use Cases

9.1.2 Performance Monitoring

9.1.2.1 OAM PM Use Cases

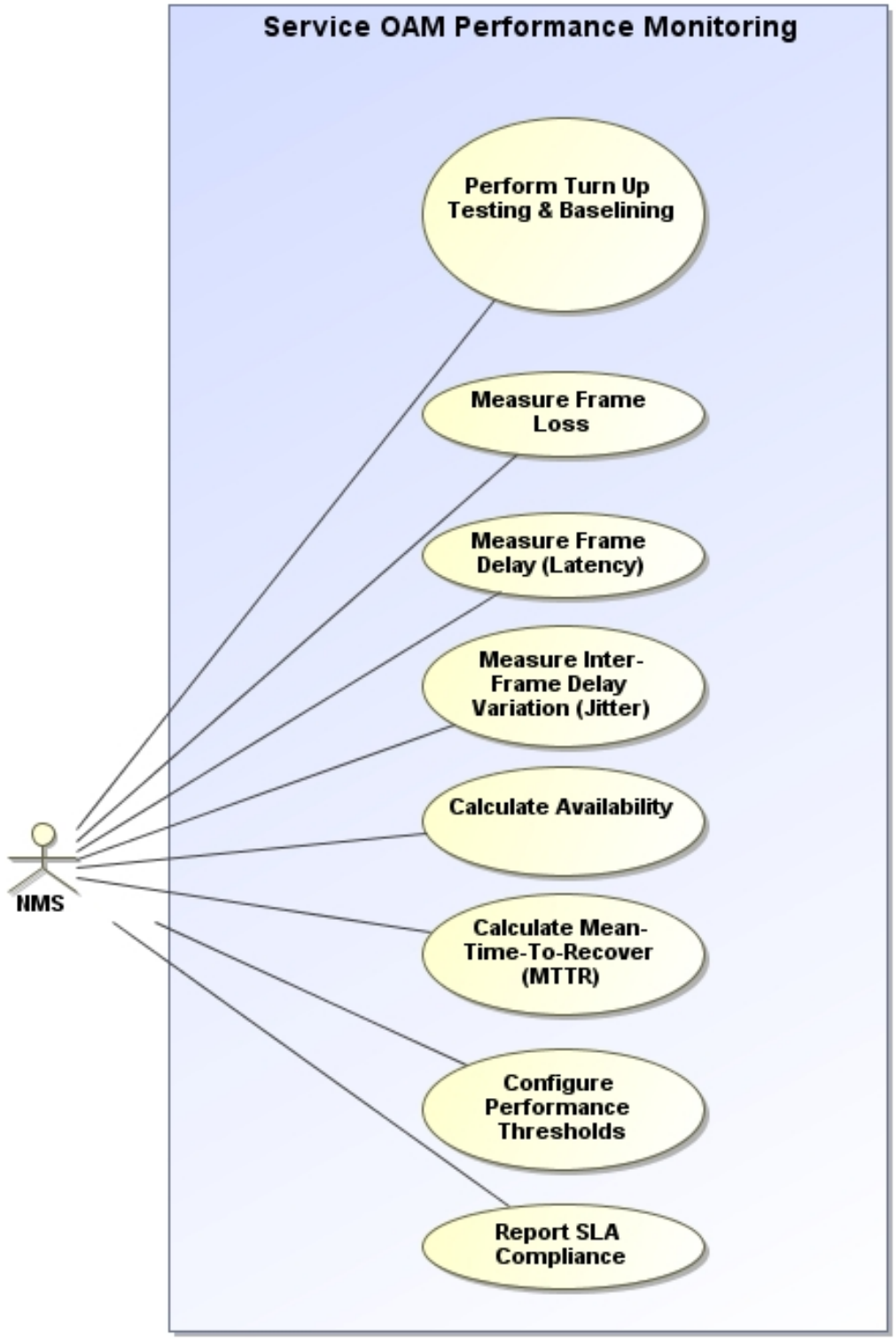

Figure 9-3 Performance Monitoring Use Cases

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.

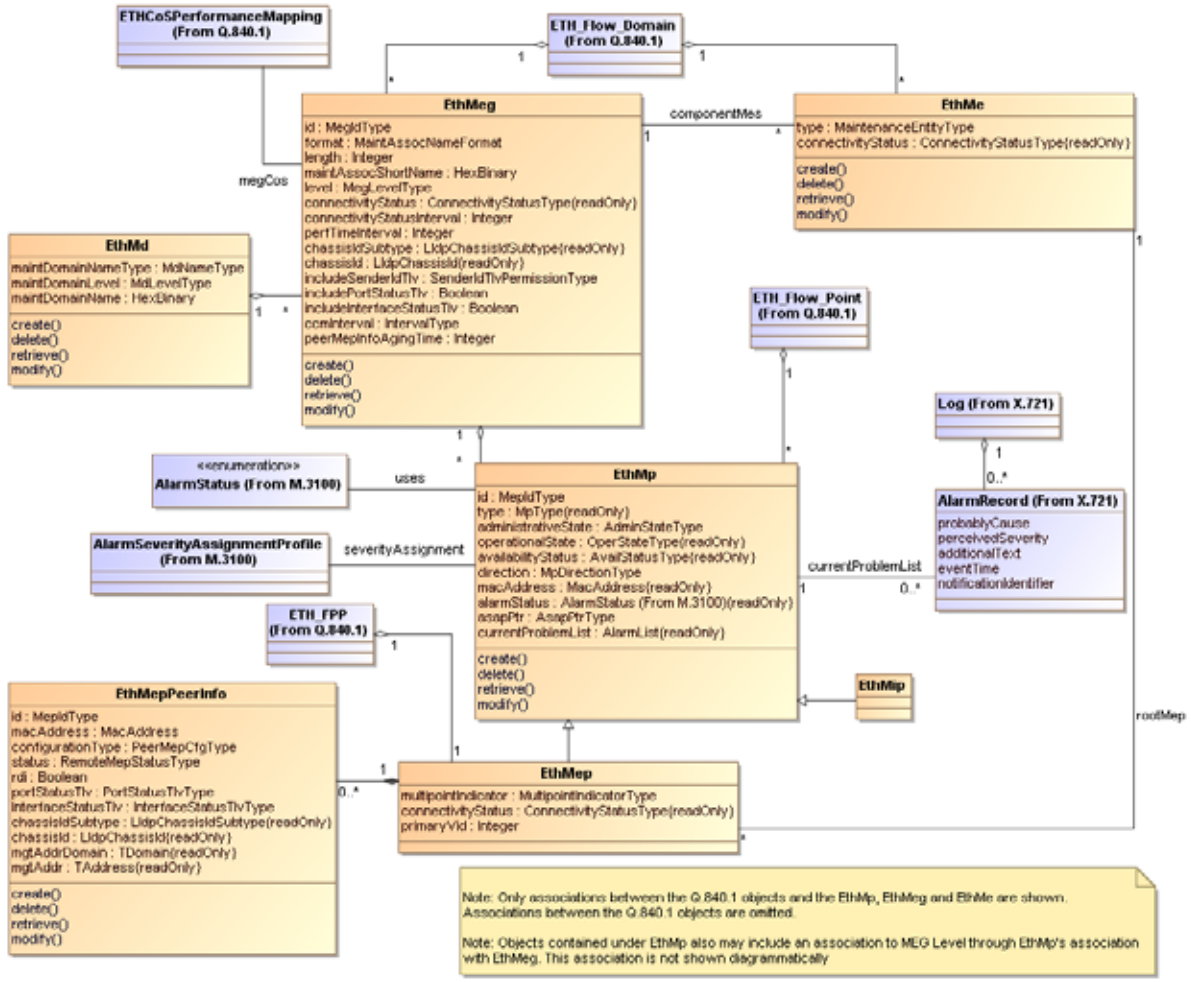

Figure 9-4 Common Service OAM Object Class Diagram

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	Type	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

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 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 **EthMe** object is contained under **ETH_Flow_Domain** defined in Q.840.1.

EthMe is associated with:

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

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

EthMeg: *ComponentMaintenanceEntities* – The Maintenance Entities that belong to the same service inside a common OAM domain are associated with the same MEG (GET, REPLACE, ADD, REMOVE)

Reportable Notifications:

objectCreation	O
objectDeletion	O

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	Type	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.	SenderIdTlvPermissionType	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

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 1..45 octets.	HexBinary		C (M if format is based on 802.1ag MAID), R/W
perfTimeInterval	This attribute specifies the Timer interval 'T' as defined in MEF 10 (MEF 17 R5a and R5b). Units are milliseconds.	Integer		M, R/W
ccmInterval	This attribute specifies the ETH-CC and ETH-RDI transmission period in seconds. For Fault Management applications the default value is 1 second. For Performance Monitoring applications the 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.	IntervalType	1	M, R/W
peerMepInfoAgingTime	This attribute defines a period of time after which an instance in the EthMepPeerInfo object is removed unless the EthMepPeerInfo instance is updated by the MEP's connectivity status process. A value of zero indicates no aging will occur.	Integer	0	O, 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.
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 **EthMeg** object is contained under **ETH_Flow_Domain** defined in Q.840.1.

EthMeg is associated with:
EthMe: ***ComponentMaintenanceEntities*** – The Maintenance Entities that belong to the same service inside a common OAM domain (GET, REPLACE, ADD, REMOVE)
EthMp: ***RootMEP*** – The Maintenance Points is the root of a multipoint MEG. (GET, REPLACE)
ETHCoSPerformanceMapping: ***MegCoS*** –Indicates the performance for specific CoS. (GET, REPLACE, ADD, REMOVE). This object is defined in Q.840.1.

Reportable Notifications:	
objectCreation	O
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**	**Type**	**Default Value**	**Qualifier**
multipointIndicator	This attribute specifies the MEP is acting as 'root' or 'leaf' for multipoint, or 'notMultipoint' if not multipoint.	MultipointIndicatorType		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	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 0..16777215.	Integer		M, R/W

Operations / Methods:	
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	O
objectDeletion	O

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**	**Type**	**Default Value**	**Qualifier**
Operations / Methods:				
Name	**Description**			
Relationships: The **EthMip** object is a generalization of the **EthMp** object.				
Reportable Notifications:				
objectCreation			O	
objectDeletion			O	

9.2.5 EthMp (Maintenance Point)

Behavior: This object defines ETH Maintenance Points representing either a MEP or a MIP (via a subclass).				
Attributes				
Name	**Description**	**Type**	**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

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		O, 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.	MpType		M, 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 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 **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	O
objectDeletion	O
stateChange	O
communicationsAlarm (ETH_AIS, ETH_RDI)	M
attributeValueChange	O

9.2.6 EthMd (Maintenance Domain)

Behavior: This object represents the Maintenance Domain (802.1ag).				
Attributes				
Name	**Description**	**Type**	**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 1..43 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:				
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 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	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	Type	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

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

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 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: **EthMepPeerInfo** is contained under the **EthMep** object.	
Reportable Notifications:	
objectCreation	O
objectDeletion	O

9.3 Fault Management Objects

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

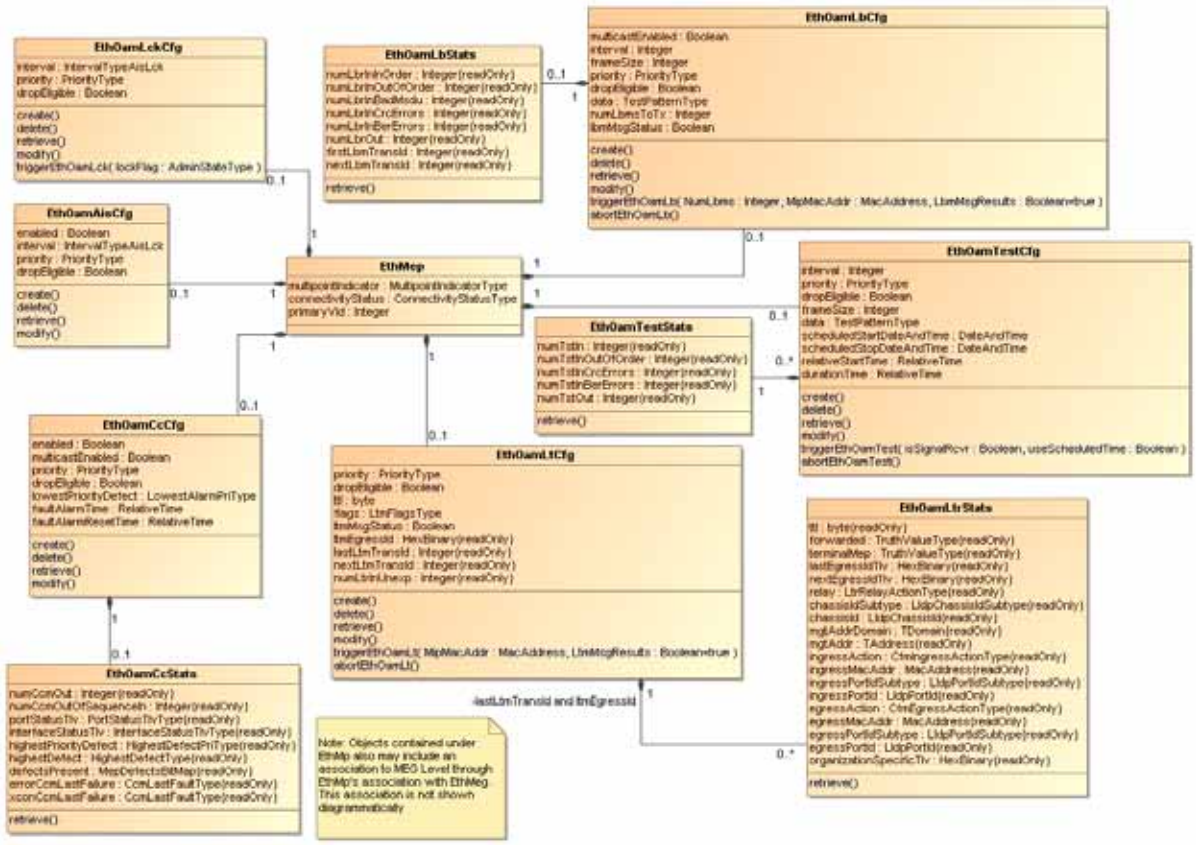

Figure 9-5 Fault Management Class Diagram

9.3.1 Continuity Check

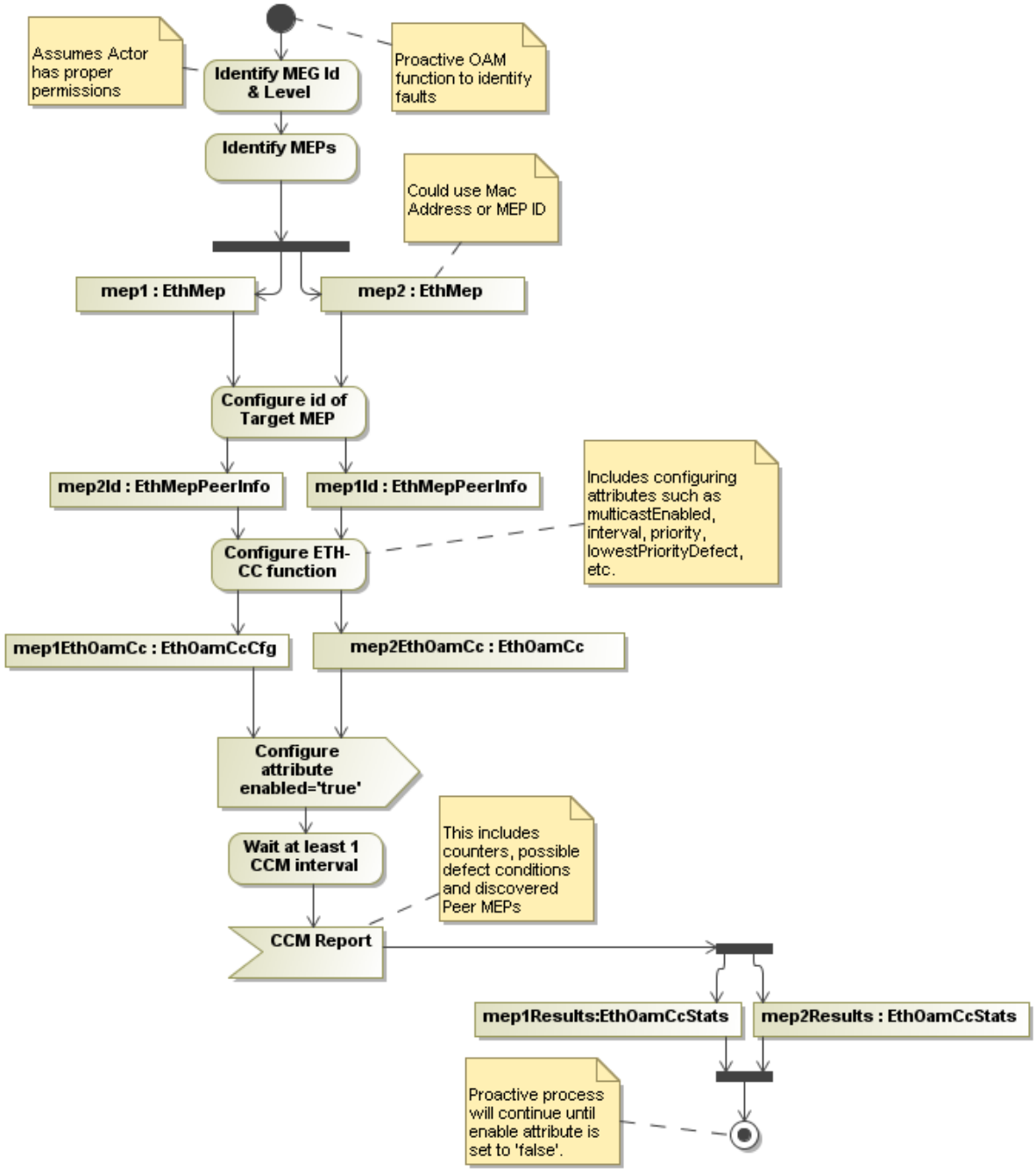

Figure 9-6 Continuity Check Activity Diagram

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.

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	Type	Default Value	Qualifier
enabled	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.	Boolean	true	M, R/W
multicastEnabled	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
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		O, 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.

Relationships:

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	O
objectDeletion	O

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**	**Type**	**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	O, 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	O, 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

	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**			
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.				
Reportable Notifications:				
objectCreation				O
objectDeletion				O

9.3.2 Loopback

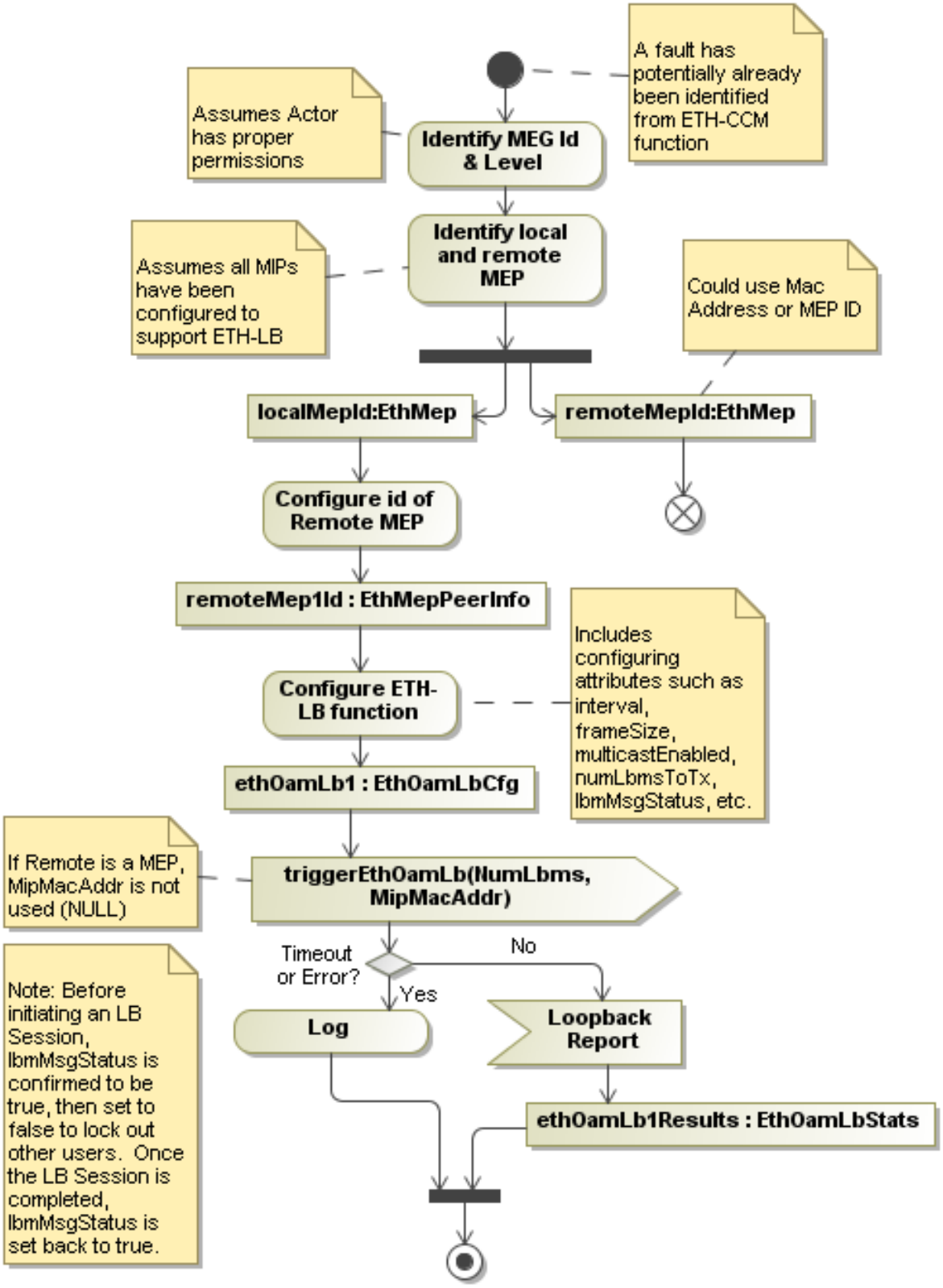

Figure 9-7 Loopback Activity Diagram

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	Type	Default Value	Qualifier
multicastEnabled	This attribute specifies whether a 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.	Boolean	false	O, R/W
interval	This attribute specifies the period 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).	Integer	1	M, R/W
frameSize	This attribute specifies the LBM 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.	Integer	64	M, R/W

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 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.
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.

Operation Parameters:

Name	Description	Type	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

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 is contained under the **EthMep** object. **EthOamLbCfg** is associated with: **EthMep: MaintenanceEndPoints** – For the unicast or multicast peer MEP MAC Address for which the loopback is performed. **EthMeg: MaintenanceEntityGroup** – For the MEG Level at which the MEP exists.				
Reportable Notifications:				
objectCreation			M	
objectDeletion			M	

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	Type	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)
numLbrlnBadMdsu	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)

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)

Operations / Methods:	
Name	**Description**
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.

Relationships:

The **EthOamLbStats** object is contained under the **EthOamLbCfg** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

9.3.3 Link Trace

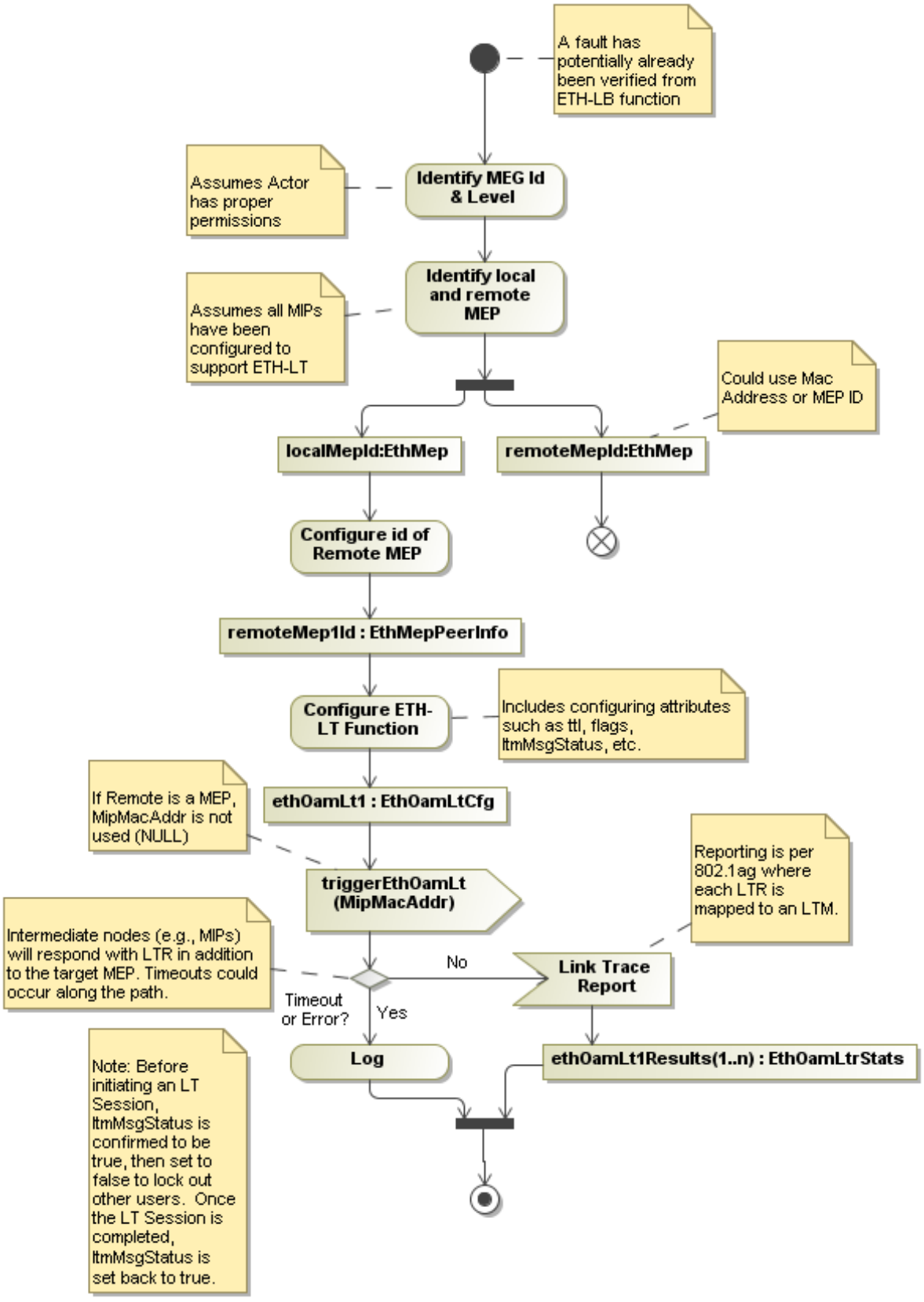

Figure 9-8 Link Trace Activity Diagram

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	Type	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	useFdbOnly	M, R/W

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 the transmitting entities.	HexBinary		M, R
lastLtmTransId	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

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.
abortEthOamLt()	This operation provides the ability to abort a currently running on-demand ETH-LT function.
triggerEthOamLt()	This operation provides the ability to administratively trigger on-demand ETH-LT, based on the configured attributes as well as the MipMacAddr input parameter. The MipMacAddr input parameter specifies a destination MIP MAC Address or NULL if the destination is a MEP. This operation blocks until the LT Session has completed.

Operation Parameters:

Name	Description	Type	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	M
objectDeletion	M

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

Name	Description	Type	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		M, R
relay	This attribute contains the value returned in the Relay Action field.	LtrRelayActionType		M, 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, 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, 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, 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, R

ingressAction	This attribute indicates the value returned in the Ingress Action Field of the LTM. The value ingNoTlv 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 ingNoTlv, 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 ingNoTlv, 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 egrNoTlv 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 egrNoTlv, then the contents of this attribute are meaningless.	LldpPortId		M, R

organizationSpecificTlv	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

Operations / Methods:	
Name	**Description**
retrieve()	This operation provides the ability to dynamically query attribute values of existing instances of this object.

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	O
objectDeletion	O

9.3.4 Signal Functions

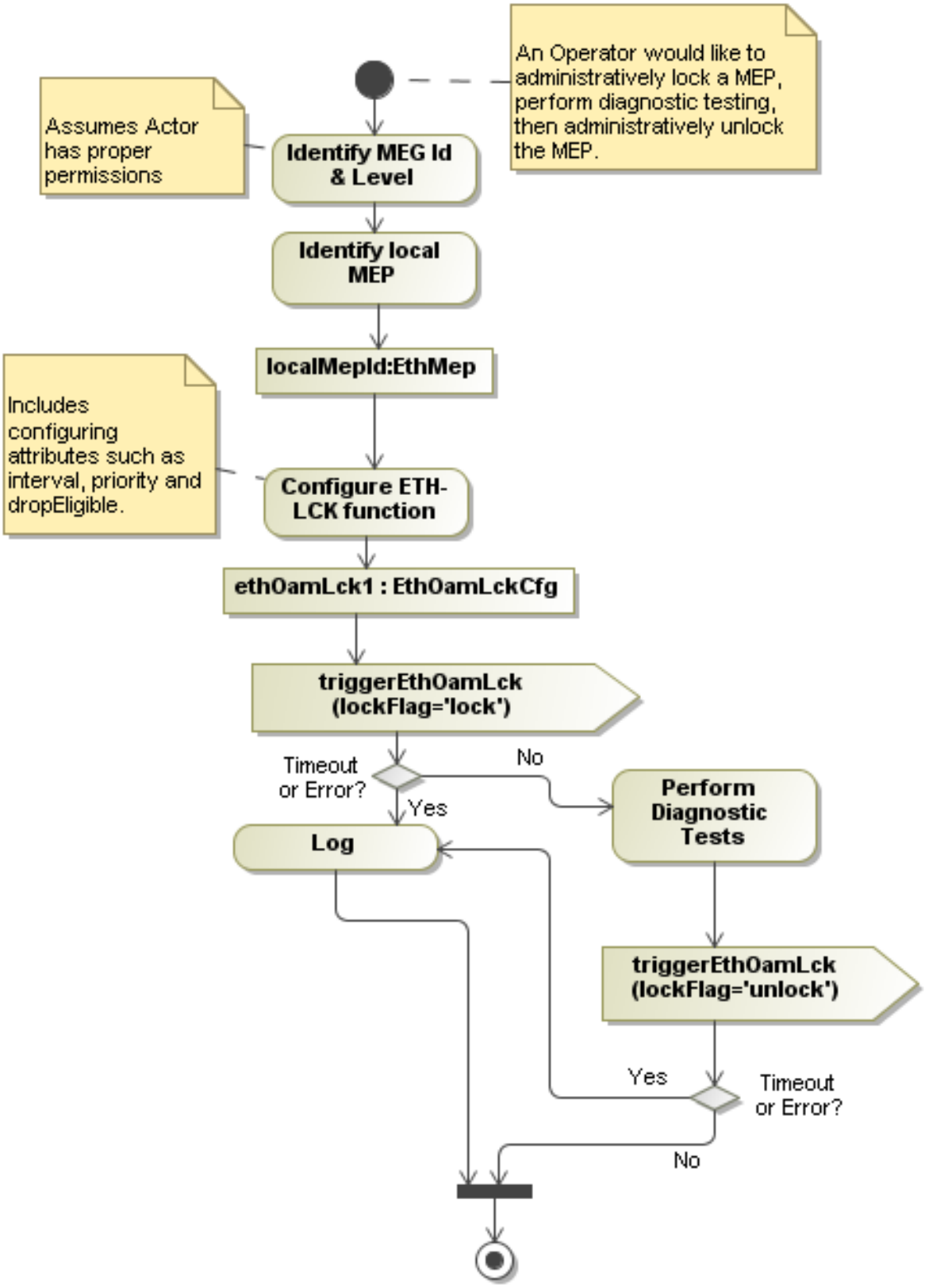

Figure 9-9 Locked Activity Diagram

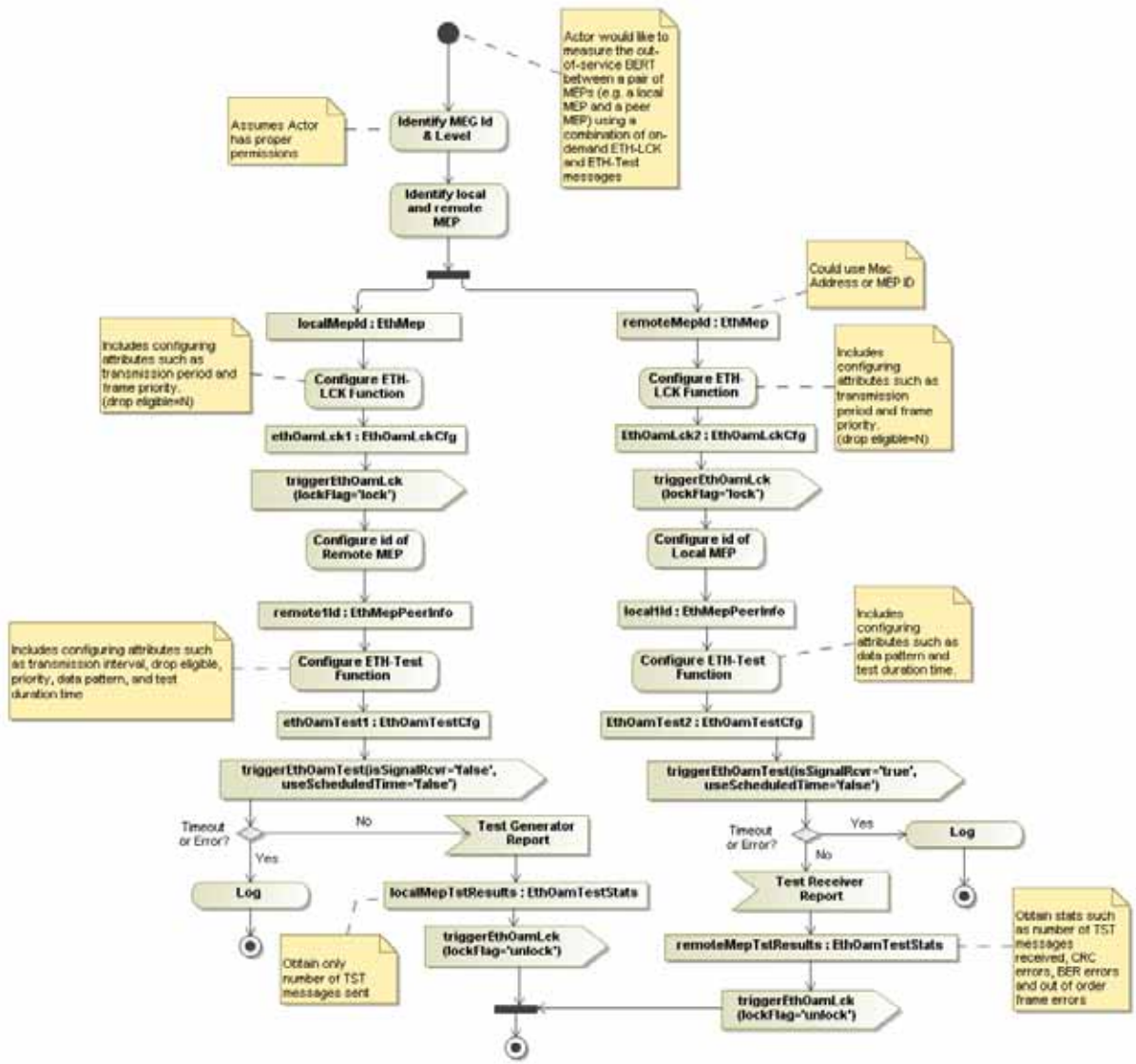

Figure 9-10 Test Activity Diagram

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

Name	Description	Type	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		O, 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

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.

Relationships:

The **EthOamAisCfg** object is contained under the **EthMep** object.

EthOamAisCfg is associated with:
EthMeg: ***MaintenanceEntityGroup*** – For the MEG Level at which the MEP exists.

Reportable Notifications:

objectCreation	O
objectDeletion	O

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	Type	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		O, 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

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.
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	Type	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

Relationships:

The **EthOamLckCfg** object is contained under the **EthMep** object.

EthOamLckCfg is associated with:

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

Reportable Notifications:

lockEvent	O
unlockEvent	O
objectCreation	O
objectDeletion	O

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	Type	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		O, 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	O, R
frameSize	This attribute specifies the TST frame size. Units are Bytes.	Integer	64	O, 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. This size is constrained to 0	TestPatternType	None	O, R/W

	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	O, 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	O, 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
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.
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	Type	Default Value	Qualifier
isSignalRcvr	This input parameter specifies 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.	Boolean	None	in
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.	Boolean	False	in

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	O
objectDeletion	O

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

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	Type	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	O, 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	O, R

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

Operations / Methods:	
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.

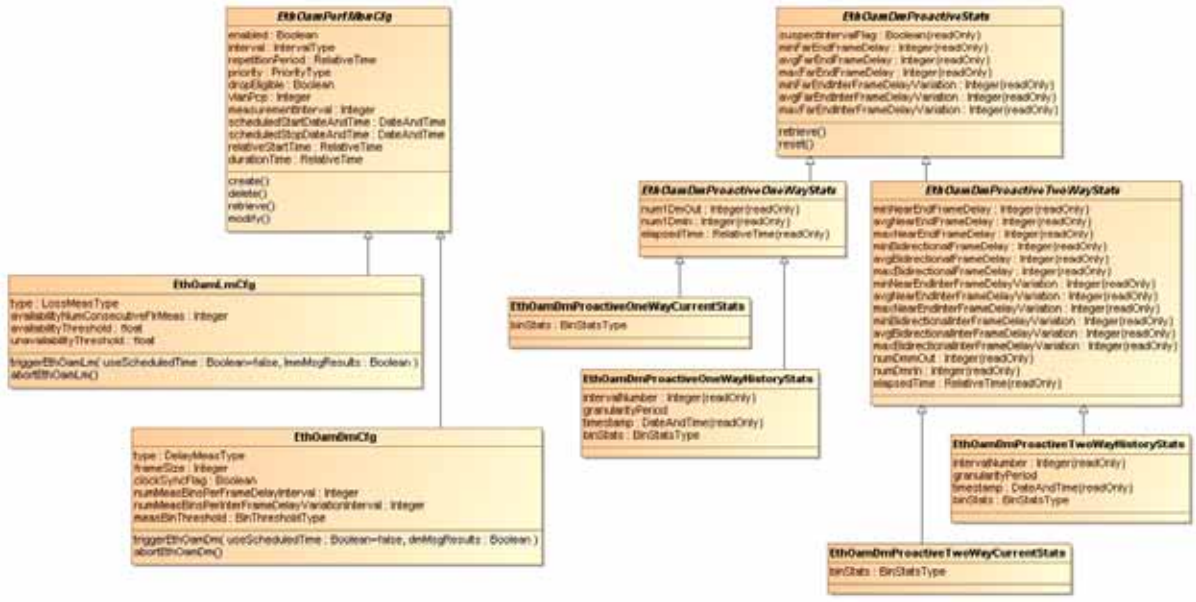

Figure 9-11 Performance Monitoring Inheritance Class Diagram

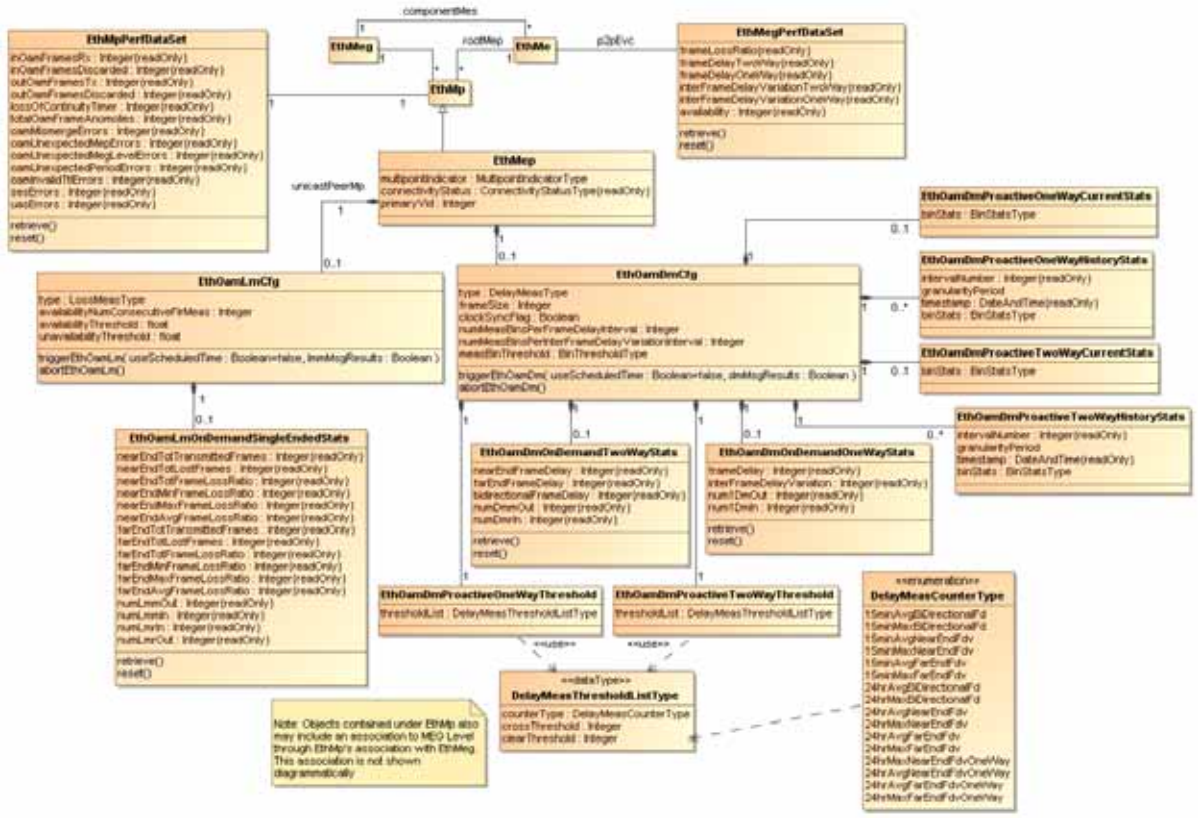

Figure 9-12 Performance Monitoring Class Diagram

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**	**Type**	**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
Operations / Methods:				
Name	**Description**			

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

Name	Description	Type	Default 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		O, R
maxFarEndFrameDelay	This attribute indicates the maximum	Integer		O (with clock synchronization),

	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
Operations / Methods:				
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.			
Relationships: The **EthOamDmProactiveStats** 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**	**Type**	**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

avgBidirectionalInterFrameDelayVariation	This attribute indicates the average measured bidirectional Inter-Frame Delay Variation.	Integer	0	O, R
avgNearEndFrameDelay	This attribute indicates the average measured near-end Frame Delay.	Integer	0	C (M with Clock Sync), R
avgNearEndInterFrameDelayVariation	This attribute indicates the average measured near-end Inter-Frame Delay Variation.	Integer	0	O, R
maxBidirectionalFrameDelay	This attribute indicates the maximum measured bidirectional Frame Delay.	Integer	0	O, R
maxBidirectionalInterFrameDelayVariation	This attribute indicates the maximum measured bidirectional Inter-Frame Delay Variation.	Integer	0	O, R
maxNearEndFrameDelay	This attribute indicates the maximum measured near-end Frame Delay.	Integer	0	O, R
maxNearEndInterFrameDelayVariation	This attribute indicates the maximum measured near-end Inter-Frame Delay Variation.	Integer	0	O, R

minBidirectionalFrameDelay	This attribute indicates the minimum measured bidirectional Frame Delay.	Integer	0	O, R
minBidirectionalInterFrameDelayVariation	This attribute indicates the minimum measured bidirectional Inter-Frame Delay Variation.	Integer	0	O, R
minNearEndFrameDelay	This attribute indicates the minimum measured near-end Frame Delay.	Integer	0	O (need clock synchronization), R
minNearEndInterFrameDelayVariation	This attribute indicates the minimum measured near-end Inter-Frame Delay Variation.	Integer	0	O, 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
Operations / Methods:				
Name	**Description**			
Relationships: The **EthOamDmProactiveTwoWayStats** object is an abstract object is a generalization of the **EthOamDmProactiveStats** object.				
Reportable Notifications:				

9.4.1.4 EthOamPerfMonCfg

Behaviour:				
This object includes configuration attributes and operations common to the ETH-DM and ETH-LM OAM operations.				
Attributes				
Name	**Description**	**Type**	**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 are minutes.	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:	
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.
Relationships: The **EthOamPerfMonCfg** object is an abstract object.	
Reportable Notifications:	

9.4.2 Loss Measurement

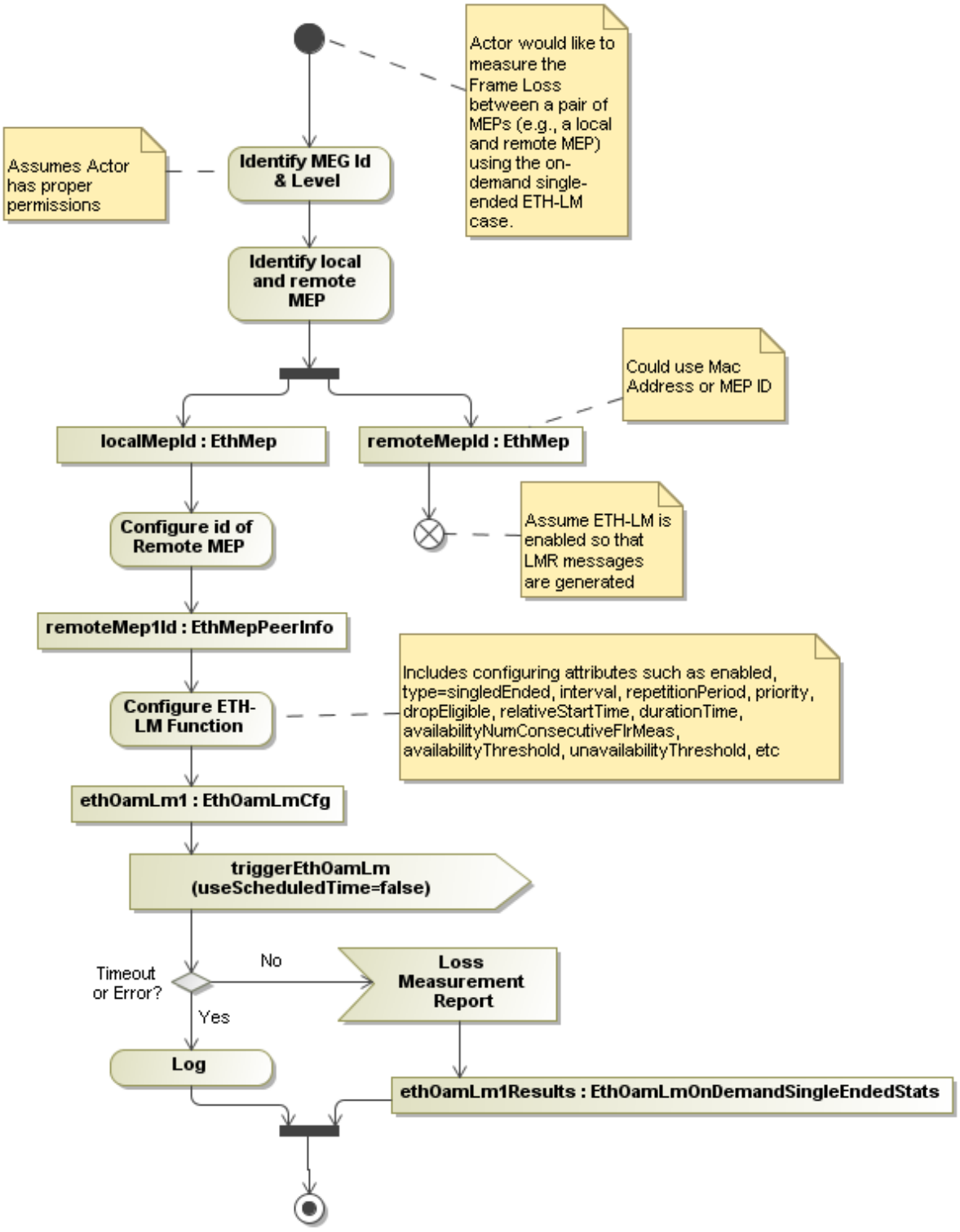

Figure 9-13 On-Demand Single-Ended Loss Measurement Activity Diagram

9.4.2.1 EthOamLmCfg (Ethernet Loss Measurement Configuration)

Behavior:

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

Name	Description	Type	Default Value	Qualifier
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 status of an availability 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
Operations / Methods:				
Name	**Description**			
abortEthOamLm()	This operation provides the ability to abort a currently running or scheduled single-ended on-demand ETH-LM function. This operation is not applicable to dual-ended proactive ETH-LM.			

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	Type	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 on-demand operation.	Boolean	FALSE	in
lmmMsgResults	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

Relationships:

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	O
objectDeletion	O

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	Type	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	O, R
nearEndMinFrameLossRatio	This attribute contains the minimum near-end frame loss ratio calculated by this MEP.	Integer	0	O, R
nearEndMaxFrameLossRatio	This attribute contains the maximum near-end frame loss ratio calculated by this MEP.	Integer	0	O, R
nearEndAvgFrameLossRatio	This attribute contains the average near-end frame loss ratio calculated by this MEP.	Integer	0	O, 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	O, R
farEndMinFrameLossRatio	This attribute contains the minimum far-end frame loss ratio calculated by this MEP.	Integer	0	O, R
farEndMaxFrameLossRatio	This attribute contains the maximum far-end frame loss ratio calculated by this MEP.	Integer	0	O, R
farEndAvgFrameLossRatio	This attribute contains the average far-end frame loss ratio calculated by this MEP.	Integer	0	O, R
farEndAvgFrameLossRatio	This attribute contains the average far-end frame loss ratio calculated by this MEP.	Integer	0	O, R
numLmmOut	This attribute contains the count of the total number of LMM frames transmitted.	Integer	0	M, R

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**			
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 **EthOamLmTotalSingleEndedStats** object is contained under the **EthOamLmCfg** object.				
Reportable Notifications:				
objectCreation			O	
objectDeletion			O	

9.4.3 Delay Measurement

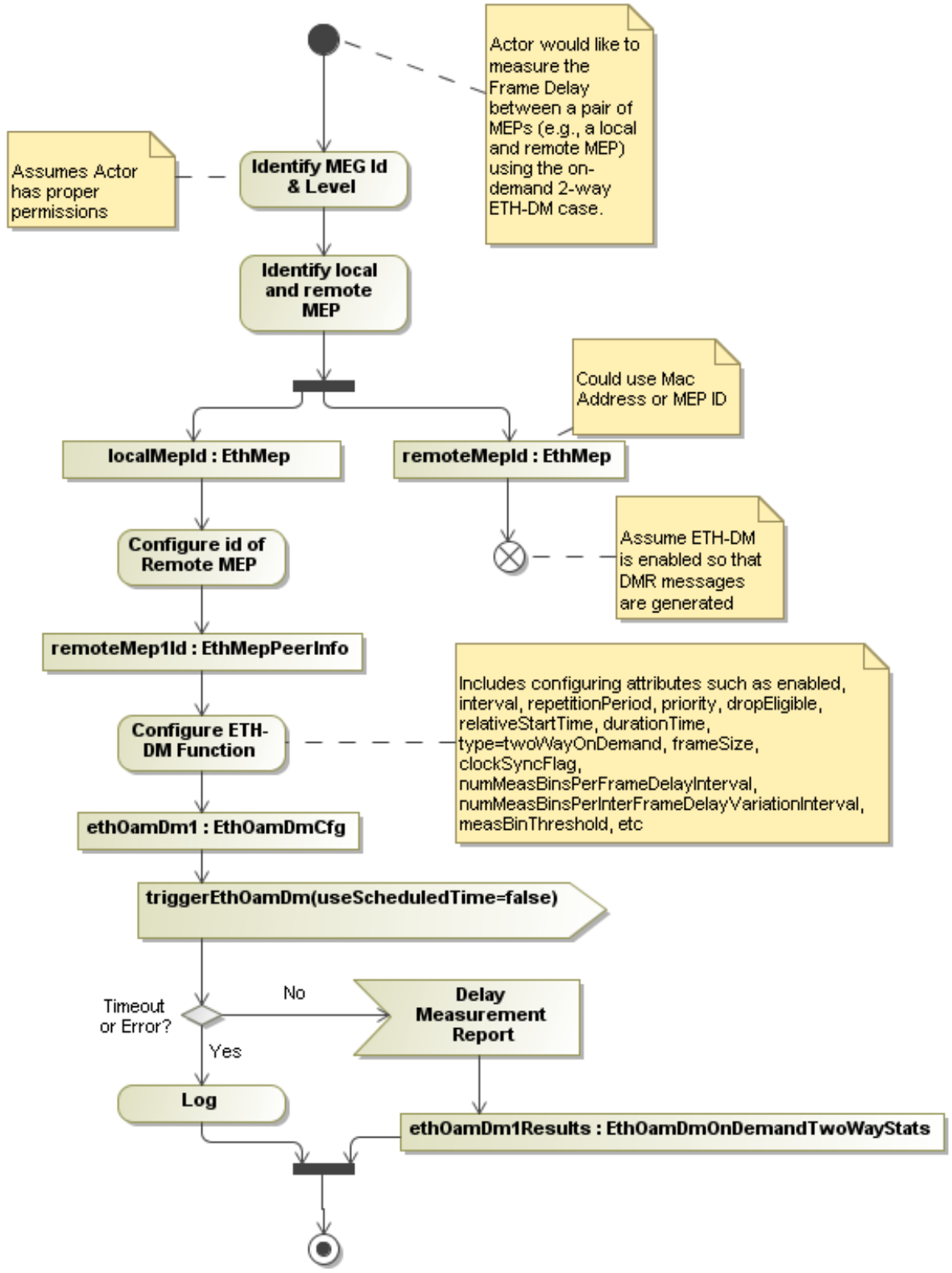

Figure 9-14 On-Demand 2-Way Delay Measurement Activity Diagram

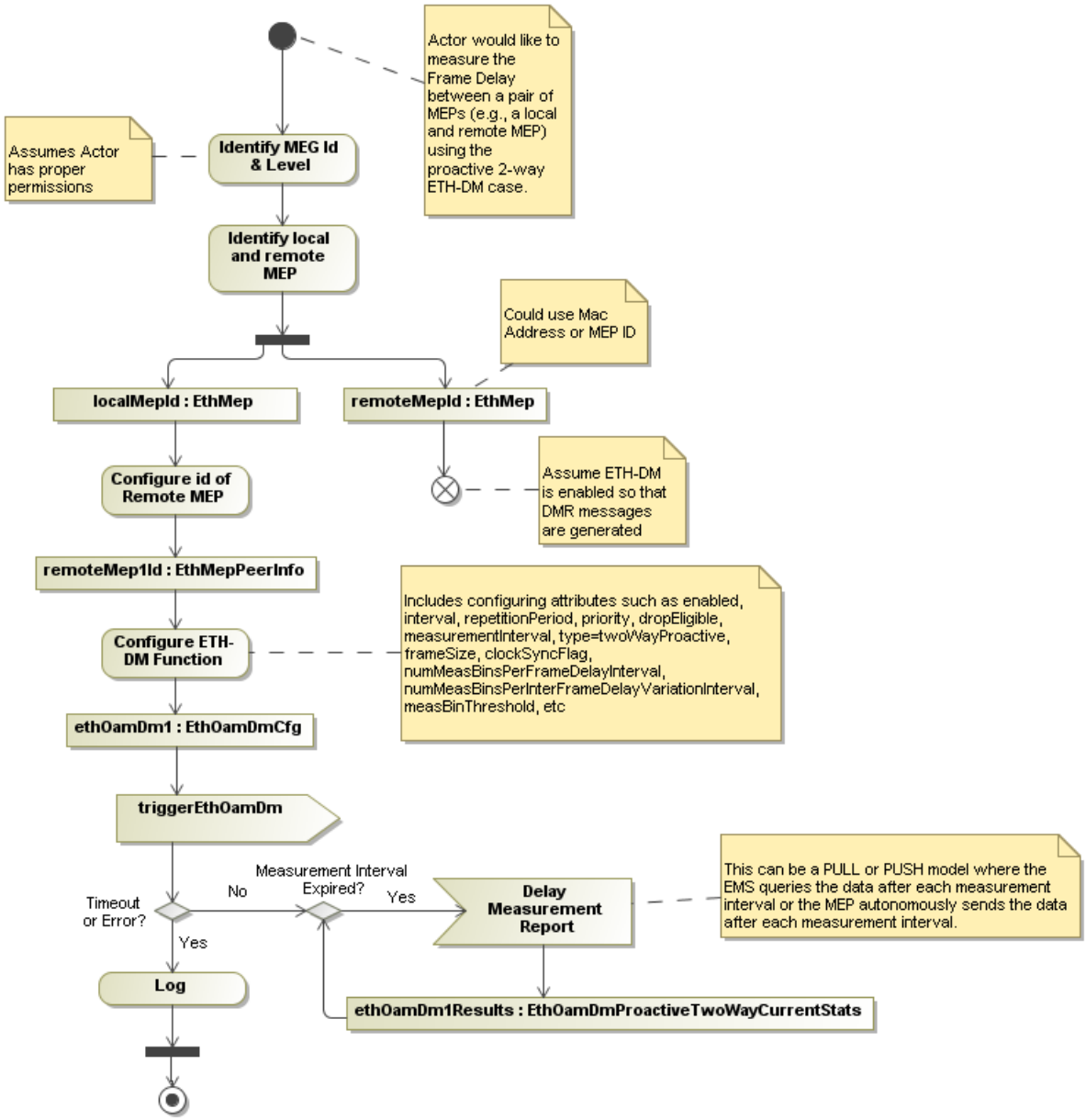

Figure 9-15 Proactive 2-Way Delay Measurement Activity Diagram

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	Type	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 (µs). The measurement threshold of the first measurement bin is fixed to 0µs. The default configured measurement threshold for a measurement bin should be an increment of 5000µs larger than the	BinThresholdType		M, R/W

	measurement threshold of the preceding measurement bin.			
numMeasBinsPerFrameDelayInterval	This attribute specifies the number of measurement bins per measurement interval for Frame Delay measurements. The valid range of values is 3..10 bins.	Integer	3	M, R/W
numMeasBinsPerInterFrameDelayVariationInterval	This attribute specifies the number of measurement bins per measurement interval for Inter-Frame Delay Variation measurements. The valid range of values is 1..10 bins.	Integer	1	O, R/W
type	This attribute indicates the type of delay measurement to be performed.	DelayMeasType		M, R/W

Operations / Methods:

Name	Description
abortEthOamDm()	This operation provides the ability to abort a currently running or scheduled ETH-DM 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.

Operation Parameters:

Name	Description	Type	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 on-demand operation.	Boolean	FALSE	in
dmMsgResults	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.

Reportable Notifications:

objectCreation	O
objectDeletion	O

9.4.3.2 EthOamDmOnDemandOneWayStats (Ethernet Delay Measurement 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	Type	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

interFrameDelayVariation	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
Operations / Methods:				
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 **EthOamDmOnDemandOneWayStats** object is contained under the **EthOamDmCfg** object.				
Reportable Notifications:				
objectCreation			O	
objectDeletion			O	

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	Type	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

Operations / Methods:	
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.

Reportable Notifications:	
objectCreation	O
objectDeletion	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**	**Type**	**Default Value**	**Qualifier**
binStats	This attribute specifies the bin measurements.	BinStatsType	0	M, R

Operations / Methods	
Name	**Description**

Relationships:
The **EthOamDmProactiveOneWayCurrentStats** object is contained under the **EthOamDmCfg** object and is a generalization of the **EthOamDmProactiveOneWayStats** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

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

Behavior:

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	Type	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 1..32 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

Operations / Methods:

Name	Description

Relationships:

The **EthOamDmProactiveOneWayHistoryStats** object is contained under the **EthOamDmCfg** object and is a generalization of the **EthOamDmProactiveOneWayStats** object.

Reportable Notifications:

objectCreation	O
objectDeletion	O

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	Type	Default Value	Qualifier
binStats	This attribute specifies the bin measurements.	BinStatsType		M, R

Operations / Methods:

Name	Description

Relationships:
The **EthOamDmProactiveTwoWayCurrentStats** object is contained under the **EthOamDmCfg** object and is a generalization of the **EthOamDmProactiveTwoWayStats** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

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	Type	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 1..32 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

Operations / Methods:

Name	Description

Relationships:
The **EthOamDmProactiveTwoWayHistoryStats** object is contained under the **EthOamDmCfg** object and is a generalization of the **EthOamDmProactiveTwoWayStats** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

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

Behavior:

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 Value	Qualifier
thresholdList	This attribute contains the list of threshold values to be configured for two-way Proactive Delay Measurements.	DelayMeasThresholdListType		O, R/W

Operations / Methods:

Name	Description

Relationships:
The **EthOamDmProactiveTwoWayThreshold** object has a one-to-one association with the **EthOamDmCfg** object.

Reportable Notifications:

objectCreation	O
objectDeletion	O

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	Type	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

Operations / Methods:

Name	Description

Relationships:
The **EthOamDmProactiveOneWayThreshold** object has a one-to-one association with the **EthOamDmCfg** object.

Reportable Notifications:

objectCreation	O
objectDeletion	O

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	Type	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 0..100.	List (<cos.>, float) thresholded	0	O, R
frameDelayOneWay	This attribute indicates the average one way Frame Delay per CoS	List (<cos.>, Integer) Thresholded (in ms)	0	O, R
frameDelayTwoWay	This attribute indicates the average round trip Frame Delay per CoS.	List (<cos.>, Integer) Thresholded (in ms)	0	O, R
frameLossRatio	This attribute indicates the ratio of frames lost per CoS.	List (<cos.>, float) thresholded	0	O, R
interFrameDelayVariationOneWay	This attribute indicates the average one way Inter-Frame Delay Variation per CoS	List (<cos.>, Integer) Thresholded (in ms)	0	O, R

interFrameDelayVariationTwoWay	This attribute indicates the average round trip Inter-Frame Delay Variation per CoS	List (<cos.>, Integer) Thresholded (in ms)	0	O, R
Operations / Methods:				
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	

9.4.4.3 EthMpPerfDataSet (ETH Maintenance Point Performance Data Set)

Behavior:				
This object contains the set of service OAM performance data to be collected for each Maintenance Point (MEP, MIP).				
Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**
inOamFramesDiscarded	This attribute indicates the count of incoming frames discarded at the MP.	Integer	0	O, R
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	O, 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	O, R
oamUnexpectedMegLevelErrors	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

	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.	Integer	0	O, R
uasErrors	This attribute indicates the count of Unavailable Seconds (UAS) for the MP.	Integer	0	O, R

Operations / Methods:	
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 **EthMpPerfDataSet** object is associated with the **EthMp** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

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	Type	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::AvailabilityStatus"	
ETH_FPP	attribute	administrativeState	CPTP (TP)	Layered Parameters: ServiceState	
ETH_FPP	attribute	ingressMaxAssignableBW	CPTP (TP)	Layered Parameters: IngressMaxAssignableBW	
ETH_FPP	attribute	egressMaxAssignableBW	CPTP (TP)	Layered Parameters: EgressMaxAssignableBW	
ETH_FPP	attribute	ingressMaxAssignableCosBW		Not Mappable	This optional attribute is not mapped
ETH_FPP	attribute	egressMaxAssignableCosBW		Not Mappable	This optional attribute is not mapped
ETH_FPP	attribute	maxNumVirtualConnections	CPTP	Layered Parameters: MaxNumFDFrs	
ETH_FPP	attribute	numConfiguredVirtualConnections	CPTP	Layered Parameters: NumConfiguredFDFrs	
ETH_FPP	attribute	mtuSize	CPTP	MaximumFrameSize	MTU Size does not include header, while frame size does.
ETH_FPP	attribute	alarmStatus	CPTP (TP)	additionalInfo: "M.3100::AlarmStatus"	
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	

Q.840.1 Object	Type	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH_FPP_UNI	attribute	layer2ControlProtocolProcessingList	CPTP (TP)	Layered Parameters: Layer2ControlProtocolProcessingList	
ETH_FPP_UNI	attribute	serviceMuxingIndicator	CPTP (TP)	Layered Parameters: ServiceMuxingIndicator	
ETH_FPP_UNI	attribute	bundling	CPTP (TP)	Layered Parameters: BundlingIndicator, AllToOneIndicator	
ETH_FPP_UNI	attribute	ingressVLANAssignmentAll	CPTP (TP)	Layered Parameters: PVID + PVIDFrameTypes	
ETH_FPP_UNI	attribute	ingressVLANAssignmentUntagged	CPTP (TP)	Layered Parameters: PVID + PVIDFrameTypes	
ETH_FPP_UNI	attribute	ingressVLANPriorityAssignmentAll	CPTP (TP)	PortDefaultUserPriority+ PVIDFrameTypes	
ETH_FPP_UNI	attribute	ingressVLANPriorityAssignmentUntagged	CPTP (TP)	PortDefaultUserPriority+ PVIDFrameTypes	
ETH_FPP_UNI	attribute	unassignedCeVlanIDList	CPTP	Not Mappable	This optional attribute is not mapped
ETH_FPP_UNI	attribute	nextAvailCeVlanID	CPTP	Not Mappable	This optional attribute is not mapped
ETH_Link			**EncapsulationLayerLink**		
ETH_Link	attribute	totalCapacity	CPTP	Layered Parameters: AvailableCapacity	Reflected on FPP (CPTP)
ETH_Link	attribute	userLabel	EncapsulationLayerLink	userLabel	
ETH_Link	attribute	usageCost	CPTP	Layered Parameters: LinkUsageCost	Reflected on FPP (CPTP)
ETH_FDFr_EVC			**FlowDomainFragment**		
ETH_FDFr_EVC	attribute	administrativeState	FlowDomainFragment	Layered Parameters: ServiceState	
ETH_FDFr_EVC	attribute	operationalState	FlowDomainFragment	Layered Parameters: ServiceState	
ETH_FDFr_EVC	attribute	availabilityStatus	FlowDomainFragment	additionalInfo: "X.721::AvailabilityStatus	
ETH_FDFr_EVC	attribute	protected	FlowDomainFragment	Not Mappable	Not Mapped Optional attribute GAP
ETH_FDFr_EVC	attribute	userLabel	FlowDomainFragment	userLabel	
ETH_FDFr_EVC	attribute	fDFrEvcType	FlowDomainFragment	Not Mappable	Not mapped. New attribute (e.g., mp2mp, p2p, rootedMp)
ETH_FDFr_EVC	attribute	fDFrEvcLabel	FlowDomainFragment	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	FlowDomainFragment	Layered Parameters: UniCeVlanIdPreservation	

Q.840.1 Object	Type	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH_FDFr_EVC	attribute	uniCeVlanCosPreservation	FlowDomainFragment	Layered Parameters: UniCeVlanCosPreservation	
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_FDFr_EVCwithFPPs	FlowDomain	addFPsToFDFr	
ETH_FDFr_EVC	operation	removeTPsFromMultiETH_FDFr_EVC	FlowDomain	removeFPsFromFDFr	
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::AvailabilityStatus	
ETH_Flow_Point	attribute	alarmStatus	CTP (TP)	additionalInfo: "M.3100::AlarmStatus"	
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	layer2ControlProtocolProcessingList	CTP (TP)	Layered Parameters: Layer2ControlProtocolDispositionList	
ETH_Flow_Point	attribute	unicastServiceFrameDelivery	CTP (TP)	Layered Parameters: UnicastServiceFrameDelivery	
ETH_Flow_Point	attribute	multicastServiceFrameDelivery	CTP (TP)	Layered Parameters: MulticastServiceFrameDelivery	
ETH_Flow_Point	attribute	broadcastServiceFrameDelivery	CTP (TP)	Layered Parameters: BroadcastServiceFrameDelivery	
ETH_Flow_Point	attribute	trailTerminating	CTP (TP)	tpMappingMode	
ETHBandwidthProfile (TrafficConditioner)			**TC Profile (CPTP)**		
ETHBandwidthProfile	attribute	userLabel	TCProfile	userLabel	
ETHBandwidthProfile	attribute	cir	TCProfile	Layered Parameters: IngressCIR	May be per COS
ETHBandwidthProfile	attribute	cbs	TCProfile	Layered Parameters: IngressCBS	May be per COS
ETHBandwidthProfile	attribute	eir	TCProfile	Layered Parameters: IngressEIR	May be per COS
ETHBandwidthProfile	attribute	ebs	TCProfile	Layered Parameters: IngressEBS	May be per COS
ETHBandwidthProfile	attribute	colorMode	TCProfile	Layered Parameters: IngressColorMode	May be per COS
ETHBandwidthProfile	attribute	couplingFlag	TCProfile	Layered Parameters: IngressCouplingFlag	May be per COS
ETHPerformanceProfile			**CPTP FP**	ingressCoSMapping	

Q.840.1 Object	Type	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
ETHServiceClassProfile			**CPTP FP**		
ETHServiceClassProfile	attribute	classifyType	CPTP FP	trafficMappingFrom_Table_VID or TrafficMappingFromTablePriority	
ETHServiceClassProfile	attribute	classifyValue	CPTP FP	trafficMappingFrom_Table_VID or TrafficMappingFromTablePriority	
ETHCoSBandwidthMapping			**CPTP FP**	TrafficMappingTable	
ETHCoSPerformanceMapping			**CPTP FP**	ClassOfServiceParameters	
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	elmiMinAsyncMessageInterval		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			**PhysicalTerminationPoint**		
TransportPort	attribute	characteristicInformationType	TP	Layer Rate	
TransportPort	attribute	operationalState	PTP	Layered Parameters: ServiceState	
TransportPort	attribute	alarmStatus	PTP	additionalInfo: "M.3100::AlarmStatus"	
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			**PTP**		
MAUTransportPort	attribute-INH	characteristicInformationType	TP	Layer Rate	
MAUTransportPort	attribute-INH	operationalState	PTP	Layered Parameters: ServiceState	

Q.840.1 Object	Type	Q.840.1 Item	MTNM Object	MTNM Item	Note
MAUTransportPort	attribute-INH	alarmStatus	PTP	additionalInfo: "M.3100::AlarmStatus"	
MAUTransportPort	attribute-INH	currentProblemList	PTP	Get Active Alarms	Open TMF Issue
MAUTransportPort	attribute-INH	userLabel	PTP	Location	
MAUTransportPort	attribute-INH	potentialCapacity	PTP	Layered Parameters: PotentialCapacity	
MAUTransportPort	attribute	mauType	PTP	Layered Parameters: MauType	
MAUTransportPort	attribute	mauMediaAvailable	PTP	Layered Parameters: MauMediaAvailable	
MAUTransportPort	attribute	mauJabberState	PTP	Layered Parameters: MauJabberState	
MAUTransportPort	attribute	mauDefaultType	PTP	Layered Parameters: MauDefaultType	
MAUTransportPort	attribute	mauMode	PTP	Layered Parameters: DuplexMode	
MAUTransportPort	attribute	mauAutoNegSupported	PTP	Layered Parameters: AutoNegotiation	
MAUTransportPort	attribute	mauTypeList	PTP	Layered Parameters: MauTypeList	
MAUTransportPort	attribute	mauJackTypeList	PTP	Layered Parameters: MauJackTypeList	
MAUTransportPort	attribute	mauAutoNegAdminState	PTP	Layered Parameters: MauAutoNegAdminState	
MAUTransportPort	attribute	mauAutoNegRemoteSignaling	PTP	Layered Parameters: MauAutoNegRemoteSignaling	
MAUTransportPort	attribute	mauAutoNegConfig	PTP	Layered Parameters: MauAutoNegConfig	
MAUTransportPort	attribute	mauAutoNegCapability	PTP	Layered Parameters: MauAutoNegCapability	
MAUTransportPort	attribute	mauAutoNegCapAdvertised	PTP	Layered Parameters: MauAutoNegCapAdvertised	
MAUTransportPort	attribute	mauAutoNegCapReceived	PTP	Layered Parameters: MauAutoNegCapReceived	
MAUTransportPort	attribute	mauAutoNegRemoteFaultAdvertised	PTP	Layered Parameters: MauAutoNegRemoteFaultAdvertised	
MAUTransportPort	attribute	mauAutoNegRemoteFaultReceived	PTP	Layered Parameters: MauAutoNegRemoteFaultReceived	
MAUTransportPort	operation	mauAutoNegRestart		Not Mappable	MAU Auto Negotiation Restart operation not mapped
ETH UNI Anomalies Performance Data Set			**SD1-28 Perf Parameters**		
ETH UNI Anomalies PerformanceDataSet	Performance measurement	Undersized Frames	SD1-28 Perf Parameters	"PMP_SUPKTS"	
ETH UNI Anomalies PerformanceDataSet	Performance measurement	Oversized Frames	SD1-28 Perf Parameters	"PMP_FTLE"	
ETH UNI Anomalies PerformanceDataSet	Performance measurement	Fragments	SD1-28 Perf Parameters	"PMP_SFRAGS"	
ETH UNI Anomalies PerformanceDataSet	Performance measurement	FCS and Alignment Errors	SD1-28 Perf Parameters	"PMP_FCSE"	

Q.840.1 Object	Type	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH UNI Anomalies PerformanceDataSet	Performance measurement	Invalid CE-VLAN ID	SD1-28 Perf Parameters	"PMP_INVALID_CE-VLAN-ID"	
ETH UNI Traffic Performance Data Set			**SD1-28 Perf Parameters**		
ETH UNI Traffic PerformanceDataSet	Performance measurement	Octets Transmitted OK	SD1-28 Perf Parameters	"PMP_OCTECTS"	
ETH UNI Traffic PerformanceDataSet	Performance measurement	Unicast Frames Transmitted OK	SD1-28 Perf Parameters	"PMP_UCASTPKTS"	
ETH UNI Traffic PerformanceDataSet	Performance measurement	Multicast Frames Transmitted OK	SD1-28 Perf Parameters	"PMP_MULTICASTPKTS"	
ETH UNI Traffic PerformanceDataSet	Performance measurement	Broadcast Frames Transmitted OK	SD1-28 Perf Parameters	"PMP_BROADCASTPKTS"	
ETH UNI Traffic PerformanceDataSet	Performance measurement	Octets Received OK	SD1-28 Perf Parameters	"PMP_OCTECTS"	
ETH UNI Traffic PerformanceDataSet	Performance measurement	Unicast Frames Received OK	SD1-28 Perf Parameters	"PMP_UCASTPKTS"	
ETH UNI Traffic PerformanceDataSet	Performance measurement	Multicast Frames Received OK	SD1-28 Perf Parameters	"PMP_MULTICASTPKTS"	
ETH UNI Traffic PerformanceDataSet	Performance measurement	Broadcast Frames Received OK	SD1-28 Perf Parameters	"PMP_BROADCASTPKTS"	
ETH Ingress Traffic Management Performance Data Set			**SD1-28 Perf Parameters**		
ETH Ingress Traffic Management PerformanceDataSet	Performance measurement	ingressGreenFrameCount	SD1-28 Perf Parameters	"PMP_INGRESS_GREEN_FRAME_COUNT<cos>"	
ETH Ingress Traffic Management PerformanceDataSet	Performance measurement	ingressYellowFrameCount	SD1-28 Perf Parameters	"PMP_INGRESS_YELLOW_FRAME_COUNT<cos>"	
ETH Ingress Traffic Management PerformanceDataSet	Performance measurement	ingressRedFrameCount	SD1-28 Perf Parameters	"PMP_INGRESS_RED_FRAME_COUNT<cos>"	
ETH Ingress Traffic Management PerformanceDataSet	Performance measurement	ingressGreenOctetCount	SD1-28 Perf Parameters	"PMP_INGRESS_GREEN_OCTET_COUNT<cos>"	
ETH Ingress Traffic Management PerformanceDataSet	Performance measurement	ingressYellowOctetCount	SD1-28 Perf Parameters	"PMP_INGRESS_YELLOW_OCTET_COUNT<cos>"	
ETH Ingress Traffic Management PerformanceDataSet	Performance measurement	ingressRedOctetCount	SD1-28 Perf Parameters	"PMP_INGRESS_RED_OCTET_COUNT<cos>"	
ETH Egress Traffic Management Performance Data Set			**SD1-28 Perf Parameters**		
ETH Egress Traffic Management PerformanceDataSet	Performance measurement	egressGreenFrameCount	SD1-28 Perf Parameters	"PMP_EGRESS_GREEN_FRAME_COUNT<cos>"	
ETH Egress Traffic Management PerformanceDataSet	Performance measurement	egressYellowFrameCount	SD1-28 Perf Parameters	"PMP_EGRESS_YELLOW_FRAME_COUNT<cos>"	
ETH Egress Traffic Management PerformanceDataSet	Performance measurement	egressGreenOctetCount	SD1-28 Perf Parameters	"PMP_EGRESS_GREEN_OCTET_COUNT<cos>"	
ETH Egress Traffic Management PerformanceDataSet	Performance measurement	egressYellowOctetCount	SD1-28 Perf Parameters	"PMP_EGRESS_YELLOW_OCTET_COUNT<cos>"	
ETH Congestion Discards Performance Data Set			**SD1-28 Perf Parameters**		

Q.840.1 Object	Type	Q.840.1 Item	MTNM Object	MTNM Item	Note
ETH Congestion Discards PerformanceDataSet	Performance measurement	greenFrameDiscards	SD1-28 Perf Parameters	"PMP_GREEN_FRAME_DISCARDS<cos>"	
ETH Congestion Discards PerformanceDataSet	Performance measurement	yellowFrameDiscards	SD1-28 Perf Parameters	"PMP_YELLOW_FRAME_DISCARDS<cos>"	
ETH Congestion Discards PerformanceDataSet	Performance measurement	greenOctetDiscards	SD1-28 Perf Parameters	"PMP_GREEN_OCTET_DISCARDS<cos>"	
ETH Congestion Discards PerformanceDataSet	Performance measurement	yellowOctetDiscards	SD1-28 Perf Parameters	"PMP_YELLOW_OCTET_DISCARDS<cos>"	
ETH ELMI Performance Data Set					
ETH ELMI PerformanceDataSet	Performance measurement	sumofElmiReliabilityErrors	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
ETH ELMI PerformanceDataSet	Performance measurement	sumofElmiProtocolErrors	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
ETH ELMI PerformanceDataSet	Performance measurement	elmiNonrcptStatusAndStatusEnquiryCount	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
ETH ELMI PerformanceDataSet	Performance measurement	elmiInvalidSeqNumCount	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
ETH ELMI PerformanceDataSet	Performance measurement	elmiProtocolVersionCount	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
ETH ELMI PerformanceDataSet	Performance measurement	elmiTooShortCount	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
ETH ELMI PerformanceDataSet	Performance measurement	elmiMessageTypeErrorCount	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
ETH ELMI PerformanceDataSet	Performance measurement	elmiInfoElementErrorCount	SD1-28 Perf Parameters	Not Mappable	New attribute not mapped
MAU Termination Performance Data Set			**SD1-28 Perf Parameters**		
MAU Termination PerformanceDataSet	Performance measurement	ifMauMediaAvailableStateExits	SD1-28 Perf Parameters	"PMP_IF_MAU_MEDIA_AVAILABLE_STATE_EXITS"	
MAU Termination PerformanceDataSet	Performance measurement	ifMauJabberingStateEnters	SD1-28 Perf Parameters	"PMP_IF_MAU_JABBERING_STATE_ENTERS"	
MAU Termination PerformanceDataSet	Performance measurement	ifMauFalseCarriers	SD1-28 Perf Parameters	"PMP_IF_MAU_FALSE_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 ifOperStatus	ITU-T X.731 Operational State	ITU-T X.731 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 1..1522 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 1..255. Defined in IEEE 802.1 LLDP-MIB.			IEEE 802.1 LLDP-MIB
LldpPortId	This data type represents an octet string of length 1..255. 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

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 0..7.			Y.1731
Taddress	This data type denotes a transport service address and is represented by an octet string of length 1..255. 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

CfmIngressActionType		Enumeration	ingNoTlv, ingOk, ingDown, ingBlocked, ingVid	IEEE 802.1ag
ConnectivityStatusType		Enumeration	active, partiallyActive, inactive	
DelayMeasCounterType	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	15minAvgBiDirectionalFd, 15minMaxBiDirectionalFd, 15minAvgNearEndFdv, 15minMaxNearEndFdv, 15minAvgFarEndFdv, 15minMaxFarEndFdv, 24hrAvgBiDirectionalFd, 24hrMaxBiDirectionalFd, 24hrAvgNearEndFdv, 24hrMaxNearEndFdv, 24hrAvgFarEndFdv, 24hrMaxFarEndFdv, 24hrMaxNearEndFdvOneWay, 24hrAvgNearEndFdvOneWay, 24hrAvgFarEndFdvOneWay, 24hrMaxFarEndFdvOneWay,	
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, someRMEPCCMdefect, someMACstatusDefect, 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
MaintAssocNameFormat	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, macAddressAndUint, 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	
MpType		Enumeration	none, mep, mip	

MultipointIndicatorType		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
SenderIdTlvPermissionType	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, sendIdChassisManage, 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 type represents a set of AlarmRecord instances. 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

Description

This complex data type represents a set of one or more bin threshold and bin number pairs.

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 represents an abstract, or scheduled, date and time.

Attributes

Name	Description	Base Type	Permited Values
day	This attribute represents the day portion with a valid range of 0..7 where the value 0 indicates the current day, 1 represents Monday and 7 represents Sunday.	Integer	0..7
hour	This attribute represents the hours portion with a valid range of 0..24	Integer	0..24
minute	This attribute represents the minutes portion with a valid range of 0..59.	Integer	0..59
second	This attribute represents the seconds portion with a valid range of 0..59.	Integer	0..59

Data Type: DelayMeasThresholdListType

Description

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

	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

Description

This complex data type is used to specify a duration of time, or relative time, in hours:minutes:seconds format. A value of zero indicates a duration of forever.

An example value is 6:10:30 which represents a relative time of 6 hours, 10 minutes and 30 seconds.

Attributes

Name	Description	Base Type	Permited Values
hours	This attribute represents the hours portion of RelativeTime with a valid range of 0..24	Integer	0..24
minutes	This attribute represents the minutes portion of RelativeTime with a valid range of 0..59.	Integer	0..59
seconds	This attribute represents the seconds portion of RelativeTime with a valid range of 0..59.	Integer	0..59

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	

multicastEnabled		
priority	dot1agCfmMepCcmLtmPriority	
dropEligible		
lowestPriorityDefect	dot1agCfmMepLowPrDef	
faultAlarmTime		
faultAlarmResetTime		
EthOamCcStats		
numCcmOut	dot1agCfmMepCciSentCcms	
numCcmOutOfSequence	dot1agCfmMepCcmSequenceErrors	
portStatusTlv	dot1agCfmMepDbPortStatusTlv	
interfaceStatusTlv	dot1agCfmMepDbInterfaceStatusTlv	
highestPriorityDefect	dot1agCfmMepHighestPrDefect	
highestDefect		
defectsPresent	dot1agCfmMepDefects	
ErrorCcmLastFailure	dot1agCfmMepErrorCcmLastFailure	
xconCcmLastFailure	dot1agCfmMepXconCcmLastFailure	
EthOamLtCfg		
priority	dot1agCfmMepCcmLtmPriority	
dropEligible	No MIB; Fixed value	
ttl	dot1agCfmMepTransmitLtmTtl	
flags	dot1agCfmMepTransmitLtmFlags	
ltmMsgStatus	dot1agCfmMepTransmitLtmStatus	
ltmEgressId	dot1agCfmMepTransmitLtmEgressIdentifier	
lastLtmTransId	dot1agCfmMepTransmitLtmSeqNumber	
nextLtmTransId	dot1agCfmMepLtmNextSeqNumber	
numLtrInUnexp	dot1agCfmMepUnexpLtrIn	
EthOamLtrStats		
ttl	dot1agCfmLtrTtl	
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		

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