MEF

Technical Specification
MEF 7.2

Carrier Ethernet
Management Information Model

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Carrier Ethernet Management Information Model

1 Abstract

This Specification defines a common set of managed object definitions that are consistent and readily integrated into a Carrier Ethernet Provider's operations environment. This common management model helps ensure that vendors provide management functionality and information in their OSSs, NMSs, EMSs, and NEs in a logically consistent fashion, and allows service providers to readily integrate such capabilities into their management environment.

ITU-T Recommendation M.3100 [15], the Generic Information Model, defines three management information views:

1. "The Network Element view is concerned with the information that is required to manage a Network Element (NE)." This includes "the information required to manage the Network Element Function (NEF) and the physical aspects of the NE."

2. "The Network view is concerned with the information representing the network, both physically and logically. It is concerned with how Network Element entities are related, topographically interconnected, and configured to provide and maintain end-to-end connectivity."

3. "The service view is concerned with how network view aspects (such as an end-to-end path) are utilized to provide a network service, and, as such, is concerned with the requirements of a network service (e.g. availability, cost, etc.), and how these requirements are met through the use of the network, and all related customer information."

    "Objects defined for a given view may be used in others, and any object may be used by any interface which requires it."

This Specification describes the overall Carrier Ethernet Management Information Model to identify and define the set of management information necessary to manage the Carrier Ethernet services as defined by the Metro Ethernet Forum. This Management Information Model serves as the base model that will be applied to define the information requirements for specific management interfaces (e.g., EMS-NMS, Remote Management Interface (RMI), Element-View interface, etc.). Each interface specific definition will identify its information requirements as a subset of this core model, and describe how each information element will be applied to suit the particular needs of the management interface.

The management functions supported by the information model in this Specification include: configuration management, performance management including performance monitoring and evaluation of performance, and alarm reporting and testing in fault management. This Specification does not cover all aspects of Ethernet management, only those related to the management of Carrier Ethernet services as defined by the MEF. In addition this document draws upon service requirements identified in MEF, ITU-T, and IEEE documents identified in the reference section.

In particular, this MEF Technical Specifications draws from ITU-T Q.840.1 [34]. ITU-T Q.840.1 provides a network view of Carrier Ethernet and EoT managed entities are modeled according to a protocol-neutral information modeling approach, and the Unified Modeling

Language (UML) use case descriptions. Class diagrams and sequence diagrams are also provided for both the requirements and the analysis of this management interface. Many of the object classes defined in ITU-T Q.840.1 may be reapplied in defining a Management Information Model for Carrier Ethernet Services.

Beyond the information model provided in MEF 7.1, MEF 7.2 supports additional sets of service attributes defined in recent MEF Specifications. Specifically MEF 7.2 adds support for:

- Ethernet External Network Network Interface (ENNI) Service Attributes,

- UNI Tunnel Access (UTA) / Virtual User Network Interface (VUNI) Service Attributes,

- SOAM Service Attributes,

- Virtual Network Interface Device (vNID) Remote Management Interface, and

- Ethernet Access Services

2   Terminology and Acronyms

This Specification uses the following terms.

Term	Acronym	Definition	Ref.
One-Way Delay Message	1DM	One-way delay message for SOAM-PM	ITU-T Y.1731 [56]
Access Ethernet Private Line	Access EPL	Access EPL service uses a Point-to-Point OVC to associate one OVC End Point at a UNI and one OVC End Point at an ENNI. One UNI can support only a single instance of the Access EPL service.	MEF 33 [11]
Access Ethernet Virtual Private Line	Access EVPL	Access EVPL service uses a Point-to-Point OVC to associate one OVC End Point at a UNI and one OVC End Point at an ENNI. One UNI can support one or more Access EVPL instances.	MEF 33 [11]
Access Provider	AP	An Operator CEN that offers the Ethernet Access Service type.	MEF 33 [11]
Alarm Indication Signal	AIS	Alarm Indication Signal	ITU-T G.8021 [55]
Alarm Severity Assignment Profile	ASAP	Specifies the alarm severity assignment for managed objects.	ITU-T M.3100 [15]
Attribute Value Change	AVC	Attribute value change notification.	ITU-T Q.827.1 [31]
Bandwidth Profile	BWP	A Bandwidth Profile is a characterization of the lengths and arrival times for Service Frames at a reference point.	MEF 10.2 [5]
Bit Error Rate	BER	Bit Error Rate	
Broadcast Service Frame		A Service Frame that has the broadcast destination MAC address.	MEF 10.2 [5]
Business Management Layer	BML	Business Management Layer	ITU-T M.3010
Carrier Ethernet Network	CEN	Carrier Ethernet Network (formerly Metro Ethernet Network)	MEF 2 [1]
CE-VLAN CoS ID		Customer Edge VLAN CoS. Also C-tag PCP.	MEF 10.2 [5]

Term	Acronym	Definition	Ref.
CE-VLAN CoS ID Preservation		CE-VLAN CoS ID Preservation describes a relationship between the format and certain field values of the frame at one External Interface and of the corresponding frame at another External Interface	MEF 10.2 [5], MEF 26.1 [8]
CE-VLAN ID		Customer Edge VLAN ID	MEF 10.2 [5]
CE-VLAN ID Preservation		CE-VLAN ID Preservation describes a relationship between the format and certain field values of the frame at one External Interface and of the corresponding frame at another External Interface	MEF 10.2 [5], MEF 26.1 [8]
Class of Service	CoS	A set of Service Frames that have a commitment from the Service Provider to receive a particular level of performance	MEF 10.2 [5]
Color Mode	CM	CM is a Bandwidth Profile parameter. The Color Mode parameter indicates whether the color-aware or color-blind property is employed by the Bandwidth Profile. It takes a value of "color-blind" or "color-aware" only.	MEF 10.2 [5]
Committed Burst Size	CBS	CBS is a Bandwidth Profile parameter. It limits the maximum number of bytes available for a burst of Frames sent at the EI speed to remain CIR-conformant.	MEF 10.2 [5]
Committed Information Rate	CIR	CIR is a Bandwidth Profile parameter. It defines the average rate in bits/s of Frames at an EI up to which the network delivers Frames, and is committed to meeting the performance objectives defined by the CoS Service Attribute.	MEF 10.2 [5]
Common Object Request Broker Architecture	CORBA	Mechanism for normalizing the method-call semantics between application objects.	OMG CORBA 3.2 [63]
Continuity Check Message	CCM	Continuity Check Message	IEEE 802.1ag ITU-T Y.1731 [56]
Connectivity Fault Management	CFM	Connectivity Fault Management	IEEE 802.1ag [54]
CoS Identifier	CoS ID	The Class of Service identifier (CoS ID) is defined for Service Frames (defined in MEF 10.2) and for ENNI Frames (defined in MEF 26.1), and further discussed in the CoS IA (MEF 23).	MEF 23 MEF10.2 [5], MEF 26.1 [8]
Coupling Flag	CF	CF is a Bandwidth Profile parameter. The Coupling Flag allows the choice between two modes of operation of the rate enforcement algorithm. It takes a value of 0 or 1 only.	MEF 10.2 [5]
Customer Edge	CE	Equipment on the Subscriber side of the UNI.	MEF 10.2 [5]
Cyclic Redundancy Check	CRC	Cyclic Redundancy Check	MEF 2 [1]
Delay Measurement	DM	Delay Measurement	MEF 35 [12]
Delay Measurement Message	DMM	Delay Measurement Message	ITU-T Y.1731 [56]
Delay Measurement Reply	DMR	Delay Measurement Reply	ITU-T Y.1731 [56]
Dual-Ended OAM		A type of process where a MEP sends measurement information to a peer MEP that will perform the calculations.	MEF 35 [12]

Term	Acronym	Definition	Ref.
Egress Bandwidth Profile		A service attribute that specifies the length and arrival time characteristics of egress Frames at the egress EI.	MEF 10.2 [5]
Egress Service Frame		A Service Frame sent from the Service Provider network to the CE.	MEF 10.2 [5]
Element Management System	EMS	Element Management System	This Document
External Network Network Interface	ENNI	A reference point representing the boundary between two Operator CENs that are operated as separate administrative domains	MEF 4 [2]
Ethernet over Transport	EoT	Ethernet over transport	ITU-T G.8010 [38]
Ethernet Services Layer Network	ETH	Ethernet services layer network	ITU-T G.8010 [38]
Ethernet Physical Layer Network	ETY	Ethernet physical layer network	ITU-T G.8010 [38]
ENNI Frame		The first bit of the Destination Address to the last bit of the Frame Check Sequence of the Ethernet Frame transmitted across the ENNI	MEF 26.1 [8]
Ethernet Virtual Connection	EVC	An association of two or more UNIs that limits the exchange of Service Frames to UNIs in the Ethernet Virtual Connection.	MEF 10.2 [5]
EVC MTU Size		The maximum sized Service Frame allowed for an EVC.	MEF 10.2 [5]
Excess Burst Size	EBS	EBS is a Bandwidth Profile parameter. It limits the maximum number of bytes available for a burst of Frames sent at the EI speed to remain EIR-conformant.	MEF 10.2 [5]
Excess Information Rate	EIR	EIR is a Bandwidth Profile parameter. It defines the average rate in bits/s of Frames up to which the network may deliver Frames but without any performance objectives.	MEF 10.2 [5]
Extensible Markup Language	XML	A set of rules for encoding documents in a format that is both human-readable and machine-readable.	W3C XML 1.0 [64]
External Interface	EI	Either a UNI or an ENNI	MEF 26.1 [8]
Fault Management	FM	Fault management (e.g., SOAM FM)	ITU-T M.3400 [22]
Flow Domain Fragment	FDFr	Flow domain fragment (particularly at the ETH layer)	ITU-T Q.840.1 [34]
Flow Point	FP	Flow point	ITU-T G.809 [36]
Flow Point Pool	FPP	Flow point pool	ITU-T G.809 [36]
Loss Measurement Message	LMM	Loss measurement message (SOAM)	ITU-T Y.1731 [56]
Loss Measurement Reply	LMR	Loss measurement reply (SOAM)	ITU-T Y.1731 [56]

Term	Acronym	Definition	Ref.
Frame Check Sequence	FCS	Frame check sequence	
Frame Delay	FD	The time required to transmit a Service Frame from ingress UNI to egress UNI.	MEF 10.2 [5]
Frame Loss Ratio	FLR	Frame Loss Ratio is the number of lost frames between the ingress UNI and the egress UNI. Frame Loss Ratio is expressed as a percentage.	MEF 10.2 [5]
Ingress Bandwidth Profile		A characterization of ingress Frame arrival times and lengths at the ingress EI and a specification of disposition of each Frame based on its level of compliance with the characterization.	MEF 10.2 [5]
Ingress Service Frame		A Service Frame sent from an EI into the Service Provider network.	MEF 10.2 [5]
Inter-Frame Delay Variation	IFDV	The difference in delay of two Service Frames belonging to the same CoS instance.	MEF 10.2 [5]
Layer Network Domain	LND	A layer network domain (LND) represents an administration's view of the resources responsible for transporting a specific type of characteristic information (e.g., IP, ETH (layer 2), ETY (ETH PHY), etc.)	This Document
Locked (SOAM)	LCK	Locked, used in reference to LCK PDUs	MEF 30
Loopback Message	LBM	Loopback Message	IEEE 802.1ag [54], ITU-T Y.1731 [56]
Loopback Reply	LBR	Loopback Reply	IEEE 802.1ag [54], ITU-T Y.1731 [56]
Linktrace Message	LTM	Linktrace Message	IEEE 802.1ag [54], ITU-T Y.1731 [56]
Linktrace Reply	LTR	Linktrace Reply	IEEE 802.1ag [54], ITU-T Y.1731 [56]
Maintenance Association	MA	A set of MEPs, each configured with the same MAID and MD Level, established to verify the integrity of a single service instance. An MA can also be thought of as a full mesh of Maintenance Entities among a set of MEPs so configured. This term is equivalent to a Maintenance Entity Group, or MEG, as defined by ITU-T Y.1731, which is the term used in this IA.	IEEE 802.1Q-2011 [47]

Term	Acronym	Definition	Ref.
Maintenance association End Point	MEP	Maintenance association End Point (IEEE 802.1Q-2011), or equivalently MEG End Point (ITUT Y.1731 or MEF 17).	IEEE 802.1Q-2011 [47], ITU-T Y.1731 [56], MEF 17 [65]
Maintenance domain Intermediate Point	MIP	Maintenance domain Intermediate Point (IEEE 802.1Q-2011) or equivalently a MEG Intermediate Point (ITU-T Y.1731 or MEF 17)	IEEE 802.1Q-2011 [47], ITU-T Y.1731 [56] MEF 17 [65]
Maintenance Entity	ME	A point-to-point relationship between two MEPs within a single MA. This term is equivalent to a Maintenance Entity, or ME, as defined by ITU-T Y.1731.	IEEE 802.1Q-2011 [47]
Maintenance Entity Group	MEG	Note that IEEE 802.1Q-2011 uses the term Maintenance Association, while ITU-T Y.1731 uses "Maintenance Entity Group". These two terms are equivalent.	ITU-T Y.1731 [56]
Maintenance Point	MP	Maintenance Point One of either a MEP or a MIP.	IEEE 802.1Q-2011 [47]
Management Information Base	MIB	Management information base	
Maximum Transmission Unit	MTU	The maximum sized Service Frame allowed for an Ethernet service.	MEF 6.1 [58]
Media Access Control	MAC	Media access control	MEF 2 [1]
Medium Access Unit	MAU	Medium Access Unit	IETF RFC 4836 [50]
Multicast Service Frame		A Service Frame that has a multicast destination MAC address.	MEF 10.2 [5]
Multipoint-to-Multipoint EVC		An EVC with two or more UNIs.	MEF 10.2 [5]
Network Element	NE	Network Element	
Network Element View	NE View	"The Network Element view is concerned with the information that is required to manage a Network Element (NE)." This includes "the information required to manage the Network Element Function (NEF) and the physical aspects of the NE."	ITU-T M.3100 [15]
Network Management System	NMS	Network Management System	
Network View		"The Network view is concerned with the information representing the network, both physically and logically. It is concerned with how Network Element entities are related, topographically interconnected, and configured to provide and maintain end-to-end connectivity."	ITU-T M.3100 [15]
On-Demand OAM		OAM actions that are initiated via manual intervention for a limited time to carry out diagnostics. On-Demand OAM can result in singular or periodic OAM actions during the diagnostic time interval.	MEF 35 [12]
Operator Virtual Connection	OVC	An association of OVC End Points	MEF 26.1 [8]

Term	Acronym	Definition	Ref.
Operations, Administration, and Maintenance	OAM	Operations, administration and maintenance.	MEF 2 [1]
OVC End Point		An association of an OVC with a specific External Interface i.e., UNI, ENNI	MEF 26.1 [8]
Performance Management	PM	Performance Management (e.g., SOAM PM)	ITU-T M.3400 [22]
Physical Layer	PHY	Physical layer	ITU-T G.8010 [38]
Point-to-Point	P2P	A connection with exactly 2 endpoints.	MEF 6.1 [47]
Proactive OAM		OAM actions that are carried on continuously to permit timely reporting of fault and/or performance status.	MEF 35 [12]
Protocol Data Unit	PDU	Protocol data unit	MEF 8 [66]
Remote Defect Indication	RDI	Remote defect indication	MEF 3 [67]
Remote Management Interface	RMI	The vNID remote management interface	
Rooted-Multipoint EVC		A multipoint EVC in which each UNI is designated as either a Root or a Leaf. Ingress Service Frames at a Root UNI can be delivered to one or more of any of the other UNIs in the EVC. Ingress Service Frames at a Leaf UNI can only be delivered to one or more Root UNIs in the EVC.	MEF 6.1 [47]
Service Frame		An Ethernet frame transmitted across the UNI toward the Service Provider or an Ethernet frame transmitted across the UNI toward the Subscriber.	MEF 6.1 [47]
Service Level Specification	SLS	The technical specification of the service level being offered by the Service Provider to the Subscriber or Operator.	MEF 10.2 [5], MEF 26.1 [8]
Service Multiplexing		A UNI service attribute in which the UNI can be in more than one EVC instance.	MEF 10.2 [5]
Service Operations, Administration, and Maintenance	SOAM	Service Operations, Administration, and Maintenance	MEF 17 [65]
Service Provider		The organization providing UNI to UNI Ethernet Service(s).	MEF 10.2 [5]
Service View		"The service view is concerned with how network view aspects (such as an end-to-end path) are utilized to provide a network service, and, as such, is concerned with the requirements of a network service (e.g. availability, cost, etc.), and how these requirements are met through the use of the network, and all related customer information."	ITU-T M.3100 [15]
Simple Network Management Protocol	SNMP	Internet-standard protocol for managing devices	IETF STD 58 [69]
Single-Ended OAM		A type of process where a MEP sends a measurement request and the peer MEP replies with the requested information so the originating MEP can calculate the measurement.	MEF 35 [12]
Subscriber		The organization purchasing and/or using Ethernet Services.	MEF 10.2 [5]
S-Tag		Service VLAN Tag.	IEEE Std 802.1ad [48]

Term	Acronym	Definition	Ref.
S-VLAN ID		The 12 bit VLAN ID field in the S-Tag of an ENNI Frame	MEF 26.1 [8]
Test PDU	TST	Test PDU	MEF 30 [10]
Time to Live	TTL	Time to Live	
Trail Termination Point	TTP	Trail termination point	ITU-T M.3100 [15]
Type, Length, and Value	TLV	Type, length, and value, a method of encoding information	IEEE 802.1 [46]
Unicast Service Frame		A Service Frame that has a unicast destination MAC address.	MEF 10.2 [5]
UNI Tunnel Access Operator Virtual Connection	UTA OVC	An OVC in the Network Operator's CEN that provides an association of a remote UNI with an ENNI in support of UTA.	MEF 28 [9]
Unified Modeling Language	UML	Unified modeling language used to define object oriented information models	OMG UML 2.0 [70]
User Network Interface	UNI	The physical demarcation point between the responsibility of the Service Provider and the responsibility of the Subscriber.	MEF 10.2 [5]
Virtual Network Interface Device	vNID	Virtual network interface device	
Virtual UNI	VUNI	Virtual UNI (VUNI) is the component consisting of a collection of service attributes in the VUNI Provider's CEN. The VUNI is paired with a remote UNI in a Network Operator's CEN. The main function of the VUNI is to map frames between a set of one or more OVCs present in the VUNI Provider domain and a single UTA.	MEF 28 [9]
Virtual Local Area Network	VLAN	Virtual LAN	IEEE 802.3-2008 [44]

3   Scope and General Overview

In G.8010 [38], two layer networks are defined in the EoT network architecture:

- Ethernet MAC (ETH) Layer Network

- Ethernet PHY (ETY) Layer Network

G.805 [35] / G.809 [36] 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 management objects needed to support what is considered to be the essential functionality of Carrier Ethernet Network (CEN) 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 service attributes supported by this Management Information Model are identified in MEF 10.2 [5].

MEF Ethernet Services Attributes Phase 2 [5] introduces the rooted multipoint EVC 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]

Interface profiles will be provided in associated specifications. They will identify the managed objects (i.e. logical UML objects) for each specific interface profile. Interface profiles will be used for creating management protocol specific data models based on CORBA, SNMP, NETCONF (XML), etc. Each logical model based interface profile has great value in that it provides a protocol independent way of representing the information required for managing Carrier Ethernet services in a particular interface specific context. The goal of this specification is to provide a set of overall management objects that can be used to specify interface profiles in a semantically consistent fashion.

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

- Ethernet (ETH) layer network interfaces (e.g., UNI, ENNI, VUNI) configuration and provisioning;

- ETH layer configuration and provisioning (including flow domain (subnetwork) provisioning);

- ETH layer network connection (i.e. EVC, OVC) management (including set-up/modification);

- ETH layer fault management;

- ETH layer performance monitoring;

- Management of the MAU/ETY layers ports (i.e. trail terminations).

The Ethernet Services Layer, also referred to as the ETH Layer, is the specific layer network within a Carrier Ethernet Network (CEN) 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 10.2 [5]), 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 802.3-2008 frame format [44].

Figure 3-1 shows the relationship between the CEN interfaces defined in the MEF Generic Architecture Framework (MEF 4 [2]) 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.

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[1] Rooted multipoint EVC is defined in the MEF Services Attributes Phase 2 Services Attributes specification.
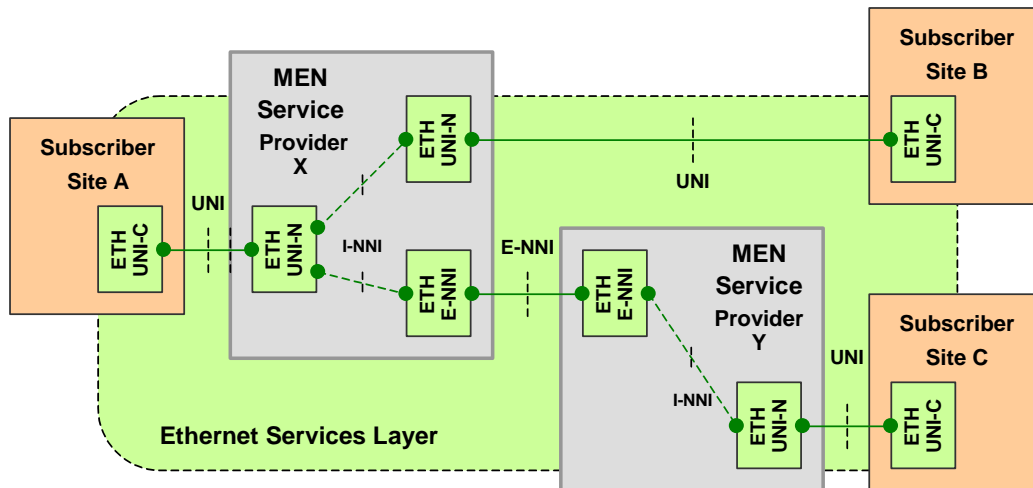
Figure 3-1 ETH Layer Interfaces and Reference Points

3.1 Service and Network View Concepts

The Service and Network Views provide an abstraction of service and network resources allowing for flexibility in the management of the Ethernet Services and the underlying network resources. This layering abstraction, allows multiple services and network technologies to be managed in an integrated fashion, the representation of a topological view of resources, and the management of end-to-end connectivity or service flows across the managed domain.

The service and network view abstraction resides at the Service Management Layer (SML) and Network Management Layer (NML) of TMN respectively. The service and network view abstraction provides service, flow, and connection oriented information that may be reapplied at the Element Management Layer (EML) and Element Layer (EL) nodal oriented Management Information Models. The Business Management Layer (BML) provides functions for managing the overall business.
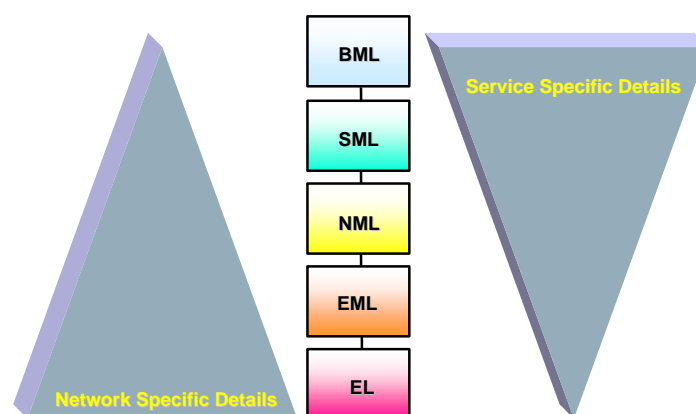
Figure 3-2 TMN Functional Layering

Service and network view models incorporate the concepts of layering, domain or subnetwork partitioning, topological view, and flow or connectivity view. These concepts allow the service and network view to provide an abstraction of the Carrier Ethernet Services being managed as an aggregate view of network resources.

A layer network domain (LND) represents an administration's view of the 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 model describes the flows (connections) through an LND, and the associated 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 service connectivity (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.

Table 3-1 Mapping to MEF 12.1, ITU-T G.805 and G.809 Constructs

MEF 7.2 / ITU-T Q.840.1 [34] Entity	MEF 12.1 [68] (and 12.1.1) Architecture Construct	Connection Oriented (ITU-T G.805 [35])	Connectionless (ITU-T G.809 [36])
ETH_Flow_Domain	ETH Flow Domain	Subnetwork	FlowDomain (MatrixFlowDomain)
ETH_FPP_UNI	ETH Access Group External Interface (EI) ETH UNI	Connection Point	FPP (FlowPointPool)
ETH_FPP_ENNI	ETH Access Group External Interface (EI) ETH ENNI	Connection Point	FPP (FlowPointPool)
ETH_FPP_Link (not used in MEF 7.2)	ETH Link	Link	FPPLink
ETH_FDFr_EVC	Subscriber ETH Connection (S-EC) Operator ETH Connection (O-EC)	Trail	FDFr (FlowDomainFragment)
ETH_OVC	Subscriber ETH Connection Segment (S-ECS) Operator ETH Connection (O-EC)	SNC (SubnetworkConnection)	Flow
ETH_OVC_End_Point	ETH Flow Point (FP) ETH Termination	Network CTP (Connection Termination Point)	Flow Point Termination Flow Point

	Flow Point (TFP)		
ETH_VUNI	ETH VUNI	Connection Point	Flow Point
ETH_Flow_Point	ETH Flow Point (FP) ETH Termination Flow Point (TFP)	Connection Point Network TTP (Trail Termination Point)	Flow Point Termination Flow Point

3.1.1 Layering

Layering provides 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 the example in Figure 3-3, 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. Note that the Layering may be represented by multiple Management Domains.
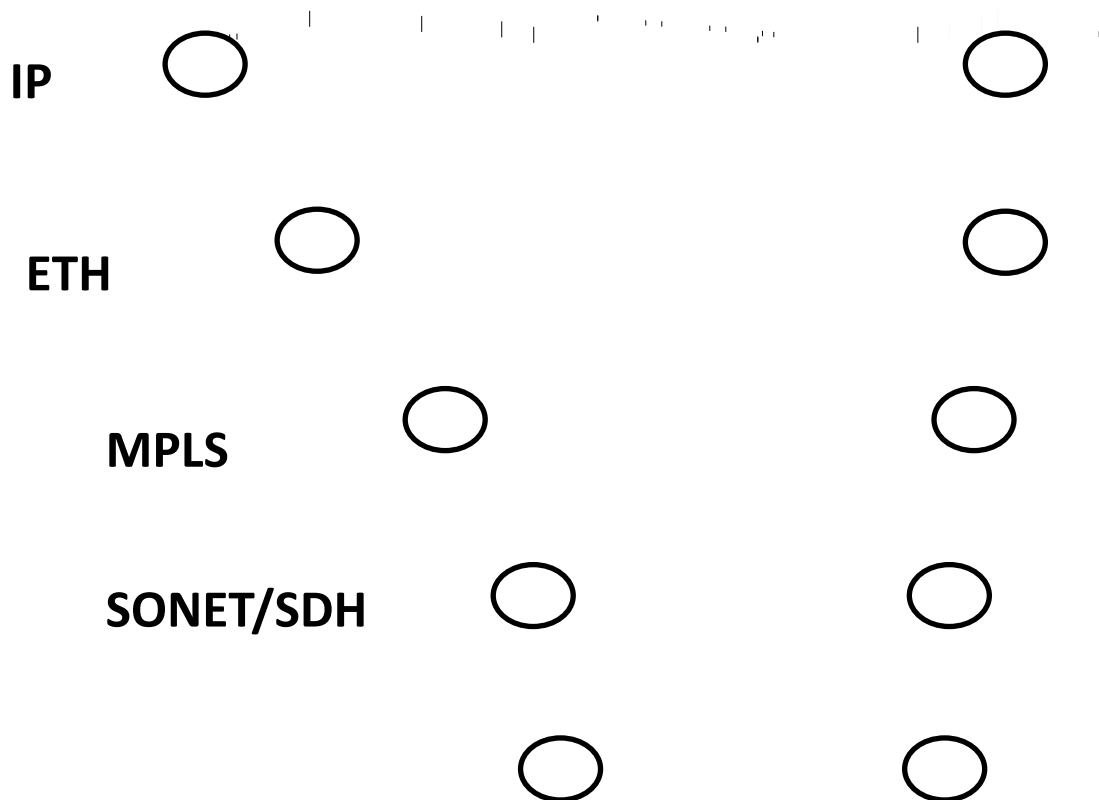
Figure 3-3 Network Layering Example

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.

3.1.2 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.

Flow Domain A
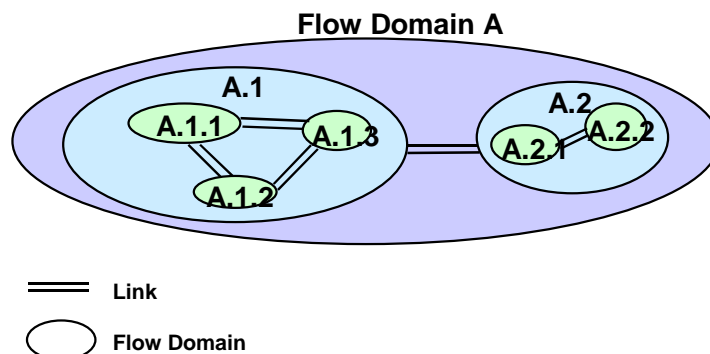
Figure 3-4 Partitioning Example

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 management system. Again within each management system 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.

3.1.3   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.
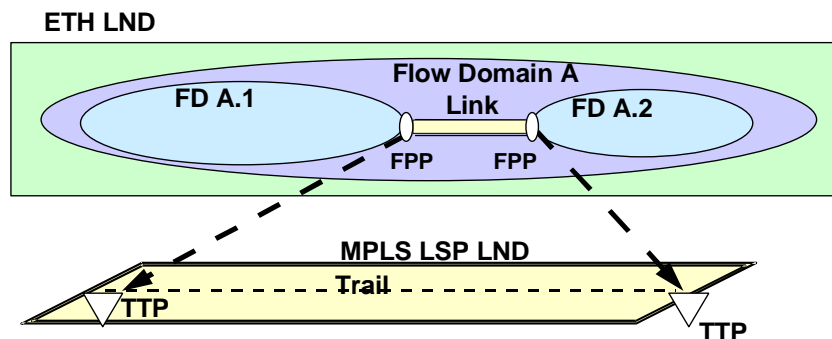
Figure 3-5 Topological Elements

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.

3.1.4   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 OVC, 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).
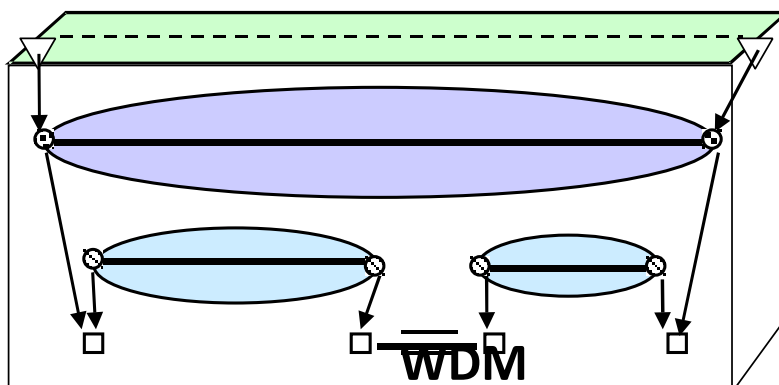
Figure 3-6 Connection Elements

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.

3.1.5   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.
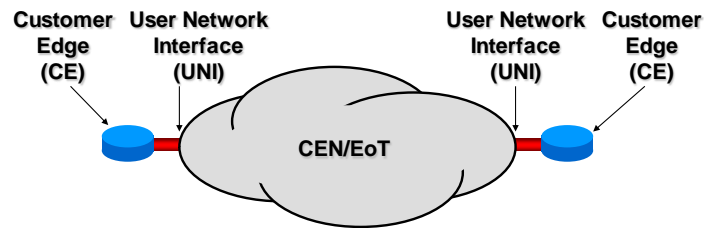
Figure 3-7 Ethernet Services Model [1]

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 Carrier Ethernet Network (CEN) /EoT exchange Service Frames. In the Service View there are no assumptions about the details of the Carrier Ethernet Network/EoT (e.g., it may consist of a single switch or a combination of networks based on many different technologies).
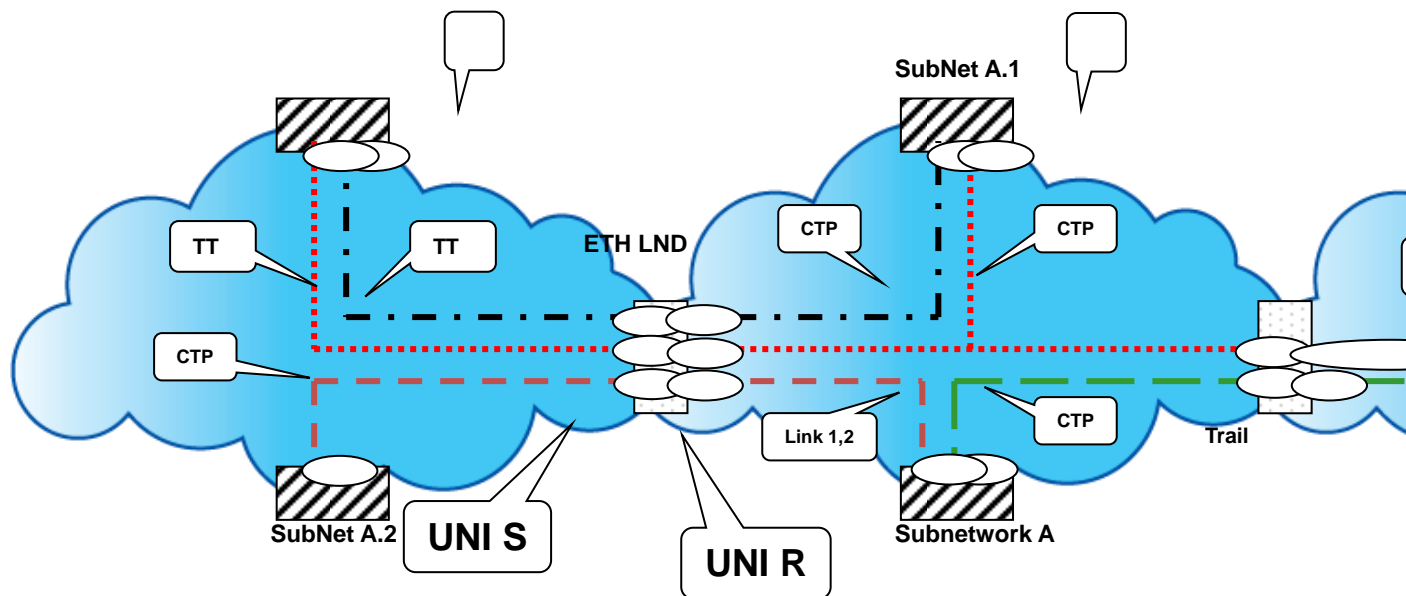
Figure 3-8 Example with ENNIs and OVCs [1]

4   Business Level Requirements

While Q.840.1 [34] only focuses on the management interface between NMS and EMS for Carrier Ethernet and EoT, and the interface management functions associated with them, this specification provides the overarching Management Information Model supporting Carrier Ethernet service, and presents general use cases for Carrier Ethernet management as a basis that may be refined in the interface specific profile documents.

4.1   Overview of Use Cases

Figure 4-1 shows the Use Case Diagram of the Carrier Ethernet management interface function.

Note that throughout the Use Cases it is assumed that dependent entities are deleted whenever a containing entity is deleted unless otherwise specified.
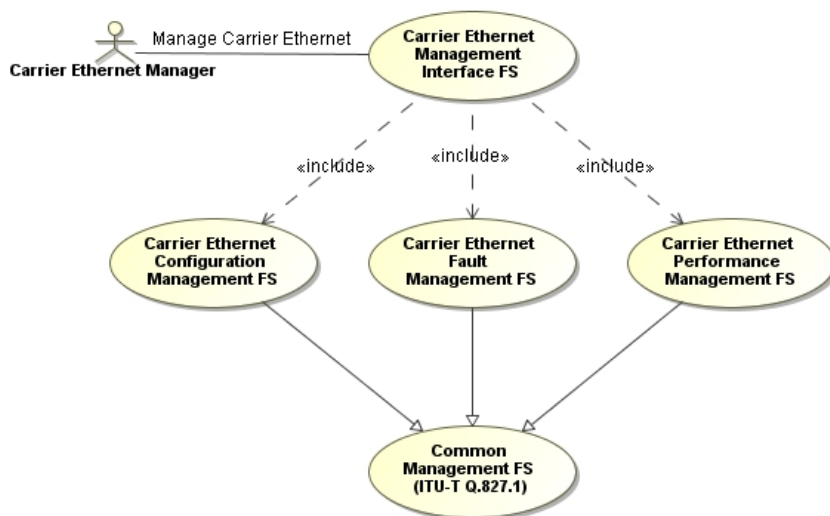
Figure 4-1 Carrier Ethernet Management Interface Function Set Overview

Figure 4-2 shows the functions involved in the Configuration management function set.
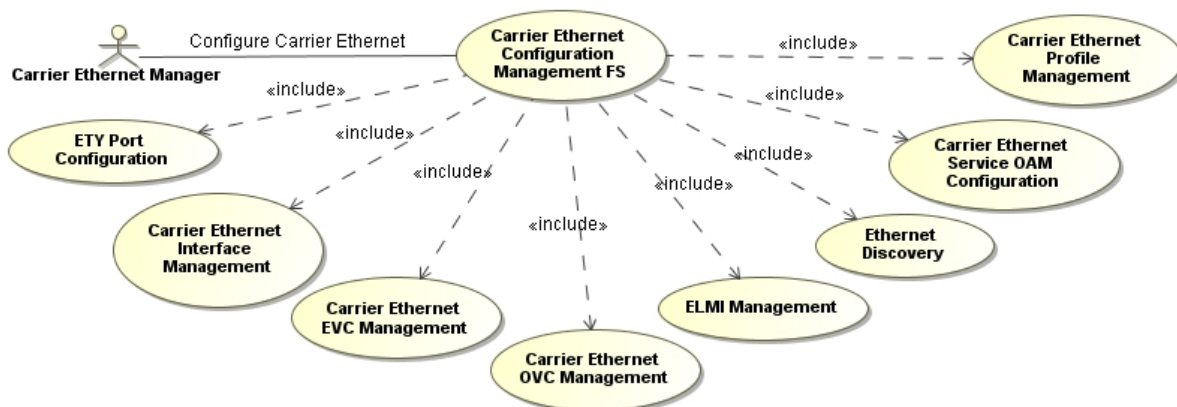
Figure 4-2 Carrier Ethernet Configuration Management Function Set

The use case diagram for performance management function set based partially on Q.827.1 [31] is found in Figure 4-3.
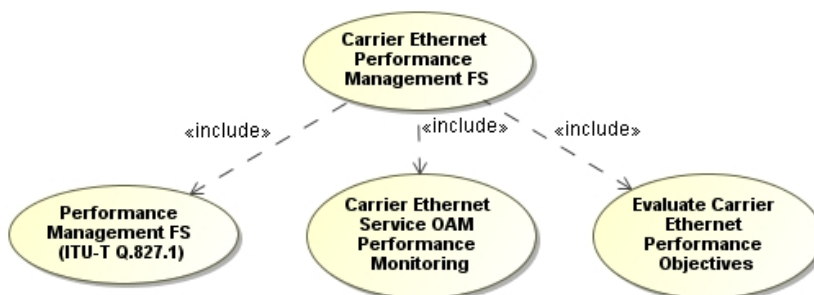
Figure 4-3 Carrier Ethernet Performance Management Function Set

The use case diagram for Fault management function set based partially on Q.827.1 is shown in Figure 4-4.
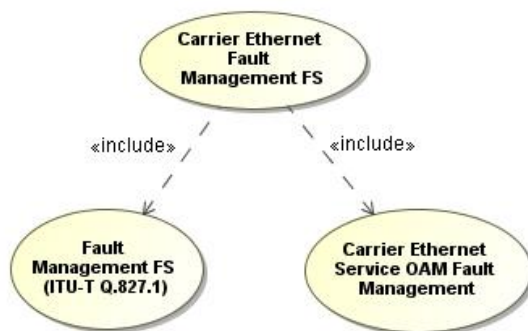
Figure 4-4 Carrier Ethernet Fault Management Function Set

Even though Q.840.1 [34] contains UML use case diagrams that summarize the functionality and interfaces of EMS, many of these Use Cases have been either replicated or updated in this document to focus on the management of Carrier Ethernet in general.

4.2   Carrier Ethernet Management Use Cases

Note that throughout the Use Cases it is assumed that dependent entities are deleted whenever a containing entity is deleted unless otherwise specified.

4.2.1   Carrier Ethernet Configuration Management Function Set

4.2.1.1   ETY Port Configuration
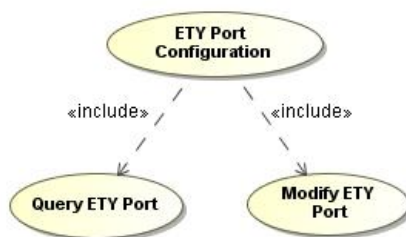
Figure 4-5 ETY Port Management Function Set

4.2.1.1.1   Query ETY Port

Name	Query ETY Port
Summary	Carrier Ethernet Manager requests to query ETY Port information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of ETY Port to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of ETY port to Managed System 2) Managed System returns the ETY port attributes to Carrier Ethernet Manager 3) Carrier Ethernet Manager receives the response from Managed System

Ends When	1) Managed System returns the ETY Port information to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Port 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ETY Port attributes when the query succeeds.

4.2.1.1.2 Modify ETY Port

Name	Modify ETY Port
Summary	Carrier Ethernet Manager requests to modify some attributes of ETY Port.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the ETY Port inventory information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of ETY Port whose attributes are to be modified.
Begins When	Carrier Ethernet Manager sends a request to Managed System to modify ETY Port attributes.
Description	1) Carrier Ethernet Manager sends a request to the Managed System to modify ETY Port attributes 2) Carrier Ethernet Manager modifies relevant attributes of ETY Port 3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers 4) Managed System responds with success indication 5) Carrier Ethernet Manager receives the response from Managed System The following attributes of ETY Port/Encapsulation Port are configurable: – Port speed – Duplex mode – If Flow Control
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Object does not exist 2) Attribute is read-only 3) Managed System Processing Error 4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.2 Carrier Ethernet Interface Management
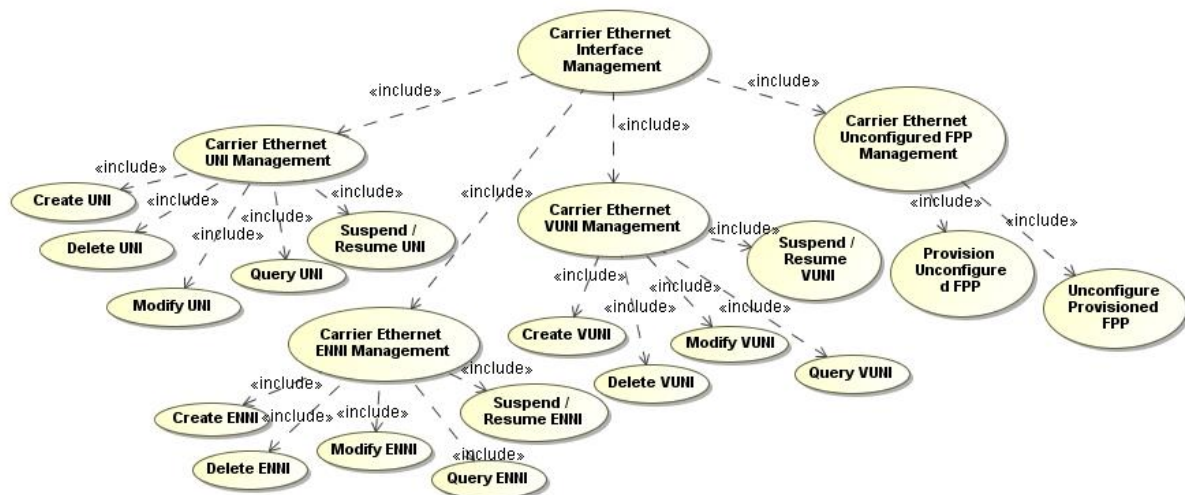
Figure 4-6 Carrier Ethernet Interface Management

4.2.1.2.1 Carrier Ethernet UNI Management

4.2.1.2.1.1 Create UNI

Name	ETH Flow Point Pool (FPP) UNI Creation
Summary	The Carrier Ethernet Manager creates and configures an ETH UNI on a pre-selected port. ETH FPP UNIs may be created automatically by Managed System when physical ports are created, and can be retrieved by Carrier Ethernet Manager.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH UNI.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System.
Begins When	The Carrier Ethernet Manager has selected a port (e.g., Generic Transport TTP) and sends a request to provision an ETH_FPP_UNI representing an Ethernet UNI on the port.
Description	The Carrier Ethernet Manager needs to create a new ETH UNI associated with a specific port. The Carrier Ethernet Manager requests the creation of a new Ethernet FPP UNI to be managed by the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet UNI configuration parameters. Based on the creation request, the Managed System creates an instance of ETH FPP UNI and returns the name of the new ETH FPP UNI instance. In addition, an Object Creation Notification for the new instance of ETH FPP UNI is autonomously sent from the Managed System.
	For an ETH FPP UNI, the following information may be provided by the Carrier Ethernet Manager as part of the creation request:
	– FPP Type: Indicates that the ETH FPP is a UNI.
	– FPP SubType (Optional): A string that indicates the detailed FPP sub-type. If the ETH FPP is a UNI, this attribute would be set to: "MEF UNI Type 1", "MEF UNI Type 2" or "MEF UNI Type 3" according to [MEF 11]. Type should be extensible to allow for future FPP sub-types.
	– User Label.
	– IEEE 802.3Address (Optional): The [IEEE 802.3] address which is placed in

|	the source-address field of any non-FDFr specific Ethernet frames that originate at this interface. – Max Number of Virtual Connections (Optional). – MTU Size. – Layer2 Control Protocol Processing List: A list of the possible Layer 2 Control protocols processed at this ETH interface, along with the processing alternative (Process, Discard, Pass-to-EVC). – Service Muxing Indicator: Describes if service multiplexing is enabled at the ETH UNI. – Bundling Indicator: There are three bundling options: yes, no and all-to-one. See [ITU-T G.8011]. – Ingress VLAN Assignment Untagged (Optional): Applicable only to untagged traffic. This one and Ingress VLAN Assignment All are optional. They cannot be valid in the same time. – Supported By: Relationship with supporting objects. – Client/Server: Relationship with TRANS layer TTP (Encapsulation Port). – Flow Domain Interfaces: Relationship with ETH Flow Domain that contains the FPP in a given layer. – Ingress Bandwidth Profile (Optional): This attribute indicates the ingress bandwidth profile for all ETH services at the ETH FPP UNI in the ingress direction. – Egress Bandwidth Profile (Optional): This attribute indicates the egress bandwidth profile for all ETH services at the ETH FPP UNI in the egress direction.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	A new instance of ETH Flow Point Pool UNI is created.

4.2.1.2.1.2 Delete UNI

Name	ETH Flow Point Pool UNI Deletion
Summary	The Carrier Ethernet Manager deletes an ETH FPP representing the UNI on a specific port.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet FPP UNI instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available. No EVCs or OVCs are associated with the UNI to be deleted.
Begins When	The Carrier Ethernet Manager sends a request to remove from service an ETH FPP representing an Ethernet UNI on a port.

Description	The Carrier Ethernet Manager needs to remove from service an ETH FPP UNI associated with a specific port. The Carrier Ethernet Manager requests the deletion of the Ethernet FPP UNI from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet UNI identifier. Based on the deletion request, the Managed System removes the instance of ETH FPP UNI. In addition, an Object Deletion Notification for the instance of ETH FPP UNI is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter 4) Undeletable Object List
Post-Conditions	The instance of ETH Flow Point Pool UNI is deleted, and associated resources are made available.

4.2.1.2.1.3 Modify UNI

Name	Modify ETH FPP UNI
Summary	Carrier Ethernet Manager requests to modify some attributes of ETH FPP UNI, such as the Layer 2 Control Protocol Processing List.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the ETH FPP UNI information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of ETH FPP to be modified.
Begins When	Carrier Ethernet Manager sends a request to the Managed System to modify ETH FPP attributes.

Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific ETH FPP UNI attributes of a specific ETH FPP UNI object.
	2) Managed System modifies relevant attributes of ETH FPP UNI.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
	The attributes that might be configured in this use case include:
	– FPP Type
	– FPP SubType
	– User Label
	– IEEE 802.3Address
	– Ingress Bandwidth Profile per UNI
	– Egress Bandwidth Profile per UNI
	– Maximum Number of Virtual Connections
	– MTU Size
	– Layer 2 Control Protocol Processing List
	– Service Multiplexing Indicator
	– Bundling
	– Ingress VLAN Assignment Untagged
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH FPP UNI
	2) Attribute is read-only
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.2.1.4 Query UNI

Name	Query ETH UNI
Summary	Carrier Ethernet Manager requests to query ETH UNI information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of ETH UNI to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of ETH UNI to Managed System
	2) Managed System returns the ETH UNI attributes to Carrier Ethernet Manager
	3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the ETH UNI information to Carrier Ethernet Manager
	2) Exception happens

Exceptions	1) Unknown ETH UNI
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ETH UNI attributes when the query succeeds.

4.2.1.2.1.5 Suspend / Resume UNI

Name	Suspend and Resume ETH FPP UNI
Summary	The Carrier Ethernet Manager resumes or temporarily suspends an ETH FPP UNI.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to update the ETH FPP UNI instance.
Pre-Conditions	The Carrier Ethernet Manager is aware of or able to retrieve the names or identifiers for the ETH FPP UNI instance to be resumed or suspended. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to resume or temporarily suspend an ETH FPP UNI.
Description	The Carrier Ethernet Manager needs to resume or temporarily suspend a specific ETH FPP UNI. As part of the resume/suspend request, the Carrier Ethernet Manager requests that the Administrative State of a specific ETH FPP UNI be set to either locked (suspended) or unlocked (resumed). Based on the resume/suspend request, the Managed System updates the Administrative State of the identified ETH FPP UNI and the contained OVC/EVC End Points. In addition, a State Change Notification for the ETH FPP UNI is autonomously sent from the Managed System and received by the Carrier Ethernet Manager.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Invalid Parameter
	3) Managed System Processing Error
Post-Conditions	The ETH FPP UNI is resumed or suspended.

4.2.1.2.2 Carrier Ethernet ENNI Management

4.2.1.2.2.1 Create ENNI

Name	ETH Flow Point Pool (FPP) ENNI Creation
Summary	The Carrier Ethernet Manager creates and configures an ETH ENNI on a pre-selected port. ETH FPP ENNIs may be created automatically by Managed System when physical ports are created, and can be retrieved by Carrier Ethernet Manager.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH ENNI.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System.

Begins When	The Carrier Ethernet Manager has selected a port (e.g., Generic Transport TTP) and sends a request to provision an ETH_FPP_ENNI representing an Ethernet ENNI on the port.
Description	The Carrier Ethernet Manager needs to create a new ETH ENNI associated with a specific port. The Carrier Ethernet Manager requests the creation of a new Ethernet FPP ENNI to be managed by the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet ENNI configuration parameters. Based on the creation request, the Managed System creates an instance of ETH FPP ENNI and returns the name of the new ETH FPP ENNI instance. In addition, an Object Creation Notification for the new instance of ETH FPP ENNI is autonomously sent from the Managed System.
	For an ETH FPP ENNI, the following information may be provided by the Carrier Ethernet Manager as part of the creation request:
	– FPP Type: Indicates that the ETH FPP is an ENNI.
	– FPP SubType (Optional): A string that indicates the detailed FPP sub-type.
	– User Label.
	– IEEE 802.3Address (Optional): The [IEEE 802.3] address which is placed in the source-address field of any non-FDFr specific Ethernet frames that originate at this interface.
	– Max Number of Virtual Connections (Optional).
	– MTU Size.
	– ENNI Label: Describes the ENNI within the scope of the Ethernet provider domain. The ENNI Label attribute is a value that is assigned to the ENNI by the Ethernet Provider.
	– Protection Mechanism: The method for protection, if any, against a failure.
	– SVLAN-ID Mapping: The map that associates each S-Tagged ENNI Frame with an End Point. The End Point Type within an End Point Map for ENNI frames mapped to an OVC MUST take the value of "OVC". The End Point Type within an End Point Map for ENNI frames mapped to a VUNI MUST take the value of "VUNI".
	– Maximum Number of OVC End Points per OVC: The Maximum Number of OVC End Points per OVC provides an upper bound on the number of OVC End Points that are associated by an OVC that the Operator can support at the ENNI. Note that if the Maximum Number of OVC End Points per OVC is one, then hairpin switching cannot be supported at the ENNI.
	– Supported By (GET, SET BY CREATE): Relationship with supporting objects.
	– Client/Server (GET, SET BY CREATE): Relationship with TRANS layer TTP (Encapsulation Port).
	– Flow Domain Interfaces (GET, SET BY CREATE): Relationship with ETH Flow Domain that contains the FPP in a given layer.
	– Ingress Bandwidth Profile (Optional): This attribute indicates the ingress bandwidth profile for all ETH services at the ETH FPP ENNI in the ingress direction.
	– Egress Bandwidth Profile (Optional): This attribute indicates the egress bandwidth profile for all ETH services at the ETH FPP ENNI in the egress direction.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager
	2) Exception happens

Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	A new instance of ETH Flow Point Pool ENNI is created.

4.2.1.2.2.2 Delete ENNI

Name	ETH Flow Point Pool ENNI Deletion
Summary	The Carrier Ethernet Manager deletes an ETH FPP representing the ENNI on a specific port.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet FPP ENNI instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available.
	No OVCs, VUNIs, or vNID RMI Segment End Points are associated with the ENNI to be deleted.
Begins When	The Carrier Ethernet Manager sends a request to remove from service an ETH FPP representing an Ethernet ENNI on a port.
Description	The Carrier Ethernet Manager needs to remove from service an ETH FPP ENNI associated with a specific port. The Carrier Ethernet Manager requests the deletion of the Ethernet FPP ENNI from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet ENNI identifier. Based on the deletion request, the Managed System removes the instance of ETH FPP ENNI. In addition, an Object Deletion Notification for the instance of ETH FPP ENNI is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
	4) Undeletable Object List
Post-Conditions	The instance of ETH Flow Point Pool ENNI is deleted, and associated resources are made available.

4.2.1.2.2.3 Modify ENNI

Name	Modify ETH FPP ENNI
Summary	Carrier Ethernet Manager requests to modify some attributes of ETH FPP ENNI, such as the Layer 2 Control Protocol Processing List.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the ETH FPP ENNI information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of ETH FPP to be modified.
Begins When	NMS sends a request to EMS to modify ETH FPP attributes.

Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific ETH FPP ENNI attributes of a specific ETH FPP ENNI object.
	2) Managed System modifies relevant attributes of ETH FPP ENNI.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
	The attributes that might be configured in this use case include:
	– FPP Type
	– FPP SubType
	– User Label
	– IEEE 802.3Address
	– Ingress Bandwidth Profile (optional)
	– Egress Bandwidth Profile (optional)
	– Maximum Number of Virtual Connections
	– MTU Size
	– ENNI Label
	– Protection Mechanism
	– SVLAN-ID Mapping
	– Maximum Number of OVC End Points per OVC
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH FPP
	2) Attribute is read-only
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.2.2.4 Query ENNI

Name	Query ETH ENNI
Summary	Carrier Ethernet Manager requests to query ETH ENNI information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of ETH ENNI to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of ETH ENNI to Managed System
	2) Managed System returns the ETH ENNI attributes to Carrier Ethernet Manager
	3) Carrier Ethernet Manager receives the response from Managed System

Ends When	1) Managed System returns the ETH ENNI information to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH ENNI
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ETH ENNI attributes when the query succeeds.

4.2.1.2.2.5 Suspend / Resume ENNI

Name	Suspend and Resume ETH FPP ENNI
Summary	The Carrier Ethernet Manager resumes or temporarily suspends an ETH FPP ENNI.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to update the ETH FPP ENNI instance.
Pre-Conditions	The Carrier Ethernet Manager is aware of or able to retrieve the names or identifiers for the ETH FPP ENNI instance to be resumed or suspended. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to resume or temporarily suspend an ETH FPP ENNI.
Description	The Carrier Ethernet Manager needs to resume or temporarily suspend a specific ETH FPP ENNI. As part of the resume/suspend request, the Carrier Ethernet Manager requests that the Administrative State of a specific ETH FPP ENNI be set to either locked (suspended) or unlocked (resumed). Based on the resume/suspend request, the Managed System updates the Administrative State of the identified ETH FPP ENNI, and the contained OVC and VUNI End Points. In addition, a State Change Notification for the ETH FPP ENNI is autonomously sent from the Managed System and received by the Carrier Ethernet Manager.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Invalid Parameter
	3) Managed System Processing Error
Post-Conditions	The ETH FPP ENNI is resumed or suspended.

4.2.1.2.3 Carrier Ethernet VUNI Management

4.2.1.2.3.1 Create VUNI

Name	ETH Flow Point Pool (FPP) VUNI Creation
Summary	The Carrier Ethernet Manager creates and configures an ETH VUNI associated with a pre-selected ENNI.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH VUNI.

Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System.
Begins When	The Carrier Ethernet Manager has selected an ENNI and sends a request to provision an ETH_FPP_VUNI representing an Ethernet VUNI associated with the ENNI.
Description	The Carrier Ethernet Manager needs to create a new ETH VUNI associated with a specific ENNI. The Carrier Ethernet Manager requests the creation of a new Ethernet FPP VUNI to be managed by the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet VUNI configuration parameters. Based on the creation request, the Managed System creates an instance of ETH FPP VUNI and returns the name of the new ETH FPP VUNI instance. In addition, an Object Creation Notification for the new instance of ETH FPP VUNI is autonomously sent from the Managed System.
	For an ETH FPP VUNI, the following information may be provided by the Carrier Ethernet Manager as part of the creation request:
	– FPP Type: Indicates that the ETH FPP is a VUNI.
	– FPP SubType (Not Applicable for VUNI): A string that indicates the detailed FPP sub-type.
	– User Label.
	– IEEE 802.3Address (Optional): The [IEEE 802.3] address which is placed in the source-address field of any non-FDFr specific Ethernet frames that originate at this interface.
	– Max Number of Virtual Connections (Optional).
	– MTU Size.
	– VUNI Label: Describes the VUNI within the scope of the Ethernet provider domain. The VUNI Label attribute is a value that is assigned to the VUNI by the Ethernet Provider. It MAY have any string as a value.
	– Supported By: Relationship with supporting objects.
	– Client/Server: Relationship with ENNI as server layer entity.
	– Flow Domain Interfaces: Relationship with ETH Flow Domain that contains the FPP in a given layer.
	– Ingress Bandwidth Profile (Optional): This attribute indicates the ingress bandwidth profile for all ETH services at the ETH FPP VUNI in the ingress direction.
	– Egress Bandwidth Profile (Optional): This attribute indicates the egress bandwidth profile for all ETH services at the ETH FPP VUNI in the egress direction.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	A new instance of ETH Flow Point Pool VUNI is created.

4.2.1.2.3.2 Delete VUNI

Name	ETH Flow Point Pool VUNI Deletion
Summary	The Carrier Ethernet Manager deletes an ETH FPP representing the VUNI associated with a specific ENNI.

Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet FPP VUNI instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available. No EVCs or OVCs are associated with the VUNI to be deleted.
Begins When	The Carrier Ethernet Manager sends a request to remove from service an ETH FPP representing an Ethernet VUNI associated with an ENNI.
Description	The Carrier Ethernet Manager needs to remove from service an ETH FPP VUNI associated with a specific ENNI. The Carrier Ethernet Manager requests the deletion of the Ethernet FPP VUNI from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet VUNI identifier. Based on the deletion request, the Managed System removes the instance of ETH FPP VUNI. In addition, an Object Deletion Notification for the instance of ETH FPP VUNI is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter 4) Undeletable Object List
Post-Conditions	The instance of ETH Flow Point Pool VUNI is deleted, and associated resources are made available.

4.2.1.2.3.3 Modify VUNI

Name	Modify ETH FPP VUNI
Summary	Carrier Ethernet Manager requests to modify some attributes of ETH FPP VUNI.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the ETH FPP VUNI information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of ETH FPP to be modified.
Begins When	Carrier Ethernet Manager sends a request to Managed System to modify ETH FPP VUNI attributes.

Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific ETH FPP VUNI attributes of a specific ETH FPP VUNI object.
	2) Managed System modifies relevant attributes of ETH FPP VUNI.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
	The attributes that might be configured in this use case include:
	– FPP Type
	– User Label
	– IEEE 802.3Address
	– Ingress Bandwidth Profile
	– Egress Bandwidth Profile
	– Maximum Number of Virtual Connections
	– MTU Size
	– VUNI Label
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH FPP VUNI
	2) Attribute is read-only
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.2.3.4 Query VUNI

Name	Query ETH VUNI
Summary	Carrier Ethernet Manager requests to query ETH VUNI information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of ETH VUNI to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of ETH VUNI to Managed System
	2) Managed System returns the ETH VUNI attributes to Carrier Ethernet Manager
	3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the ETH VUNI information to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH VUNI
	2) Managed System Processing Error
	3) Invalid Parameter

Post-Conditions	Carrier Ethernet Manager receives ETH VUNI attributes when the query succeeds.

4.2.1.2.3.5 Suspend / Resume VUNI

Name	Suspend and Resume ETH FPP VUNI
Summary	The Carrier Ethernet Manager resumes or temporarily suspends an ETH FPP VUNI.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to update the ETH FPP VUNI instance.
Pre-Conditions	The Carrier Ethernet Manager is aware of or able to retrieve the names or identifiers for the ETH FPP VUNI instance to be resumed or suspended. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to resume or temporarily suspend an ETH FPP VUNI.
Description	The Carrier Ethernet Manager needs to resume or temporarily suspend a specific ETH FPP VUNI. As part of the resume/suspend request, the Carrier Ethernet Manager requests that the Administrative State of a specific ETH FPP VUNI be set to either locked (suspended) or unlocked (resumed). Based on the resume/suspend request, the Managed System updates the Administrative State of the identified ETH FPP VUNI and the contained OVC and EVC End Points. In addition, a State Change Notification for the ETH FPP VUNI is autonomously sent from the Managed System and received by the Carrier Ethernet Manager.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Invalid Parameter 3) Managed System Processing Error
Post-Conditions	The ETH FPP VUNI is resumed or suspended.

4.2.1.2.4 Carrier Ethernet Unconfigured External Interface Management

4.2.1.2.4.1 Provision Unconfigured External Interface

Name	Provision Unconfigured External Interface
Summary	The Carrier Ethernet Manager provisions an unconfigured ETH FPP to represent the UNI or ENNI on a pre-selected port. In most cases, ETH FPPs are created automatically by Managed System when physical ports are created, and can be retrieved by Carrier Ethernet Manager.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to provision the Ethernet Flow Point Pool.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System.

Begins When	The Carrier Ethernet Manager has selected a port (e.g., Generic Transport TTP) and the associated ETH FPP instance and sends a request to provision an ETH_FPP_UNI or ETH_FPP_ENNI representing an Ethernet External Interface on the port.
Description	The Carrier Ethernet Manager needs to provision an ETH FPP as an UNI or ENNI associated with a specific port. The Carrier Ethernet Manager requests the provisioning of an Ethernet FPP to be managed by the Managed System. As part of the provisioning request, the Carrier Ethernet Manager provides Ethernet UNI/ENNI configuration parameters. Based on the configuration request, the Managed System creates an instance of ETH FPP UNI or ETH FPP ENNI and returns the name of the new instance. In addition, an Object Creation Notification for the new instance is autonomously sent from the Managed System and received by the Carrier Ethernet Manager. Also, the Managed System removes the ETH FPP superclass instance associated with the specified port and sends an Object Deletion Notification to the Carrier Ethernet Manager.
	For an ETH FPP to be configured as a UNI or NNI, the following information may be provided by the Carrier Ethernet Manager as part of the provisioning request:
	The attributes that might be provisioned in this use case for both UNI and ENNI include:
	– FPP Type
	– FPP SubType
	– User Label
	– IEEE 802.3Address
	– Ingress Bandwidth Profile (optional)
	– Egress Bandwidth Profile (optional)
	– Maximum Number of Virtual Connections
	– MTU Size
	– Client/Server Relationship with TRANS layer TTP
	The attributes that could be provisioned in this use case for UNI include:
	– Layer 2 Control Protocol Processing List
	– Service Multiplexing Indicator
	– Bundling Indicator
	– Ingress VLAN Assignment Untagged
	The attributes that could be provisioned in this use case for ENNI include:
	– ENNI Label
	– Protection Mechanism
	– SVLAN-ID Mapping
	– Maximum Number of OVC End Points per OVC
Ends When	1) Managed System returns a response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	A new instance of ETH Flow Point Pool UNI or ENNI is created. And the instance representing the previously unconfiugred parent superclass ETH FPP is removed.

4.2.1.2.4.2 Unconfigure Provisioned External Interface

Name	Unconfigured Provisioned External Interface
Summary	The Carrier Ethernet Manager unconfigures a provisioned ETH FPP UNI or ENNI to represent a generic FPP on a pre-selected port.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to unconfigure an Ethernet Flow Point Pool.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System. No EVCs or OVCs are associated with the External Interface to be unconfigured.
Begins When	The Carrier Ethernet Manager has selected a provisioned ETH_FPP_UNI or ETH_FPP_ENNI representing an Ethernet External Interface on a port to unconfigure and sends the unconfigure request to the Managed System.
Description	The Carrier Ethernet Manager needs to remove from service and unconfigure a UNI or ENNI associated with a specific port, returning to the representation of the port as a generic ETH FPP. The Carrier Ethernet Manager requests that the Managed System unconfigure a UNI or ENNI. As part of the unconfigure request, the Carrier Ethernet Manager provides ETH UNI or ENNI identifier. Based on the unconfigure request, the Managed System removes the instance of ETH FPP UNI or ENNI. In addition, an Object Deletion Notification for the instance of ETH FPP UNI or ENNI is autonomously sent from the Managed System. Also, the Managed System instantiates the ETH FPP superclass associated with the specified port and sends an Object Creation Notification to the Carrier Ethernet Manager.
Ends When	1) Managed System returns a response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	A new instance of ETH Flow Point Pool is created. And the instance representing the unconfigured ETH FPP UNI or ENNI is removed.

4.2.1.3   Carrier Ethernet EVC Management

Figure 4-7 Carrier Ethernet EVC Management

4.2.1.3.1 Establish EVC

Name	Establish ETH EVC
Summary	The Carrier Ethernet Manager establishes an Ethernet Virtual Connection representing the UNI-to-UNI service across an Ethernet Flow Domain or a collection of Ethernet Flow Domains. During EVC establishment, the Managed System creates the EVC and associated Flow Points. An ETH EVC provides connectivity among the identified flow points.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to establish Ethernet EVCs. Carrier Ethernet Manager has already retrieved the ETH FD information.
Pre-Conditions	The Managed System is responsible for the management of all UNIs participating in the EVC. The Bandwidth Profiles for the EVC must be created prior to EVC establishment. The Carrier Ethernet Manager is aware of or able to retrieve the Bandwidth Profile instance names representing the Ethernet Bandwidth Profiles to be associated with the EVC. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to establish a UNI-to-UNI EVC across a flow domain or collection of flow domains (Managed by the Managed System) between two or more than two UNIs. The Carrier Ethernet Manager has selected the UNIs where the EVC terminates and is ready to configure EVC parameters.

Description	The Carrier Ethernet Manager needs to provision an Ethernet Virtual Connection representing the UNI-to-UNI service across an Ethernet Flow Domain (or collection of Flow Domains all managed by the Managed System). During EVC establishment, the Carrier Ethernet Manager configures the parameters of the EVC. After determining that there are sufficient resources to fulfill the request, the Managed System creates the EVC and associated Flow Points. The Managed System also establishes relationships for the newly created EVC and Flow Points.
	For establishing an EVC, the Carrier Ethernet Manager provides the following as part of the provisioning request:
	– EVC Type: Describes the ETH FDFr/EVC as: mp2mp, p2p, rootedMp.
	– a End ETH FPP and Parameters: Indicates the a-end UNI and associated EVC Parameters (including VLAN ID Mapping, BW Profiles, etc.).
	– z End ETH FPPs and Parameters: Indicates the z-end UNI(s) and associated EVC Parameters (including VLAN ID Mapping, BW Profiles, etc.).
	– EVC Name: The ethEVCName is a string that is a unique EVC ID identifying value for the ETH Virtual Connection.
	– Initial Administrative State: This parameter is used to activate (unlock) or deactivate (lock) this managed entity. In the Locked state, frame flow through the EVC is prohibited.
	– EVC Label: (optional) A text string that may be used to provide additional information about the EVC, such as a circuit identifier.
	– Maximum Number of UNI EndPoints
	– EVC MTU Size
	– UNI CE VLAN Id Preservation
	– UNI CE VLAN CoS Preservation
	– Layer2 Control Protocol Processing List (EVC per UNI)
	– Unicast Service Frame Delivery (EVC per UNI)
	– Multicast Service Frame Delivery (EVC per UNI)
	– Broadcast Service Frame Delivery (EVC per UNI)
	– ETH CoS Performance Mapping List
	– Routing Criteria (optional) This parameter indicates the routing restriction information. It is a list of ETH FPPs that are included or excluded in the route.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
	4) Success return parameter set to "false" if resources cannot be allocated.
Post-Conditions	A new instance of EVC and associated ETH Flow Points are created. And corresponding creation notifications are sent to Carrier Ethernet Managers registered for this notification.

4.2.1.3.2 Release EVC

Name	Release ETH EVC
Summary	The Carrier Ethernet Manager releases an Ethernet Virtual Connection representing the UNI-to-UNI service across an Ethernet Flow Domain or a collection of Ethernet Flow Domains. During EVC release, the Managed System removes the EVC and associated Flow Points.

Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to release Ethernet EVCs. Carrier Ethernet Manager has already retrieved the EVC information.
Pre-Conditions	The Managed System is responsible for the management of all UNIs participating in the EVC. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to release an EVC.
Description	The Carrier Ethernet Manager needs to release an Ethernet Virtual Connection representing the UNI-to-UNI service across an Ethernet Flow Domain (or collection of Flow Domains all managed by the Managed System). Upon receipt of the request the Managed System removes the EVC and associated Flow Points. The Managed System also removes the associated relationships. For releasing an EVC, the Carrier Ethernet Manager provides the following as part of the release request: – EVC ID.
Ends When	1) Managed System returns the release response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Instance of EVC and associated ETH Flow Points are removed. And corresponding deletion notifications are sent to Carrier Ethernet Managers registered for this notification.

4.2.1.3.3 Modify EVC

Name	Modify EVC
Summary	The Carrier Ethernet Manager requests to modify attributes of EVC.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has already retrieved or created the EVC instance.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of EVC to be modified.
Begins When	The Carrier Ethernet Manager sends a request to Managed System to modify EVC attributes.

Description	1) Carrier Ethernet Manager sends a request to Managed System to modify attribute(s) of a specific EVC.
	2) Managed System modifies relevant attribute(s) of the EVC.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
	The attributes that might be configured in this use case include:
	– User Label
	– uniCeVlanIdPreservation
	– uniCeVlanCoSPreservation
	– maxUNIEndPoints
	– ETH CoS Performance Mapping List
	– mtuSize
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Attribute is read-only
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	The relevant attribute(s) of the EVC is updated.

4.2.1.3.4 Query EVC

Name	Query EVC
Summary	Carrier Ethernet Manager requests to retrieve attributes of a specific EVC from Managed System, or request discovery of instances and attributes of all EVCs within a specific Flow Domain managed by the Managed System. In addition, the Carrier Ethernet Manager retrieves all attributes of the ETH Flow Points that terminate each EVC.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the EVC and Ethernet Flow Point information. And Carrier Ethernet Manager has already retrieved the ETH Flow Domain information.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends Managed System a query of one specific or all EVCs in an ETH FD.

Description	1) The Carrier Ethernet Manager requests retrieval of the attributes of a specific EVC, or the name or identifier for all instances of the EVC object class that are contained in a specific Flow Domain.
	2) The Managed System returns the attributes of the specific EVC or a list of identifiers for all EVCs within the specified Flow Domain.
	3) Carrier Ethernet Manager receives the attributes, or the list of ETH EVC identifiers which can be used to query the corresponding attributes for the list of EVCs.
	Attributes of ETH EVC include:
	– ETH EVC ID: This attribute represents a unique value for the EVC
	– User Label: A text string that may be used to describe the object or provide additional information.
	– EVC Type: This attribute indicates the connectivity between Ethernet FPs in the ETH EVC. There are three options: mp2mp, p2p, rootedMp.
	– ETH FP List: This attribute indicates the ETH FPs contained in the ETH EVC.
	– Ingress VLAN ID Preservation: This attribute indicates whether the VLAN ID will be the same on ingress and egress to the EVC. The options are: Yes or no.
	– Ingress CoS Preservation: This attribute indicates whether the class of service (priority) of the ETH_CI will be the same on ingress and egress to the EVC. The options are: Yes or no.
	– ETH CoS Performance Mapping List: This attribute indicates the performance profiles for specified ETH services at the EVC. It is a list of the sequence (ETHServiceClassProfileID, ETHPerformanceProfileID), where ETHServiceClassProfileID may be null which represents all kinds of CoS.
	– mtuSize: This attribute describes the maximum transmission unit size for the EVC.
	– Administrative State
	– Operational State
	– Availability Status
	4) For each EVC, the Carrier Ethernet Manager requests retrieval of all attributes for each ETH Flow Point that terminates the EVC.
Ends When	1) Managed System returns the EVC information to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives EVC information when the query succeeds. The Carrier Ethernet Manager has current values for the attributes for the EVC instance, and for each Ethernet Flow Point instance that terminates an EVC.

4.2.1.3.5 Suspend / Resume EVC

Name	Suspend and Resume EVC
Summary	The Carrier Ethernet Manager resumes or temporarily suspends an EVC.
Actor(s)	Carrier Ethernet Manager

Assumptions	The Carrier Ethernet Manager has the authority to update the ETH Flow Point instances related to the EVC.
Pre-Conditions	The Carrier Ethernet Manager is aware of or able to retrieve the names or identifiers for the EVC's ETH Flow Point instance to be resumed or suspended. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to resume or temporarily suspend an EVC.
Description	The Carrier Ethernet Manager needs to resume or temporarily suspend a specific EVC. As part of the resume/suspend request, the Carrier Ethernet Manager requests that the Administrative State of the ETH Flow Points related to the specific EVC be set to either locked (suspended) or unlocked (resumed). Based on the resume/suspend request, the Managed System updates the Administrative State of the identified ETH Flow Points. In addition, a State Change Notifications for the Flow Points are autonomously sent from the Managed System and received by the Carrier Ethernet Manager.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Invalid Parameter 3) Managed System Processing Error
Post-Conditions	The EVC is resumed or suspended.

4.2.1.3.6 Query ETH Flow Points

Name	Query ETH Flow Points (FP)
Summary	Carrier Ethernet Manager requests to retrieve ETH FP from Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the ETH FDFr/EVC.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a query of ETH FPs in an ETH FDFr/EVC or a query of specific ETH FP to Managed System.

Description	1) Carrier Ethernet Manager sends a query of ETH FPs in an ETH FDFr/EVC or a query of specific ETH FP to Managed System.
	2) Managed System returns the ETH FPs with the following attributes:
	– FP ID: This attribute represents a unique value for the ETH flow point.
	– FDFr/EVC Pointer: This attribute identifies the ETH FDFr/EVC containing the ETH FP.
	– Ingress CoS Bandwidth Mapping List: This attribute indicates the ingress bandwidth profiles for specified ETH services at the ETH FP in the ingress direction (single, or one per CoS). It is a list of the sequence (ETHServiceClassProfileID, ETHBandwidthProfileID), where ETHServiceClassProfileID may be null which represents all kinds of CoS. The Ingress BandwidthProfile List associated with the FP will overwrite that associated with the related FPP.
	– Egress CoS Bandwidth Mapping List: This attribute indicates the egress bandwidth profiles for specified ETH services at the ETH FP in the egress direction (single, or one per CoS). It is a list of the sequence (ETHServiceClassProfileID, ETHBandwidthProfileID), where ETHServiceClassProfileID may be null which represents all kinds of CoS. The egress BandwidthProfile List associated with the FP will overwrite that associated with the related FPP.
	– ETH FPP Pointer: This attribute identifies the ETH FPP which the ETH FP is mapped to.
	– VLAN ID List: This attribute indicates the VLAN IDs mapped to the ETH FP.
	– FDFr/EVC Id
	– Layer 2 Control Protocol Disposition List: This attribute provides a list that describes Layer 2 control protocols, along with the frame disposition.
	– Unicast/Multicast/Broadcast Service Frame Delivery: Describes the service frame delivery option for Unicast/Multicast/Broadcast Service Frames as: Discard, DeliveryUnconditionally, or DeliveryConditionally.
	– Trail Terminating Indicator (Optional): Indicates if frame flow terminates at this FP.
	– Administrative State
	– Operational State
	– Availability Status
	– Alarm Status
	– Current Problem List
	3) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the ETH FP attributes to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH FP
	2) Unknown ETH FDFr/EVC
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ETH FP attributes when the query succeeds.

4.2.1.3.7 Add Flow Points to a Multipoint EVC

Name	Add FPs To a Multipoint EVC
Summary	Carrier Ethernet Manager requests to add FPs to an existing multipoint EVC by mapping UNIs to the EVC with corresponding VLAN IDs.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the EVC.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of EVC for action. 3) Carrier Ethernet Manager knows the object of ETH UNI to be mapped to the EVC.
Begins When	Carrier Ethernet Manager sends an action request to Managed System to map ETH UNIs to a specific EVC.
Description	1) Carrier Ethernet Manager sends an action request to Managed System to map ETH UNIs to a specific EVC. Input parameters are EVC ID and ETH UNI List. 2) Managed System creates new ETH FPs in the EVC and modifies the corresponding ETH FP List attribute of the EVC. 3) Managed System forwards AVC Notification of the EVC and creation Notifications of new ETH FPs to all registered Carrier Ethernet Managers. 4) Managed System responds with new created ETH FP ID list. 5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EVC 2) Unknown ETH UNI 3) Managed System Processing Error 4) Invalid Parameter
Post-Conditions	If use case is successful, new ETH FPs are created and EVC attribute is modified, and the corresponding AVC and creation Notifications are sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.3.8 Remove Flow Points from a Mulitpoint EVC

Name	Remove FPs From Multipoint EVC
Summary	Carrier Ethernet Manager requests to remove FPs from a multipoint EVC.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the EVC.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of EVC for action. 3) Multipoint EVC has at least three ETH Flow Points
Begins When	Carrier Ethernet Manager sends an action request to Managed System to remove ETH FPs from a specific EVC.

Description	1) Carrier Ethernet Manager sends an action request to Managed System to remove ETH FPs from a specific EVC. Input parameters are EVC ID and ETH FP List. 2) Managed System deletes the ETH FPs in the EVC and modifies the corresponding ETH FP List attribute of the EVC. 3) Managed System forwards AVC Notification of the EVC and deletion Notifications of ETH FPs to all registered Carrier Ethernet Managers. 4) Managed System responds with success indication. 5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EVC 2) Unknown ETH FP 3) Managed System Processing Error 4) Invalid Parameter
Post-Conditions	If use case is successful, relevant ETH FPs are deleted and EVC attribute is modified, and the corresponding AVC and deletion Notifications are sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.4 Carrier Ethernet OVC Management
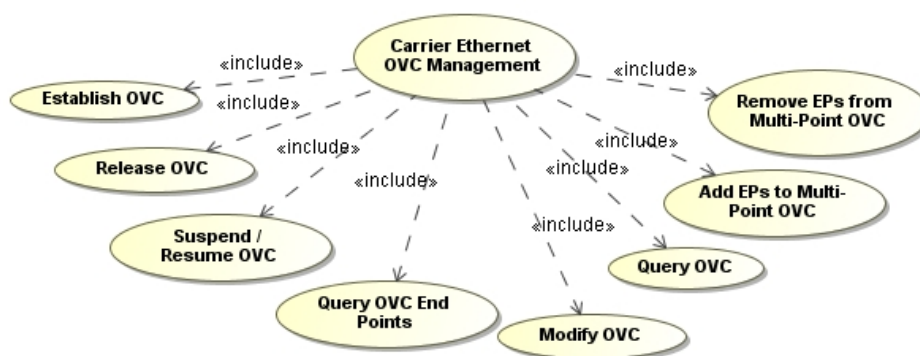
Figure 4-8 Carrier Ethernet OVC Management

4.2.1.4.1 Establish OVC

Name	Establish ETH OVC
Summary	The Carrier Ethernet Manager establishes an Ethernet Operator Virtual Connection (OVC) representing External Interface-to-External Interface (i.e. ENNI-to-ENNI or UNI-to-ENNI) connectivity across an Ethernet Flow Domain. During OVC establishment, the Managed System creates the OVC and associated OVC End Points. An ETH OVC provides connectivity among the identified OVC End Points.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to establish Ethernet OVCs. Carrier Ethernet Manager has already retrieved the ETH FD information.

Pre-Conditions	The Managed System is responsible for the management of all External Interfaces participating in the OVC.
	The Bandwidth Profiles for the OVC must be created prior to OVC establishment.
	The Carrier Ethernet Manager is aware of or able to retrieve the Bandwidth Profile instance names representing the Ethernet Bandwidth Profiles to be associated with the OVC.
	Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to establish an External Interface-to-External Interface OVC across a flow domain or collection of flow domains (Managed by the Managed System) among two or more than two External Interfaces. The Carrier Ethernet Manager has selected the External Interfaces where the OVC terminates and is ready to configure OVC parameters.

Description	The Carrier Ethernet Manager needs to provision an Ethernet OVC representing the External Interface-to-External Interface flow across an Ethernet Flow Domain. During OVC establishment, the Carrier Ethernet Manager configures the parameters of the OVC. After determining that there are sufficient resources to fulfill the request, the Managed System creates the OVC and associated OVC End Points. The Managed System also establishes relationships for the newly created OVC and OVC End Points.
	For establishing an OVC, the Carrier Ethernet Manager provides the following as part of the provisioning request:
	– OVC Type: Describes the ETH FDFr/OVC as: Multipoint-To-Multipoint, Point-To-Point, Rooted-Multipoint.
	– a End ETH FPP and Parameters: Indicates the a-end External Interface and associated OVC Parameters (including VLAN ID Mapping, BW Profiles, etc.).
	– z End ETH FPPs and Parameters: Indicates the z-end External Interface(s) and associated OVC Parameters (including VLAN ID Mapping, BW Profiles, etc.).
	– OVC Name: A string that is a unique identifying value for the ETH Virtual Connection.
	– Initial Administrative State: This parameter is used to activate (unlock) or deactivate (lock) this managed entity. In the Locked state, frame flow through the OVC is prohibited.
	– OVC Label: A text string that may be used to provide additional information about the OVC, such as a circuit identifier.
	– Maximum Number of End Points (total, UNI, ENNI)
	– OVC MTU Size
	– Access Service Type
	– CE VLAN Id Preservation
	– CE VLAN CoS Preservation
	– S VLAN Id Preservation
	– S VLAN CoS Preservation
	– Color Forwarding
	– Layer2 Control Protocol Processing List (OVC per External Interface)
	– Unicast Service Frame Delivery (OVC per External Interface)
	– Multicast Service Frame Delivery (OVC per External Interface)
	– Broadcast Service Frame Delivery (OVC per External Interface)
	– Ingress and Egress OVC End Point Role (OVC per External Interface)
	– Trunk Identifiers (OVC per ENNI)
	– Routing Criteria (optional) This parameter indicates the routing restriction information. It is a list of ETH FPPs that are included or excluded in the route.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	A new instance of OVC and associated ETH OVC End Points are created. And corresponding creation notifications are sent to Carrier Ethernet Managers registered for this notification.

4.2.1.4.2 Release OVC

Name	Release ETH OVC
Summary	The Carrier Ethernet Manager releases an OVC representing an External Interface-to-External Interface flow across an Ethernet Flow Domain. During OVC release, the Managed System removes the OVC and associated End Points.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to release Ethernet OVCs. Carrier Ethernet Manager has already retrieved the OVC information.
Pre-Conditions	The Managed System is responsible for the management of all External Interfaces participating in the OVC. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to release an OVC.
Description	The Carrier Ethernet Manager needs to release an OVC representing a flow across an Ethernet Flow Domain. Upon receipt of the request the Managed System removes the OVC and associated End Points. The Managed System also removes the associated relationships. For releasing an OVC, the Carrier Ethernet Manager provides the following as part of the release request: – OVC ID.
Ends When	1) Managed System returns the release response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Instance of OVC and associated OVC End Points are removed. And corresponding deletion notifications are sent to Carrier Ethernet Managers registered for this notification.

4.2.1.4.3 Modify OVC

Name	Modify OVC
Summary	The Carrier Ethernet Manager requests to modify attributes of OVC.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has already retrieved or created the OVC instance.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of OVC to be modified.
Begins When	The Carrier Ethernet Manager sends a request to Managed System to modify OVC attributes.

Description	1) Carrier Ethernet Manager sends a request to Managed System to modify attribute(s) of a specific OVC.
	2) Managed System modifies relevant attribute(s) of the OVC.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
	The attributes that might be configured in this use case include:
	– ceVlanIdPreservation
	– ceVlanCoSPreservation
	– sVlanIdPreservation
	– sVlanCosPreservation
	– colorForwarding
	– maxNumberOfUNIEndPoints
	– maxNumberOfENNIEndPoints
	– mtuSize
	– accessServiceType
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Attribute is read-only
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	The relevant attribute(s) of the OVC is updated.

4.2.1.4.4 Query OVC

Name	Query OVC
Summary	Carrier Ethernet Manager requests to retrieve attributes of a specific OVC from Managed System, or request discovery of instances and attributes of all OVCs within a specific Flow Domain managed by the Managed System. In addition, the Carrier Ethernet Manager retrieves all attributes of the OVC End Points that terminate each OVC.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the OVC and OVC End Point information. And Carrier Ethernet Manager has already retrieved the ETH Flow Domain information.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends Managed System a query of one specific or all OVCs in an ETH FD.

Description	1) The Carrier Ethernet Manager requests retrieval of the attributes of a specific OVC, or the name or identifier for all instances of the OVC object class that are contained in a specific Flow Domain.
	2) The Managed System returns the attributes of the specific OVC or a list of identifiers for all OVCs within the specified Flow Domain.
	3) Carrier Ethernet Manager receives the attributes, or the list of ETH OVC identifiers which can be used to query the corresponding attributes for the list of OVCs.
	Attributes of ETH OVC are described in the information model section of this document.
	– 4) For each OVC, the Carrier Ethernet Manager requests retrieval of all attributes for each OVC End Point that terminates the OVC.
Ends When	1) Managed System returns the OVC information to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives OVC information when the query succeeds. The Carrier Ethernet Manager has current values for the attributes for the OVC instance, and for each OVC End Point instance that terminates an OVC.

4.2.1.4.5 Suspend / Resume OVC

Name	Suspend and Resume OVC
Summary	The Carrier Ethernet Manager resumes or temporarily suspends an OVC.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to update the OVC End Points associated with the OVC instance.
Pre-Conditions	The Carrier Ethernet Manager is aware of or able to retrieve the names or identifiers for the OVC End Points instances related to the OVC to be resumed or suspended. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to resume or temporarily suspend an OVC.
Description	The Carrier Ethernet Manager needs to resume or temporarily suspend a specific OVC. As part of the resume/suspend request, the Carrier Ethernet Manager requests that the Administrative State of OVC End Points related to the specific OVC be set to either locked (suspended) or unlocked (resumed). Based on the resume/suspend request, the Managed System updates the Administrative State of the identified OVC End Points. In addition, a State Change Notifications for the OVC End Points are autonomously sent from the Managed System and received by the Carrier Ethernet Manager.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Invalid Parameter
	3) Managed System Processing Error
Post-Conditions	The OVC is resumed or suspended.

4.2.1.4.6 Query OVC End Points

Name	Query OVC End Points (EPs)
Summary	Carrier Ethernet Manager requests to retrieve OVC EP from Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the ETH OVC.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a query of OVC EPs in an ETH OVC or a query of specific OVC EP to Managed System.
Description	1) Carrier Ethernet Manager sends a query of OVC EPs in an ETH OVC or a query of specific OVC EP to Managed System. 2) Managed System returns the OVC EPs with the attributes as described in the information model portion of this document. 3) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the OVC EP attributes to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown OVC EP 2) Unknown ETH OVC 3) Managed System Processing Error 4) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives OVC EP attributes when the query succeeds.

4.2.1.4.7 Add End Points to a Multipoint OVC

Name	Add EPs To a Multipoint OVC
Summary	Carrier Ethernet Manager requests to add EPs to an existing multipoint OVC by mapping External Interfaces to the OVC along with the corresponding VLAN ID mapping.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the OVC.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of OVC for action. 3) Carrier Ethernet Manager knows the object of ETH External Interface to be mapped to the OVC.
Begins When	Carrier Ethernet Manager sends an action request to Managed System to map ETH External Interfaces to a specific OVC.
Description	1) Carrier Ethernet Manager sends an action request to Managed System to map ETH External Interfaces to a specific OVC. Input parameters are OVC ID and ETH External Interface List. 2) Managed System creates new ETH EPs in the OVC and modifies the corresponding EP List attribute of the OVC. 3) Managed System forwards AVC Notification of the OVC and creation Notifications of new EPs to all registered Carrier Ethernet Managers. 4) Managed System responds with new created EP ID list. 5) Carrier Ethernet Manager receives the response from Managed System.

Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown OVC
	2) Unknown External Interface
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	If use case is successful, new ETH EPs are created and OVC attribute is modified, and the corresponding AVC and creation Notifications are sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.4.8 Remove End Points from a Multipoint OVC

Name	Remove EPs From Multipoint OVC
Summary	Carrier Ethernet Manager requests to remove EPs from a multipoint OVC.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the OVC.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of OVC for action.
	3) Multipoint OVC has at least three OVC End Points
Begins When	Carrier Ethernet Manager sends an action request to Managed System to remove ETH EPs from a specific OVC.
Description	1) Carrier Ethernet Manager sends an action request to Managed System to remove ETH EPs from a specific OVC. Input parameters are OVC ID and list of EP IDs.
	2) Managed System deletes the ETH EPs in the OVC and modifies the corresponding EP List attribute of the OVC.
	3) Managed System forwards AVC Notification of the OVC and deletion Notifications of ETH EPs to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown OVC
	2) Unknown ETH EP
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	If use case is successful, relevant ETH EPs are deleted and OVC attribute is modified, and the corresponding AVC and deletion Notifications are sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.5 ELMI Management

Figure 4-9 ELMI Management

4.2.1.5.1 Create ELMI Profile

Name	Create ELMI Profile
Summary	Carrier Ethernet Manager requests creation of ELMI Profile on the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ELMI profile for future bandwidth assignment.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ELMI Profile to Managed System.

Description	1) Carrier Ethernet Manager sends to the Managed System a request of creation of ELMI Profile with parameters including:
	   a) elmiAdministrativeState
	   b) elmiProtocolVersion
	   c) elmiAsyncStatusEnabled (default to TRUE if not provided)
	   d) elmiMinAsyncMessageInterval
	   e) elmiN393 (default to 4 if not provided)
	   f) elmiT392 (0=timer disabled) (default to 10 if not provided)
	2) The Managed System creates ELMI Profile
	3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers
	4) Managed System responds with new created ELMI Profile ID
	5) Carrier Ethernet Manager receives the response from Managed System

Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ELMI Profile is created and corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.5.2 Delete ELMI Profile

Name	Delete ELMI Profile
Summary	Carrier Ethernet Manager requests deletion of ELMI Profile on Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created ELMI Profile.

Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of ELMI Profile to be deleted
Begins When	Carrier Ethernet Manager requests deletion of ELMI Profile to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of deletion of ELMI Profile with a specific ELMI Profile ID.
	2) Managed System deletes ELMI Profile.
	3) Managed System forwards Deletion Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ELMI Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	If use case is successful, the ELMI Profile is deleted and the corresponding deletion notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.5.3 Modify ELMI Profile

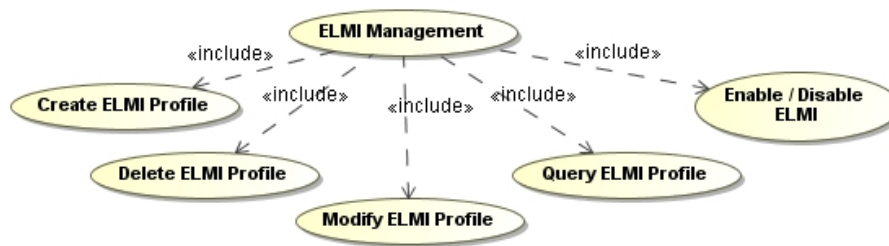| Name | Modify ELMI Profile |
Summary	Carrier Ethernet Manager requests to modify attributes of ELMI Profile.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the ELMI Profile.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of ELMI Profile to be modified.
Begins When	Carrier Ethernet Manager sends a request to Managed System to modify ELMI Profile attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify parameters of a specific ELMI Profile, including:
	b) elmiProtocolVersion
	c) elmiAsyncStatusEnabled
	d) elmiMinAsyncMessageInterval
	e) elmiN393
	f) elmiT392
	2) Managed System modifies relevant attributes of ELMI Profile.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens

Exceptions	1) Unknown ELMI Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.5.4 Query ELMI Profile

Name	Query ELMI Profile
Summary	Carrier Ethernet Manager requests to retrieve ELMI Profile from the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Managed System has the list of ELMI Profiles.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a query of one specific or all ELMI Profiles to the Managed System.
Description	1) Carrier Ethernet Manager sends a query to retrieve one specific or all ELMI Profiles to the Managed System.
	2) Managed System returns the ELMI Profile with the following attributes:
	a) elmiProfileID
	b) elmiOperationalState
	c) elmiAdministrativeState
	d) elmiProtocolVersion
	e) elmiAsyncStatusEnabled
	f) elmiMinAsyncMessageInterval
	g) elmiN393
	h) elmiT392
	3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the ELMI Profile information to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ELMI Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ELMI Profile information when the query succeeds.

4.2.1.5.5 Enable / Disable ELMI

Name	Enable and Disable ELMI Mechanism on a specific UNI
Summary	The Carrier Ethernet Manager enables or disables the ELMI mechanism on an ETH FPP UNI.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to update the ELMI Profile instance.

Pre-Conditions	The Carrier Ethernet Manager is aware of or able to retrieve the names or identifiers for the ELMI Profile instance contained in the ETH FPP UNI instance to be enabled or disabled. Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to enable or disable an ELMI Mechanism on a specific UNI.
Description	The Carrier Ethernet Manager needs to enable or disable a specific ELMI mechanism. As part of the enable/disable request, the Carrier Ethernet Manager requests that the Administrative State of a specific ELMI Profile containe in a specific ETH FPP UNI be set to either locked (disabled) or unlocked (enabled). Based on the enable/disable request, the Managed System updates the Administrative State of the identified ELMI Profile. In addition, a State Change Notification for the ELMI Profile is autonomously sent from the Managed System and received by the Carrier Ethernet Manager.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Invalid Parameter 3) Managed System Processing Error
Post-Conditions	The ELMI mechanism is enabled or disable as requested. Administrative State in the supporting ELMI Profile is updated.

4.2.1.6 Ethernet Discovery
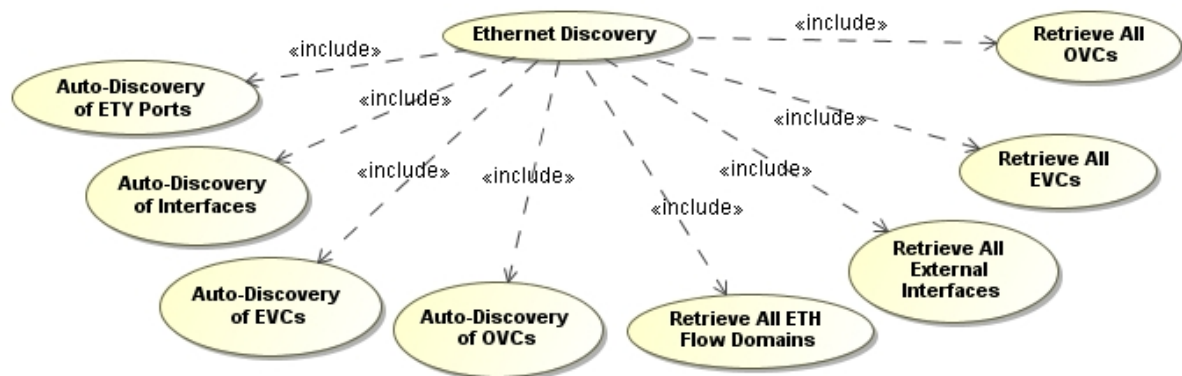
Figure 4-10 Ethernet Discovery Function Set

4.2.1.6.1 Auto-Discovery of ETY Port

Name	Auto-discovery of ETY Ports
Summary	The Carrier Ethernet Manager receives discovery/creation notification including all attributes whenever new instances of ETY Ports are created in the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the ETY Port information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.
Begins When	A new instance of ETY Port is created in the Managed System and the Carrier Ethernet Manager sends a request to discover new instances and attributes of ETY Port managed by the Managed System.
Description	The Carrier Ethernet Manager auto-discovers new ETY Ports managed by the Managed System. The Managed System sends the identifier and all attributes for each newly created ETY Port.
Ends When	The Managed System sends the ETY Port information to the Carrier Ethernet Manager.
Exceptions	Not applicable.
Post-Conditions	The Carrier Ethernet Manager has discovered new ETY Ports managed by the Managed System. The Carrier Ethernet Manager has current values for the attributes for each instance.

4.2.1.6.2 Auto-Discovery of External Interfaces

Name	Auto-discovery of Ethernet Flow Point Pool Subclasses (UNI, ENNI, VUNI)
Summary	The Carrier Ethernet Manager receives discovery/creation notification including all attributes whenever new instances of Ethernet Flow Point Pool subclasses are created in the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the Ethernet Flow Point Pool subclass information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.
Begins When	A new instance of a Ethernet Flow Point Pool subclass is created in the Managed System and the Carrier Ethernet Manager sends a request to discover new instances and attributes of Ethernet Flow Point Pool subclasses managed by the Managed System.
Description	The Carrier Ethernet Manager auto-discovers new Ethernet Flow Point Pool subclassess managed by the Managed System. The Managed System sends the identifier and all attributes for each newly created Ethernet Flow Point Pool subclasses.
Ends When	The Managed System sends the Ethernet Flow Point Pool subclass instance information to Carrier Ethernet Manager
Exceptions	Not applicable.
Post-Conditions	The Carrier Ethernet Manager has discovered new Ethernet Flow Point Pool subclasses managed by the Managed System. The Carrier Ethernet Manager has

	current values for the attributes for each instance.

4.2.1.6.3 Auto-Discovery of EVCs

Name	Auto-discovery of EVCs
Summary	The Carrier Ethernet Manager receives discovery/creation notification including all attributes whenever new instances of EVCs are created in the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the EVC information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.
Begins When	A new instance of EVC is created in the Managed System and the Carrier Ethernet Manager sends a request to discover new instances and attributes of EVCs managed by the Managed System.
Description	The Carrier Ethernet Manager auto-discovers new EVCs managed by the Managed System. The Managed System sends the identifier and all attributes for each newly created EVCs.
Ends When	The Managed System sends the EVC information to Carrier Ethernet Manager.
Exceptions	Not applicable.
Post-Conditions	The Carrier Ethernet Manager has discovered new EVCs managed by the Managed System. The Carrier Ethernet Manager has current values for the attributes for each instance.

4.2.1.6.4 Auto-Discovery of OVCs

Name	Auto-discovery of Ethernet OVCs
Summary	The Carrier Ethernet Manager receives discovery/creation notification including all attributes whenever new instances of Ethernet OVCs are created in the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the Ethernet OVC information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.
Begins When	A new instance of Ethernet OVC is created in the Managed System and the Carrier Ethernet Manager sends a request to discover new instances and attributes of Ethernet OVCs managed by the Managed System.
Description	The Carrier Ethernet Manager auto-discovers new Ethernet OVCs managed by the Managed System. The Managed System sends the identifier and all attributes for each newly created Ethernet OVCs.
Ends When	The Managed System sends the Ethernet OVC information to Carrier Ethernet Manager.
Exceptions	Not applicable.
Post-Conditions	The Carrier Ethernet Manager has discovered new Ethernet OVCs managed by the Managed System. The Carrier Ethernet Manager has current values for the attributes for each instance.

4.2.1.6.5 Retrieve All ETH Flow Domains

Name	Retrieval of All Ethernet Flow Domains (FDs)
Summary	The Carrier Ethernet Manager requests discovery of instances and attributes of all Ethernet FDs managed by the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the Ethernet FD information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to discover instances and attributes of all Ethernet FDs managed by the Managed System.
Description	The Carrier Ethernet Manager has a need to discover all Ethernet FDs managed by a Managed System. The Carrier Ethernet Manager requests retrieval of the name/identifier or attributes for all instances of the Ethernet FD object class.
	The Ethernet FD may have the following attributes and relationships:
	– FD ID: This attribute represents a unique value for the ETH FD.
	– User Label: A text string that may be used to describe the object or provide additional information.
	– Parent ETH Flow Domain: which contains the nested ETH FD.
	– ETH FPP List: This attribute represents Flow Domain's External Interfaces.
	– Member ETH Flow Domain List: Partitioned or nested ETH FDs contained in the ETH FD.
	– Member FDFr/EVC List: FDFrs/EVCs contained in the ETH FD.
	– Member OVC List: OVCs contained in the ETH FD.
	– Supporting Elements: The elements that support this ETH FD. For example, the NEs and Circuit packs that support this ETH FD.
Ends When	1) Managed System returns the Ethernet FD information to the Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Invalid Parameter
	3) Managed System Processing Error
Post-Conditions	The Carrier Ethernet Manager has discovered all Ethernet FDs managed by the Managed System. The Carrier Ethernet Manager has current values for the attributes for each instance.

4.2.1.6.6 Retrieve All External Interfaces

Name	Retrieval of All Ethernet External Interfaces
Summary	The Carrier Ethernet Manager requests discovery of instances and attributes of all Ethernet External Interfaces (e.g., ENNIs, UNIs) managed by the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the Ethernet External Interface information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.

Begins When	The Carrier Ethernet Manager sends a request to discover instances and attributes of all Ethernet External Interfaces managed by the Managed System.
Description	The Carrier Ethernet Manager has a need to discover all Ethernet External Interfaces managed by a Managed System. The Carrier Ethernet Manager requests retrieval of the name/identifier or attributes for all instances of the ETH Flow Point Pool object class.
Ends When	1) Managed System returns the Ethernet External Interface information to the Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Invalid Parameter 3) Managed System Processing Error
Post-Conditions	The Carrier Ethernet Manager has discovered all Ethernet External Interfaces managed by the Managed System. The Carrier Ethernet Manager has current values for the attributes for each instance.

4.2.1.6.7 Retrieve All EVCs

Name	Retrieval of All Ethernet Virtual Connections (EVCs)
Summary	The Carrier Ethernet Manager requests discovery of instances and attributes of all Ethernet EVCs managed by the Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the Ethernet EVC information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to discover instances and attributes of all Ethernet EVCs managed by the Managed System.
Description	The Carrier Ethernet Manager has a need to discover all Ethernet EVCs managed by a Managed System. The Carrier Ethernet Manager requests retrieval of the name/identifier or attributes for all instances of the Ethernet EVC object class.
Ends When	1) Managed System returns the Ethernet EVC information to the Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Invalid Parameter 3) Managed System Processing Error
Post-Conditions	The Carrier Ethernet Manager has discovered all Ethernet EVCs managed by the Managed System. The Carrier Ethernet Manager has current values for the attributes for each instance.

4.2.1.6.8 Retrieve All OVCs

Name	Retrieval of All Operator Virtual Connections (OVCs)
Summary	The Carrier Ethernet Manager requests discovery of instances and attributes of all Ethernet OVCs managed by the Managed System.

Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to retrieve the Ethernet OVC information.
Pre-Conditions	The communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to discover instances and attributes of all Ethernet OVCs managed by the Managed System.
Description	The Carrier Ethernet Manager has a need to discover all Ethernet OVCs managed by a Managed System. The Carrier Ethernet Manager requests retrieval of the name/identifier or attributes for all instances of the Ethernet OVC object class.
Ends When	1) Managed System returns the Ethernet OVC information to the Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Invalid Parameter 3) Managed System Processing Error
Post-Conditions	The Carrier Ethernet Manager has discovered all Ethernet OVCs managed by the Managed System. The Carrier Ethernet Manager has current values for the attributes for each instance.

4.2.1.7 Carrier Ethernet Service OAM Configuration
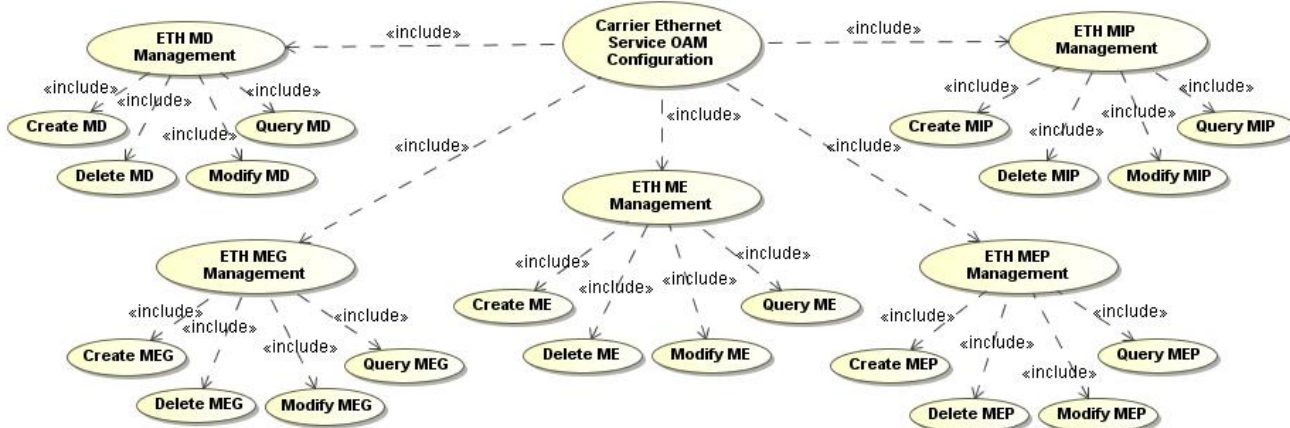
Figure 4-11 Carrier Ethernet Service OAM Configuration

4.2.1.7.1 ETH Maintenance Domain (MD) Management

4.2.1.7.1.1 Create MD

Name	ETH Maintenance Domain Creation
Summary	The Carrier Ethernet Manager creates and configures an ETH Maintenance Domain.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH MD.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System.

Begins When	The Carrier Ethernet Manager sends a request to provision an EthMd representing an Ethernet Maintenance Domain in the Managed System.
Description	The Carrier Ethernet Manager needs to create a new ETH Maintenance Domain within the Managed System. The Carrier Ethernet Manager requests the creation of a new Ethernet MD to be managed in the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet MD configuration parameters. Based on the creation request, the Managed System creates an instance of EthMd and returns the name of the new EthMd instance. In addition, an Object Creation Notification for the new instance of EthMd is autonomously sent from the Managed System. For an EthMd, the following information may be provided by the Carrier Ethernet Manager as part of the creation request: – MD Name Type (Optional): Indicates the type and format of the Maintenance Domain Name. – MD Level (Optional): The Maintenance Domain Level (802.1ag). The default value is zero. – User Label. – MD Name (Optional): The Maintenance Domain Name (802.1ag). The type and format is specified by the MaintDomainNameType attribute.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	A new instance of EthMd is created.

4.2.1.7.1.2 Delete MD

Name	ETH Maintenance Domain Deletion
Summary	The Carrier Ethernet Manager deletes an EthMd representing a Ethernet Maintenance Domain.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet MD instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available. The EthMd has no contained EthMeg instances.
Begins When	The Carrier Ethernet Manager sends a request to remove an Ethernet Maintenance Domain.
Description	The Carrier Ethernet Manager needs to remove an Ethernet Maintenance Domain. The Carrier Ethernet Manager requests the deletion of the EthMd from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet MD identifier. Based on the deletion request, the Managed System removes the instance of EthMd. In addition, an Object Deletion Notification for the instance of EthMd is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager 2) Exception happens

Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
	4) Undeletable Object List
Post-Conditions	The instance of EthMd is deleted.

4.2.1.7.1.3 Modify MD

Name	Modify ETH Maintenance Domain
Summary	Carrier Ethernet Manager requests to modify some attributes of EthMd.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the EthMd information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of EthMd to be modified.
Begins When	Carrier Ethernet Manager sends a request to the Managed System to modify EthMd attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific Ethernet Maintenance Domain attributes of a specific EthMd object instance.
	2) Managed System modifies relevant attributes of EthMd.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
	The attributes that might be configured in this use case include:
	– Maintenance Domain Name Type
	– Maintenance Domain Level
	– Maintenance Domain Name
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown EthMd
	2) Attribute is read-only
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.7.1.4 Query MD

Name	Query ETH Maintenance Domain
Summary	Carrier Ethernet Manager requests to query Ethernet Maintenance Domain information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.

Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of EthMd to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of EthMd to Managed System 2) Managed System returns the EthMd attributes to Carrier Ethernet Manager 3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the EthMd information to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EthMd 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives EthMd attributes when the query succeeds.

4.2.1.7.2 ETH Maintenance Entity Group (MEG) Management

4.2.1.7.2.1 Create MEG

Name	ETH Maintenance Entity Group Creation
Summary	The Carrier Ethernet Manager creates and configures an ETH Maintenance Entity Group.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH MEG.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System.
Begins When	The Carrier Ethernet Manager sends a request to provision an EthMeg representing an Ethernet Maintenance Entity Group in the Managed System.
Description	The Carrier Ethernet Manager needs to create a new ETH Maintenance Entity Group within the Managed System. The Carrier Ethernet Manager requests the creation of a new Ethernet MEG to be managed in the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet MEG configuration parameters. Based on the creation request, the Managed System creates an instance of EthMeg and returns the name of the new EthMeg instance. In addition, an Object Creation Notification for the new instance of EthMeg is autonomously sent from the Managed System. For an EthMeg, the following information may be provided by the Carrier Ethernet Manager as part of the creation request: – Chassis Id (Optional): indicates the Chassis ID to be sent in the Sender ID TLV for all MPs in this MEG. – Chassis Id Subtype (Optional): indicates the format of the Chassis ID to be sent in the Sender ID TLV for all MPs in this MEG. – Connectivity Status Interval: specifies a configurable time interval to detect a change in Connectivity Status. – MEG ID: specifies the MEG ID (Y.1731) or MAID (802.1ag).. – Include Interface Status Tlv: specifies if the Interface Status TLV (802.1ag) is included in OAM messages transmitted by MPs configured in this MEG. – Include Port Status Tlv: specifies if the Port Status TLV (802.1ag) is included in OAM messages transmitted by MPs configured in this MEG. – Include Sender Id Tlv: 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. – Length: represents the MEG ID (Y.1731) or Short MA Name (802.1ag) length. – MEG Level: specifies the MEG Level used to distinguish between OAM frames belonging to different nested MEs. – Format: represents the MEG ID (Y.1731) or Short MA Name (802.1ag) format. – Maintenance Association Short Name (Conditional): specifies the short Maintenance Name (802.1ag). Mandatory if format is based on 802.1ag MAID. – Performance Measurement Interval Duration: length of the period of time associated with a Measurement Interval. – CCM Interval: specifies the ETH-CC and ETH-RDI transmission period. – Peer MEP Information Aging Time (Optional): 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.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	A new instance of EthMeg is created.

4.2.1.7.2.2 Delete MEG

Name	ETH Maintenance Entity Group Deletion
Summary	The Carrier Ethernet Manager deletes an EthMeg representing an Ethernet Maintenance Entity Group.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet MEG instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available. The EthMeg has no contained EthMp (MIP or MEP) instances.
Begins When	The Carrier Ethernet Manager sends a request to remove an Ethernet Maintenance Entity Group.
Description	The Carrier Ethernet Manager needs to remove an Ethernet Maintenance Entity Group. The Carrier Ethernet Manager requests the deletion of the EthMeg from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet MEG identifier. Based on the deletion request, the Managed System removes the instance of EthMeg. In addition, an Object Deletion Notification for the instance of EthMeg is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity Group 2) Managed System Processing Error 3) Invalid Parameter 4) Undeletable Object List

Post-Conditions	The instance of EthMeg is deleted.

4.2.1.7.2.3 Modify MEG

Name	Modify ETH Maintenance Entity Group
Summary	Carrier Ethernet Manager requests to modify some attributes of EthMeg.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the EthMeg information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of EthMeg to be modified.
Begins When	Carrier Ethernet Manager sends a request to the Managed System to modify EthMeg attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific Ethernet Maintenance Entity Group attributes of a specific EthMeg object instance. 2) Managed System modifies relevant attributes of EthMeg. 3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers. 4) Managed System responds with success indication. 5) Carrier Ethernet Manager receives the response from Managed System. The attributes that might be configured in this use case include: – Chassis Id – Chassis Id Subtype – Connectivity Status Interval – MEG ID – Include Interface Status Tlv – Include Port Status Tlv – Include Sender Id Tlv – Length – MEG Level – Format – Maintenance Association Short Name – Performance Measurement Interval Duration – CCM Interval – Peer MEP Information Aging Time
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EthMeg 2) Attribute is read-only 3) Managed System Processing Error 4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.7.2.4 Query MEG

Name	Query ETH Maintenance Entity Group
Summary	Carrier Ethernet Manager requests to query Ethernet Maintenance Entity Group information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of EthMeg to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of EthMeg to Managed System 2) Managed System returns the EthMeg attributes to Carrier Ethernet Manager 3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the EthMeg information to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EthMeg 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives EthMeg attributes when the query succeeds.

4.2.1.7.3 ETH Maintenance Entity (ME) Management

4.2.1.7.3.1 Create ME

Name	ETH Maintenance Entity Creation
Summary	The Carrier Ethernet Manager creates and configures an ETH Maintenance Entity.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH ME.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System. The associated MEG instance exists.
Begins When	The Carrier Ethernet Manager sends a request to provision an EthMe representing an Ethernet Maintenance Entity in the Managed System.
Description	The Carrier Ethernet Manager needs to create a new ETH Maintenance Entity within the Managed System. The Carrier Ethernet Manager requests the creation of a new Ethernet ME to be managed in the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet ME configuration parameters. Based on the creation request, the Managed System creates an instance of EthMe and returns the name of the new EthMe instance. In addition, an Object Creation Notification for the new instance of EthMe is autonomously sent from the Managed System. For an EthMe, the following information may be provided by the Carrier Ethernet Manager as part of the creation request: – Type: describes the ME type as "Subscriber", "EVC", "UNI", or "NNI".
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens

Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	A new instance of EthMe is created.

4.2.1.7.3.2 Delete ME

Name	ETH Maintenance Entity Deletion
Summary	The Carrier Ethernet Manager deletes an EthMe representing an Ethernet Maintenance Entity.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet ME instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to remove an Ethernet Maintenance Entity Group.
Description	The Carrier Ethernet Manager needs to remove an Ethernet Maintenance Entity. The Carrier Ethernet Manager requests the deletion of the EthMe from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet ME identifier. Based on the deletion request, the Managed System removes the instance of EthMe. In addition, an Object Deletion Notification for the instance of EthMe is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown Managed Entity
	2) Managed System Processing Error
	3) Invalid Parameter
	4) Undeletable Object List
Post-Conditions	The instance of EthMe is deleted.

4.2.1.7.3.3 Modify ME

Name	Modify ETH Maintenance Entity
Summary	Carrier Ethernet Manager requests to modify some attributes of EthMe.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the EthMe information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of EthMe to be modified.
Begins When	Carrier Ethernet Manager sends a request to the Managed System to modify EthMe attributes.

Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific Ethernet Maintenance Entity attributes of a specific EthMe object instance.
	2) Managed System modifies relevant attributes of EthMe.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
	The attributes that might be configured in this use case include:
	– Type
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown EthMe
	2) Attribute is read-only
	3) Managed System Processing Error
	4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.7.3.4 Query ME

Name	Query ETH Maintenance Entity
Summary	Carrier Ethernet Manager requests to query Ethernet Maintenance Entity information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of EthMe to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of EthMe to Managed System
	2) Managed System returns the EthMe attributes to Carrier Ethernet Manager
	3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the EthMe information to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown EthMe
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives EthMe attributes when the query succeeds.

4.2.1.7.4 ETH MEG End Point (MEP) Management

4.2.1.7.4.1 Create MEP

Name	ETH MEG End Point
Summary	The Carrier Ethernet Manager creates and configures an ETH MEG End Point.

Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH MEP.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System. The associated MEG instance exists.
Begins When	The Carrier Ethernet Manager sends a request to provision an EthMep representing an Ethernet MEG End Point in the Managed System.
Description	The Carrier Ethernet Manager needs to create a new ETH MEG End Point within the Managed System. The Carrier Ethernet Manager requests the creation of a new Ethernet MEP to be managed in the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet MEP configuration parameters. Based on the creation request, the Managed System creates an instance of EthMep and returns the name of the new EthMep instance. In addition, an Object Creation Notification for the new instance of EthMep is autonomously sent from the Managed System. For an EthMep, the following information may be provided by the Carrier Ethernet Manager as part of the creation request: – ASAP Pointer: the alarm severity assignment profile associated with the EthMp to assign alarm severity to specific alarms. – Administrative State: specifies the administrative state of the EthMep. – Connectivity Status (Optional): indicates the connectivity status for a MEP in EVC MEs. – Primary VID: specifies an integer indicating the Primary VID of the MEP. – Direction: specifies the direction in which the Maintenance Association (MEP only) faces on the bridge port. – MEP ID: specifies the MEP ID as defined in Y.1731.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	A new instance of EthMep is created.

4.2.1.7.4.2 Delete MEP

Name	ETH MEG End Point
Summary	The Carrier Ethernet Manager deletes an EthMep representing an Ethernet MEG End Point.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet MEP instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to remove an Ethernet MEG End Point.

Description	The Carrier Ethernet Manager needs to remove an Ethernet MEG End Point. The Carrier Ethernet Manager requests the deletion of the EthMep from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet MEP identifier. Based on the deletion request, the Managed System removes the instance of EthMep. In addition, an Object Deletion Notification for the instance of EthMep is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed End Point 2) Managed System Processing Error 3) Invalid Parameter 4) Undeletable Object List
Post-Conditions	The instance of EthMep is deleted.

4.2.1.7.4.3 Modify MEP

Name	Modify ETH MEG End Point
Summary	Carrier Ethernet Manager requests to modify some attributes of EthMep.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the EthMep information.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of EthMep to be modified.
Begins When	Carrier Ethernet Manager sends a request to the Managed System to modify EthMep attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific Ethernet MEG End Point attributes of a specific EthMep object instance. 2) Managed System modifies relevant attributes of EthMep. 3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers. 4) Managed System responds with success indication. 5) Carrier Ethernet Manager receives the response from Managed System. The attributes that might be configured in this use case include: – ASAP Pointer – Administrative State – Connectivity Status – Primary VID – Direction – MEP ID
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EthMep 2) Attribute is read-only 3) Managed System Processing Error 4) Invalid Parameter

Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.7.4.4 Query MEP

Name	Query ETH MEG End Point
Summary	Carrier Ethernet Manager requests to query Ethernet MEG End Point information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of EthMep to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of EthMep to Managed System 2) Managed System returns the EthMep attributes to Carrier Ethernet Manager 3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the EthMep information to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EthMep 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives EthMep attributes when the query succeeds.

4.2.1.7.5 ETH MEG Intermediate Point (MIP) Management

4.2.1.7.5.1 Create MIP

Name	ETH MEG Intermediate Point
Summary	The Carrier Ethernet Manager creates and configures an ETH MEG Intermediate Point.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to create the ETH MIP.
Pre-Conditions	The Carrier Ethernet Manager has established communication with Managed System. The associated MEG instance exists.
Begins When	The Carrier Ethernet Manager sends a request to provision an EthMip representing an Ethernet MEG Intermediate Point in the Managed System.
Description	The Carrier Ethernet Manager needs to create a new ETH MEG Intermediate Point within the Managed System. The Carrier Ethernet Manager requests the creation of a new Ethernet MIP to be managed in the Managed System. As part of the creation request, the Carrier Ethernet Manager provides Ethernet MIP configuration parameters. Based on the creation request, the Managed System creates an instance of EthMip and returns the name of the new EthMip instance. In addition, an Object Creation Notification for the new instance of EthMip is autonomously sent from the Managed System.

	For an EthMip, the following information may be provided by the Carrier Ethernet Manager as part of the creation request: – ASAP Pointer: the alarm severity assignment profile associated with the EthMp to assign alarm severity to specific alarms.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Entity 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	A new instance of EthMip is created.

4.2.1.7.5.2 Delete MIP

Name	ETH MEG Intermediate Point
Summary	The Carrier Ethernet Manager deletes an EthMip representing an Ethernet MEG Intermediate Point.
Actor(s)	Carrier Ethernet Manager
Assumptions	The Carrier Ethernet Manager has the authority to delete the Ethernet MIP instance.
Pre-Conditions	Communication between Carrier Ethernet Manager and Managed System is available.
Begins When	The Carrier Ethernet Manager sends a request to remove an Ethernet MEG Intermediate Point.
Description	The Carrier Ethernet Manager needs to remove an Ethernet MEG Intermediate Point. The Carrier Ethernet Manager requests the deletion of the EthMip from the Managed System. As part of the deletion request, the Carrier Ethernet Manager provides Ethernet MIP identifier. Based on the deletion request, the Managed System removes the instance of EthMip. In addition, an Object Deletion Notification for the instance of EthMip is autonomously sent from the Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown Managed Intermediate point 2) Managed System Processing Error 3) Invalid Parameter 4) Undeletable Object List
Post-Conditions	The instance of EthMip is deleted.

4.2.1.7.5.3 Modify MIP

Name	Modify ETH MEG Intermediate Point
Summary	Carrier Ethernet Manager requests to modify some attributes of EthMip.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved the EthMip information.

Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of EthMip to be modified.
Begins When	Carrier Ethernet Manager sends a request to the Managed System to modify EthMip attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify specific Ethernet MEG Intermediate Point attributes of a specific EthMip object instance. 2) Managed System modifies relevant attributes of EthMip. 3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers. 4) Managed System responds with success indication. 5) Carrier Ethernet Manager receives the response from Managed System. The attributes that might be configured in this use case include: – ASAP Pointer
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EthMip 2) Attribute is read-only 3) Managed System Processing Error 4) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and corresponding AVC is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.7.5.4 Query MIP

Name	Query ETH MEG Intermediate Point
Summary	Carrier Ethernet Manager requests to query Ethernet MEG Intermediate Point information.
Actor(s)	Carrier Ethernet Manager
Assumptions	None.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a request of query of EthMip to Managed System.
Description	1) Carrier Ethernet Manager sends a request of query of EthMip to Managed System 2) Managed System returns the EthMip attributes to Carrier Ethernet Manager 3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the EthMip information to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown EthMip 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives EthMip attributes when the query succeeds.

4.2.1.8   Carrier Ethernet Profile Management

Figure 4-12 Carrier Ethernet Profile Management

4.2.1.8.1   ETH Bandwidth Profile Management

4.2.1.8.1.1   Create ETH Bandwidth Profile

Name	Create ETH Bandwidth Profile
Summary	Carrier Ethernet Manager requests creation of ETH Bandwidth Profile on Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH Bandwidth Profile for future bandwidth assignment.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH Bandwidth Profile to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH Bandwidth Profile with parameters including CIR, CBS, EIR, EBS 2) Managed System creates ETH Bandwidth Profile 3) Managed System forwards Creation Notification to all registered Carrier Ethernet Manager 4) Managed System responds with new created ETH Bandwidth Profile ID 5) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH Bandwidth Profile is created and corresponding creation notification is sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.8.1.2   Query ETH Bandwidth Profile

Name	Query ETH Bandwidth Profile

Summary	Carrier Ethernet Manager requests to retrieve ETH Bandwidth Profile from Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Managed System has the list of ETH Bandwidth Profile.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a query of one specific or all ETH Bandwidth Profile to Managed System.

Description	1) Carrier Ethernet Manager sends a query of one specific or all ETH Bandwidth Profile to Managed System.
	2) Managed System returns the ETH Bandwidth Profile with the following attributes:
	  – ETH Bandwidth Profile ID
	  – CIR: This attribute identifies the Committed Information Rate (CIR) in bits per second for one direction of ETH traffic.
	  – CBS: This attribute identifies the Committed Burst Size (CBS) in bytes for one direction of ETH traffic.
	  – EIR: This attribute identifies the Excess Information Rate (EIR) in bits per second for one direction of ETH traffic.
	  – EBS: This attribute identifies the Excess Burst Size (EBS) in bytes for one direction of ETH traffic.
	  – Color Mode: This attribute describes the color mode (CM) to be applied as "color-blind mode" or "color-aware mode".
	  – Coupling Flag: This attribute describes if yellow frames will be admitted if unused bandwidth is available.
	3) Carrier Ethernet Manager receives the response from Managed System

Ends When	1) Managed System returns the ETH Bandwidth Profile information to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown ETH Bandwidth Profile 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ETH Bandwidth Profile information when the query succeeds.

4.2.1.8.1.3 Modify ETH Bandwidth Profile

Name	Modify ETH Bandwidth Profile
Summary	Carrier Ethernet Manager requests to modify attributes of ETH Bandwidth Profile.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the ETH Bandwidth Profile.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of ETH Bandwidth Profile to be modified.

Begins When	Carrier Ethernet Manager sends a request to Managed System to modify ETH Bandwidth Profile attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify CIR, CBS, EIR or EBS of a specific ETH Bandwidth Profile.
	2) Managed System modifies relevant attributes of ETH Bandwidth Profile.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH Bandwidth Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and the corresponding AVC is sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.8.1.4 Delete ETH Bandwidth Profile

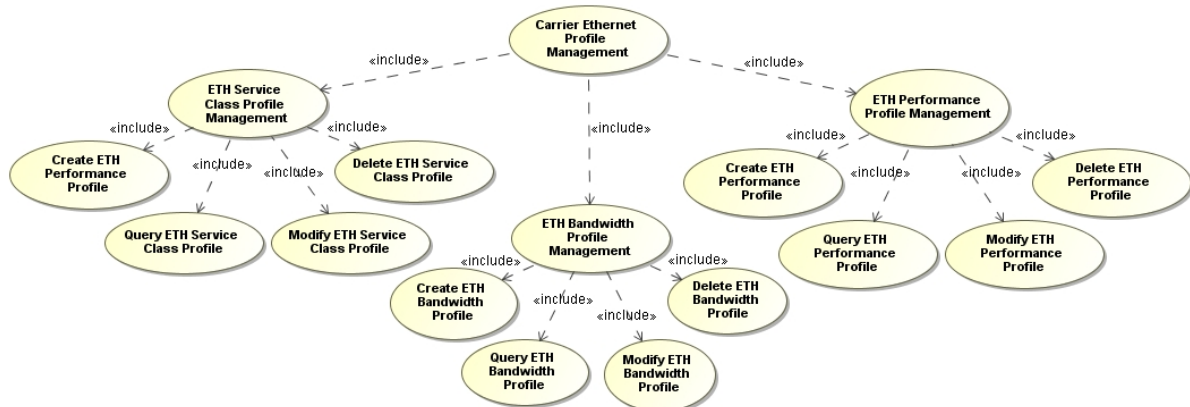| Name	Delete ETH Bandwidth Profile
Summary	Carrier Ethernet Manager requests deletion of ETH Bandwidth Profile from Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created ETH Bandwidth Profile.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of ETH Bandwidth Profile to be deleted.
	3) No active services refer to the ETH Bandwidth Profile Instance.
Begins When	Carrier Ethernet Manager requests deletion of ETH Bandwidth Profile to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request for deletion of ETH Bandwidth Profile with a specific ETH Bandwidth Profile ID.
	2) Managed System verifies that the ETH Bandwidth Profile to be deleted is not currently being used.
	3) Managed System deletes ETH Bandwidth Profile.
	4) Managed System forwards Deletion Notification to all registered Carrier Ethernet Manager.
	5) Managed System responds with success indication.
	6) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager
	2) Exception happens

Exceptions	1) Unknown ETH Bandwidth Profile
	2) Managed System Processing Error
	3) Invalid Parameter
	4) ETH Bandwidth Profile in use
Post-Conditions	If use case is successful, the ETH Bandwidth Profile is deleted and the corresponding deletion notification is sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.8.2 ETH Service Class Profile Management

4.2.1.8.2.1 Create ETH Service Class Profile

Name	Create ETH Service Class Profile
Summary	Carrier Ethernet Manager requests creation of ETH Service Class Profile on Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH Service Class profile for future bandwidth assignment.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH Service Class Profile to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH Service Class Profile with parameters including Classification Characteristic and Classification parameters.
	2) Managed System creates ETH Service Class Profile
	3) Managed System forwards Creation Notification to all registered Carrier Ethernet Manager.
	4) Managed System responds with new created ETH Service Class Profile ID
	5) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH Service Class Profile is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.8.2.2 Query ETH Service Class Profile

Name	Query ETH Service Class Profile
Summary	Carrier Ethernet Manager requests to retrieve ETH Service Class Profile from Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Managed System has the list of ETH Service Class Profile.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.

Begins When	Carrier Ethernet Manager sends a query of one specific or all ETH Service Class Profile to Managed System.

Description	1) Carrier Ethernet Manager sends a query of one specific or all ETH Service Class Profile to Managed System.
	
	2) Managed System returns the ETH Service Class Profile with the following attributes:
	  – ETH Service Class ID
	  – Classify Type: This attribute identifies the characteristic type on which ETH services are classified, such as VLAN ID, VLAN Priority (defined in [IEEE 802.1Q] [47]), EVC, etc.
	  – Classify Value: This attribute lists the characteristic values corresponding to the above classify type to identify a specific service class.
	
	3) Carrier Ethernet Manager receives the response from Managed System

Ends When	1) Managed System returns the ETH Service Class Profile information to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Unknown ETH Service Class Profile 2) Managed System Processing Error 3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ETH Service Class Profile information when the query succeeds.

4.2.1.8.2.3 Modify ETH Service Class Profile

Name	Modify ETH Service Class Profile
Summary	Carrier Ethernet Manager requests to modify attributes of ETH Service Class Profile.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the ETH Service Class Profile.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System. 2) Carrier Ethernet Manager knows the object of ETH Service Class Profile to be modified.
Begins When	Carrier Ethernet Manager sends a request to Managed System to modify ETH Service Class Profile attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify Classification Characteristic or Classification parameters of a specific ETH Service Class Profile. 2) Managed System modifies relevant attributes of ETH Service Class Profile. 3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers. 4) Managed System responds with success indication. 5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the response to Carrier Ethernet Manager 2) Exception happens

Exceptions	1) Unknown ETH Service Class Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and the corresponding AVC is sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.8.2.4 Delete ETH Service Class Profile

Name	Delete ETH Service Class Profile
Summary	Carrier Ethernet Manager requests deletion of the ETH Service Class Profile on Managed System.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created ETH Service Class Profile.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of ETH Service Class Profile to be deleted
	3) No active services refer to the ETH Service Class Profile Instance.
Begins When	Carrier Ethernet Manager requests deletion of ETH Service Class Profile to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of deletion of ETH Service Class Profile with a specific ETH Service Class Profile ID.
	2) Managed System verifies that the ETH Service Class Profile is not in use.
	3) Managed System deletes ETH Service Class Profile.
	4) Managed System forwards Deletion Notification to all registered Carrier Ethernet Manager.
	5) Managed System responds with success indication.
	6) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH Service Class Profile
	2) Managed System Processing Error
	3) Invalid Parameter
	4) ETH Service Class Profile In Use
Post-Conditions	If use case is successful, the ETH Service Class Profile is deleted and the corresponding deletion notification is sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.8.3 ETH Performance Profile Management

4.2.1.8.3.1 Create ETH Performance Profile

Name	Create ETH Performance Profile
Summary	Carrier Ethernet Manager requests creation of ETH Performance Profile on

	Managed System. The ETH Performance Profile is used to specify the performance objectives.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH Performance profile for future assignment.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH Performance Profile to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH Performance Profile with parameters including: – ETH Perf Identifier – ETH CoS Frame Delay – ETH CoS Frame Delay Variation – ETH CoS Frame Loss Ratio – Availability 2) Managed System creates ETH Performance Profile 3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers. 4) Managed System responds with new created ETH Performance Profile ID. 5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH Performance Profile is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.1.8.3.2 Query ETH Performance Profile

Name	Query ETH Performance Profile
Summary	Carrier Ethernet Manager requests to retrieve ETH Performance Profile from Managed System. The ETH Performance Profile is used to specify the performance objectives.
Actor(s)	Carrier Ethernet Manager
Assumptions	Managed System has the list of ETH Performance Profile.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager sends a query of one specific or all ETH Performance Profile to Managed System.

Description	1) Carrier Ethernet Manager sends a query of one specific or all ETH Performance Profile to Managed System.
	2) Managed System returns the ETH Performance Profile with the following attributes:
	– ETH Performance Identifier: This attribute identifies the specific CoS Value described within this profile.
	– ETH CoS Frame Delay
	– ETH CoS Frame Delay Variation
	– ETH CoS Frame Loss Ratio
	– Availability: This attribute identifies the Availability objective for the EVC.
	3) Carrier Ethernet Manager receives the response from Managed System
Ends When	1) Managed System returns the ETH Performance Profile information to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH Performance Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	Carrier Ethernet Manager receives ETH Performance Profile information when the query succeeds.

4.2.1.8.3.3 Modify ETH Performance Profile

Name	Modify ETH Performance Profile
Summary	Carrier Ethernet Manager requests to modify attributes of ETH Performance Profile. The ETH Performance Profile is used to specify the performance objectives.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created the ETH Performance Profile.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of ETH Performance Profile to be modified.
Begins When	Carrier Ethernet Manager sends a request to Managed System to modify ETH Performance Profile attributes.
Description	1) Carrier Ethernet Manager sends a request to Managed System to modify the following parameters of a specific ETH Performance Profile.
	– ETH CoS Frame Delay
	– ETH CoS Frame Delay Variation
	– ETH CoS Frame Loss Ratio
	– Availability
	2) Managed System modifies relevant attributes of ETH Performance Profile.
	3) Managed System forwards AVC Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.

Ends When	1) Managed System returns the response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH Performance Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	If use case is successful, attribute value from specific object is set and the corresponding AVC is sent to the Carrier Ethernet Manager registered for this notification.

4.2.1.8.3.4 Delete ETH Performance Profile

Name	Delete ETH Performance Profile
Summary	Carrier Ethernet Manager requests deletion of ETH Performance Profile on Managed System. The ETH Performance Profile is used to specify the performance objectives.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has already retrieved or created ETH Performance Profile.
Pre-Conditions	1) Carrier Ethernet Manager has established communication with Managed System.
	2) Carrier Ethernet Manager knows the object of ETH Performance Profile to be deleted
	3) No active services refer to the ETH Performance Profile Instance.
Begins When	Carrier Ethernet Manager requests deletion of ETH Performance Profile to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of deletion of ETH Performance Profile with a specific ETH Performance Profile ID.
	2) Managed System deletes ETH Performance Profile.
	3) Managed System forwards Deletion Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds with success indication.
	5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the deletion response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Unknown ETH Performance Profile
	2) Managed System Processing Error
	3) Invalid Parameter
Post-Conditions	If use case is successful, the ETH Performance Profile is deleted and the corresponding deletion notification is sent to the Carrier Ethernet Manager registered for this notification.

4.2.2   Carrier Ethernet Performance Management

4.2.2.1   Performance Management FS (ITU-T Q.827.1)
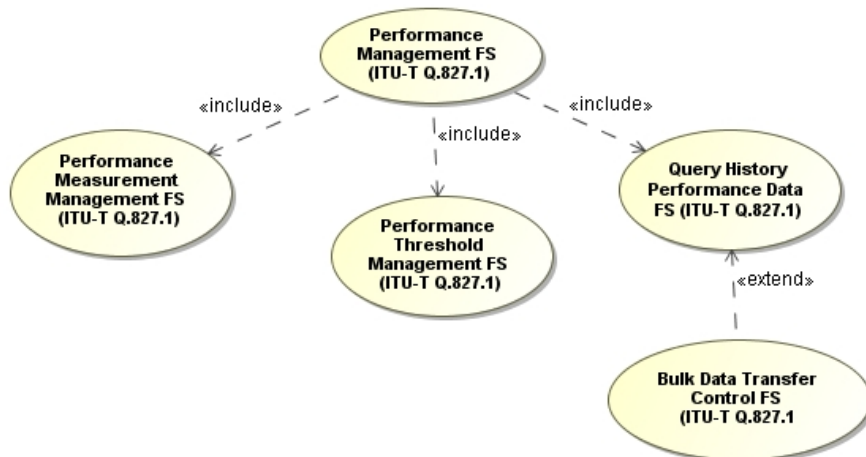
Figure 4-13 ITU-T Q.827.1 Performance Management Function Set

4.2.2.2   Carrier Ethernet Service OAM Performance Monitoring
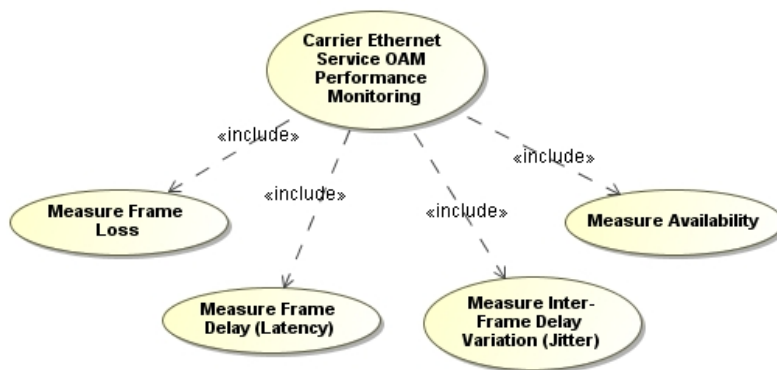
Figure 4-14 Carrier Ethernet SOAM Performance Monitoring

4.2.2.2.1   Measure Frame Loss and Measure Availability

4.2.2.2.1.1   Ethernet Loss Measurement Configuration

Name	Configure Ethernet Loss Measurement
Summary	Carrier Ethernet Manager requests creation of ETH OAM LM Configuration on Managed System. The ETH OAM LM Configuration is used to specify the configuration attributes and operations for the single-ended on-demand and dual-ended proactive Performance Monitoring Frame Loss Measurement function (ETH-Loss) defined in Y.1731.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM LM Configuration.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.

Begins When	Carrier Ethernet Manager requests creation of ETH OAM LM Configuration to Managed System.

Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM LM Configuration with parameters including:
	  – Start Time Type (optional)
	  – Stop Time Type (optional)
	  – Relative Stop Time
	  – Enabled (optional)
	  – Interval
	  – Measurement Interval
	  – Priority
	  – Relative Start Time (optional)
	  – Repetition Period (optional)
	  – Scheduled Start Date And Time
	  – Scheduled Stop Date And Time
	  – Type
	  – Availability Number of Consecutive FLR Measurements
	  – Availability Threshold
	2) Managed System creates ETH OAM LM Configuration
	3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM LM Configuration.
	5) Carrier Ethernet Manager receives the response from Managed System.

Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM LM Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.2.2.1.2 Trigger Ethernet Loss Measurement

Name	Trigger Ethernet Loss Measurement
Summary	Carrier Ethernet Manager requests triggering of single-ended on-demand or dual-ended proactive ETH-Loss based on the configured values of type, start date/time, and end date/time. This operation blocks until the Loss Session has completed.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to Trigger ETH OAM Loss Measurement.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System trigger ETH OAM Loss Measurements.
Description	1) Carrier Ethernet Manager sends Managed System a request to ETH OAM

	Loss Measurements with parameters including: − Use Scheduled Time: 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. 2) Managed System triggers ETH OAM Loss Measurement and blocks until the Loss Session has completed 3) Returns: lmmMsgResults This return parameter indicates the result of the ETH-Loss operation. A value of 'true' indicates ETH-LM or ETH-SLM message(s) will be (or has been) transmitted. A value of 'false' indicates message(s) will not be sent.
Ends When	1) Managed System returns the response to ETH OAM Loss Measurement request 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Loss Measurement is triggered and the corresponding results are sent to Carrier Ethernet Manager that triggered this measurement.

4.2.2.2.2 Measure Frame Delay (Latency) and Frame Delay Variation (Jitter)

4.2.2.2.2.1 Ethernet Frame Delay Measurement Configuration

Name	Configure Ethernet Frame Delay Measurement
Summary	Carrier Ethernet Manager requests creation of ETH OAM DM Configuration on Managed System. The ETH OAM DM Configuration is used to specify the 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
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM DM Configuration.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH OAM DM Configuration to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM DM Configuration with parameters including: − Start Time Type (optional) − Stop Time Type (optional) − Relative Stop Time − Enabled (optional) − Interval

	– Measurement Interval
	     – Priority
	     – Relative Start Time (optional)
	     – Repetition Period (optional)
	     – Scheduled Start Date And Time
	     – Scheduled Stop Date And Time
	     – Clock Sync Flag (optional)
	     – Frame Size
	     – Measurement Bin Threshold
	     – Number of Measurement Bins Per Frame Delay Interval
	     – Number of Measurement Bins Per Frame Delay Variation Interval
	 2) Managed System creates ETH OAM DM Configuration
	 3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers.
	 4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM DM Configuration.
	 5) Carrier Ethernet Manager receives the response from Managed System.

Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM DM Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.2.2.2.2 Trigger Ethernet Frame Delay Measurement

Name	Trigger Ethernet Frame Delay Measurement
Summary	Carrier Ethernet Manager requests triggering of the one-way and two-way on-demand and proactive Performance Monitoring Frame Delay Measurement function (ETH-DM) defined in Y.1731, based on the configured values of type, start date/time, and end date/time. This operation blocks until the Delay Session has completed.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to Trigger ETH OAM Frame Delay Measurement.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System trigger ETH OAM Frame Delay Measurements.
Description	1) Carrier Ethernet Manager sends Managed System a request to ETH OAM Frame Delay Measurements with parameters including: – Use Scheduled Time: 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. 2) Managed System triggers ETH OAM Frame Delay Measurement and blocks

	until the Frame Delay Session has completed
	3) Returns: dmMsgResults This return parameter indicates the result of the ETH-DM operation. A value of 'true' indicates ETH-DM message(s) will be (or has been) transmitted. A value of 'false' indicates message(s) will not be sent.
	4) Managed System instantiates associated stats objects:
	- Ethernet Delay Measurement On-Demand 1-Way Statistics
	- Ethernet Delay Measurement On-Demand 2-Way Statistics
	- Ethernet Delay Measurement Proactive 1-Way Current Statistics
	- Ethernet Delay Measurement Proactive 1-Way History Statistics
	- Ethernet Delay Measurement Proactive 2-Way Current Statistics
	- Ethernet Delay Measurement Proactive 2-Way History Statistics
	5) Carrier Ethernet Manager retrieves the associated stats objects.
Ends When	1) Managed System returns the response to ETH OAM Frame Delay Measurement request
	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Frame Delay Measurement is triggered and the corresponding results are sent to Carrier Ethernet Manager that triggered this measurement.

4.2.3   Carrier Ethernet Fault Management

4.2.3.1   Fault Management FS (ITU-T Q.827.1)

Figure 4-15 ITU-T Q.827.1 Fault Management Function Set

4.2.3.2   Carrier Ethernet Service OAM Fault Management

This section defines the high level SOAM Fault Management Use Cases, based on the UML Use Case diagram syntax.
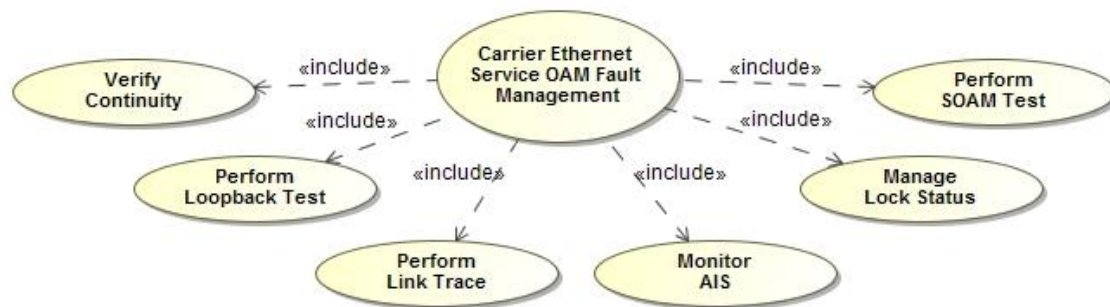
Figure 4-16 Carrier Ethernet SOAM Fault Management

4.2.3.2.1 Verify Continuity

4.2.3.2.1.1 Ethernet Continuity Check Configuration

Name	Configure Ethernet Continuity Check
Summary	Carrier Ethernet Manager requests creation of ETH OAM CC Configuration on Managed System. The ETH OAM CC Configuration is used to specify the configuration attributes and operations for the proactive Ethernet OAM Fault Management 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM CC Configuration.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH OAM CC Configuration to Managed System.

Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM CC Configuration with parameters including:
	  – Enabled
	  – Multicast Enabled
	  – Priority (optional)
	  – Lowest Priority Defect
	  – Fault Alarm Time
	  – Fault Alarm Reset Time
	2) Managed System creates ETH OAM CC Configuration
	3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM CC Configuration.
	5) Carrier Ethernet Manager receives the response from Managed System.

Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter

Post-Conditions	If use case is successful, ETH OAM CC Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.3.2.1.2 Enable / Disable Ethernet Continuity Check

Name	Enable / Disable Ethernet Continuity Check
Summary	Carrier Ethernet Manager requests ETH-Continuity Check is enabled (or disable).
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to Enable or Disable ETH OAM Continuity Check.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System update the enabled attribute to True (or False) ETH OAM Continuity Check
Description	1) Carrier Ethernet Manager sends Managed System a request to set the enabled attribute to True / False the ETH OAM Continuity Check. 2) Managed System begins (on enabled=True) or terminates (on enable=False) ETH OAM Continuity Check 3) Managed System instantiates associated stats objects: - Ethernet Continuity Check Statistics 4) Carrier Ethernet Manager retrieves the associated stats objects.
Ends When	1) Managed System updates the enabled attribute 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Continuity Check is begins (or terminates) and the corresponding stats objects are generated.

4.2.3.2.2 Perform Loopback Test

4.2.3.2.2.1 Ethernet Loopback Configuration

Name	Configure Ethernet Loopback
Summary	Carrier Ethernet Manager requests creation of ETH OAM LB Configuration on Managed System. The ETH OAM LB Configuration is used to specify the 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM LB Configuration.

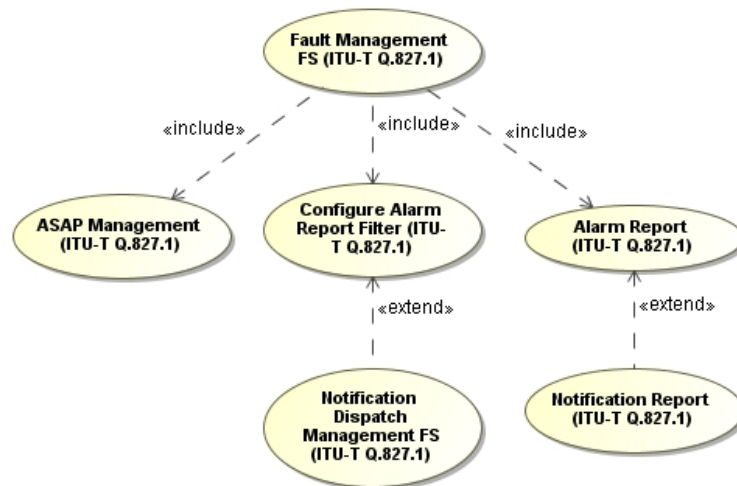| Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH OAM LB Configuration to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM LB Configuration with parameters including: – Multicast Enabled (optional) – Interval – Frame Size – Priority – Data (optional) – Number of LBMs to Transmit – LBM Message Status – Test TLV Included (optional) – Test TLV Pattern (optional) – Timeout (optional) 2) Managed System creates ETH OAM LB Configuration 3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers. 4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM LB Configuration. 5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM LB Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.3.2.2.2 Trigger Ethernet Loopback

Name	Trigger Ethernet Loopback
Summary	Carrier Ethernet Manager requests triggering 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to Trigger ETH OAM Loopback.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System trigger ETH OAM Loopbacks.

| Description	1) Carrier Ethernet Manager sends Managed System a request to ETH OAM Loopbacks with parameters including:
	– MIP MAC Address: 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.
	– Number of LBMs: specifies the number of LBM messages this MEP should transmit. The default value is three.
	2) Managed System triggers ETH OAM Loopback and blocks until the Loopback Session has completed
	3) Returns: 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.
	4) Managed System instantiates associated stats objects:
	- Ethernet Loopback Statistics
	5) Carrier Ethernet Manager retrieves the associated stats objects.
Ends When	1) Managed System returns the response to ETH OAM Loopback request
	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Loopback is triggered and the corresponding results are sent to Carrier Ethernet Manager that triggered this measurement.

4.2.3.2.3 Perform Link Trace

4.2.3.2.3.1 Ethernet Link Trace Configuration

Name	Configure Ethernet Link Trace
Summary	Carrier Ethernet Manager requests creation of ETH OAM LT Configuration on Managed System. The ETH OAM LT Configuration is used to specify the 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM LT Configuration.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH OAM LT Configuration to Managed System.

Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM LT Configuration with parameters including:
	   – Priority
	   – TTL
	   – Flags
	   – LTM Message Status
	2) Managed System creates ETH OAM LT Configuration
	3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM LT Configuration.
	5) Carrier Ethernet Manager receives the response from Managed System.

Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM LT Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.3.2.3.2 Trigger Ethernet Link Trace

Name	Trigger Ethernet Link Trace
Summary	Carrier Ethernet Manager requests triggering 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to Trigger ETH OAM Link Trace.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System trigger ETH OAM Link Traces.

Description	1) Carrier Ethernet Manager sends Managed System a request to ETH OAM Link Trace with parameters including:
	   – MIP MAC Address: 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.
	2) Managed System triggers ETH OAM Link Trace and blocks until the Link Trace Session has completed
	3) Returns: 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.
	4) Managed System instantiates associated stats objects:
	   - Ethernet Link Trace Response Statistics

	5) Carrier Ethernet Manager retrieves the associated stats objects.
Ends When	1) Managed System returns the response to ETH OAM Link Trace request
	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Link Trace is triggered and the corresponding results are sent to Carrier Ethernet Manager that triggered this test.

4.2.3.2.4 Monitor AIS

4.2.3.2.4.1 Ethernet Alarm Indication Signal Configuration

Name	Configure Ethernet Alarm Indication Signal
Summary	Carrier Ethernet Manager requests creation of ETH OAM AIS Configuration on Managed System. The ETH OAM AIS Configuration is used to specify the 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.)
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM AIS Configuration.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH OAM AIS Configuration to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM AIS Configuration with parameters including: – Enabled – Interval – Priority (optional) – Drop Eligible (optional) – MD Level (optional) 2) Managed System creates ETH OAM AIS Configuration 3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers. 4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM AIS Configuration. 5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM AIS Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered

	for this notification.

4.2.3.2.4.2 Enable / Disable Ethernet Alarm Indication Signal

Name	Enable / Disable Ethernet Alarm Indication Signal
Summary	Carrier Ethernet Manager requests ETH-Alarm Indication Signal is enabled (or disable).
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to Enable or Disable ETH OAM Alarm Indication Signal.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System update the enabled attribute to True (or False) ETH OAM Alarm Indication Signal
Description	1) Carrier Ethernet Manager sends Managed System a request to set the enabled attribute to True / False the ETH OAM Alarm Indication Signal. 2) Managed System begins (on enabled=True) or terminates (on enable=False) ETH OAM Alarm Indication Signal 3) Managed System instantiates associated stats objects: - Ethernet Alarm Indication Signal Statistics 4) Carrier Ethernet Manager retrieves the associated stats objects.
Ends When	1) Managed System updates the enabled attribute 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Alarm Indication Signal is begins (or terminates) and the corresponding stats objects are generated.

4.2.3.2.5 Manage SOAM Lock Status

4.2.3.2.5.1 Ethernet Lock Signal Configuration

Name	Configure Ethernet Lock Signal
Summary	Carrier Ethernet Manager requests creation of ETH OAM LCK Configuration on Managed System. The ETH OAM LCK Configuration is used to specify the 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM LCK Configuration.

Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH OAM LCK Configuration to Managed System.

Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM LCK Configuration with parameters including:
	  – Interval
	  – Priority (optional)
	  – MD Level (optional)
	2) Managed System creates ETH OAM LCK Configuration
	3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers.
	4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM LCK Configuration.
	5) Carrier Ethernet Manager receives the response from Managed System.

Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager 2) Exception happens
Exceptions	1) Managed System Processing Error 2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM LCK Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.3.2.5.2 Trigger Ethernet Lock Signal

Name	Trigger Ethernet Lock Signal
Summary	Carrier Ethernet Manager requests 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to request ETH OAM Lock Signal.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System request ETH OAM Lock Signals.

Description	1) Carrier Ethernet Manager sends Managed System a request to ETH OAM Lock Signal with parameters including:
	  – Lock Flag: 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.
	2) Managed System administratively locks or unlocks the MEP
	4) Managed System instantiates associated stats objects:
	  - Ethernet Lock Signal Statistics
	5) Carrier Ethernet Manager retrieves the associated stats objects.

Ends When	1) Managed System returns the response to ETH OAM Lock Signal request

	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Lock Signal is performed and the corresponding results are made available to the requesting Carrier Ethernet Manager.

4.2.3.2.6 Perform SOAM Test

4.2.3.2.6.1 Ethernet Test Signal Configuration

Name	Configure Ethernet Test Signal
Summary	Carrier Ethernet Manager requests creation of ETH OAM Test Configuration on Managed System. The ETH OAM Test Configuration is used to specify the 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 Base-lining OAM Use Case. This function is only applicable to MEPs.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to create ETH OAM Test Configuration.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests creation of ETH OAM Test Configuration to Managed System.
Description	1) Carrier Ethernet Manager sends Managed System a request of creation of ETH OAM TEST Configuration with parameters including: – Interval (optional) – Priority (optional) – Frame Size (optional) – Data (optional) – Start Time Type (optional) – Scheduled Start Date and Time (optional) – Scheduled Stop Date and Time (optional) – Relative Start Time (optional) – Duration Time (optional) – Out Enabled (optional) – In Enabled (optional) – In Service (optional) – MAC Address (optional) – MEP ID (optional) 2) Managed System creates ETH OAM Test Configuration 3) Managed System forwards Creation Notification to all registered Carrier Ethernet Managers. 4) Managed System responds to Carrier Ethernet Manager with newly created ETH OAM Test Configuration.

	5) Carrier Ethernet Manager receives the response from Managed System.
Ends When	1) Managed System returns the creation response to Carrier Ethernet Manager
	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Test Configuration is created and the corresponding creation notification is sent to Carrier Ethernet Manager registered for this notification.

4.2.3.2.6.2 Trigger Ethernet Test Signal

Name	Trigger Ethernet Test Signal
Summary	Carrier Ethernet Manager requests triggering 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.
Actor(s)	Carrier Ethernet Manager
Assumptions	Carrier Ethernet Manager has the authority to Trigger ETH OAM Test Signal.
Pre-Conditions	Carrier Ethernet Manager has established communication with Managed System.
Begins When	Carrier Ethernet Manager requests that the Managed System trigger ETH OAM Test Signals.

Description	1) Carrier Ethernet Manager sends Managed System a request to ETH OAM Test Signal with parameters including:
	   − Is Signal Reciever: 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.
	   − Use scheduled Time: 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.
	2) Managed System instantiates associated stats objects:
	   - Ethernet Test Signal Statistics
	3) Carrier Ethernet Manager retrieves the associated stats objects.

Ends When	1) Managed System returns the response to ETH OAM Test Signal request
	2) Exception happens
Exceptions	1) Managed System Processing Error
	2) Invalid Parameter
Post-Conditions	If use case is successful, ETH OAM Test Signal is performed and the corresponding results are made available to the requesting Carrier Ethernet Manager.

5 Information Model Overview

This section provides the detailed analysis of the Carrier Ethernet Management Information Model. 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.

5.1 Common Management Function Set
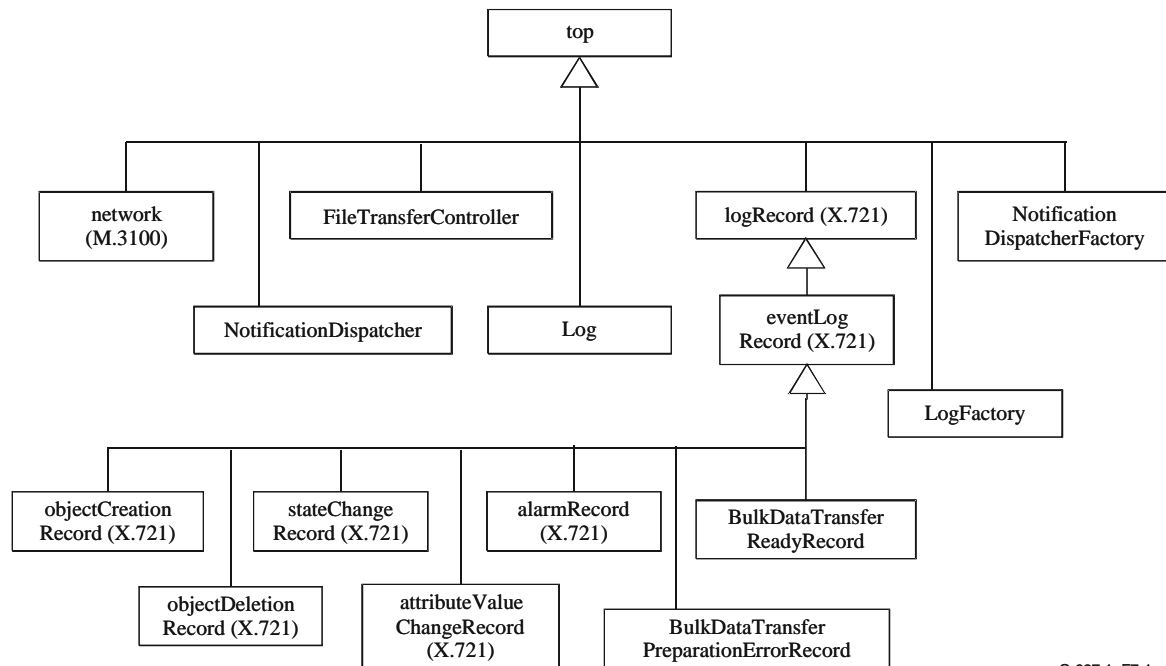
Figure 5-1 Q.827.1 Inheritance diagram of common management
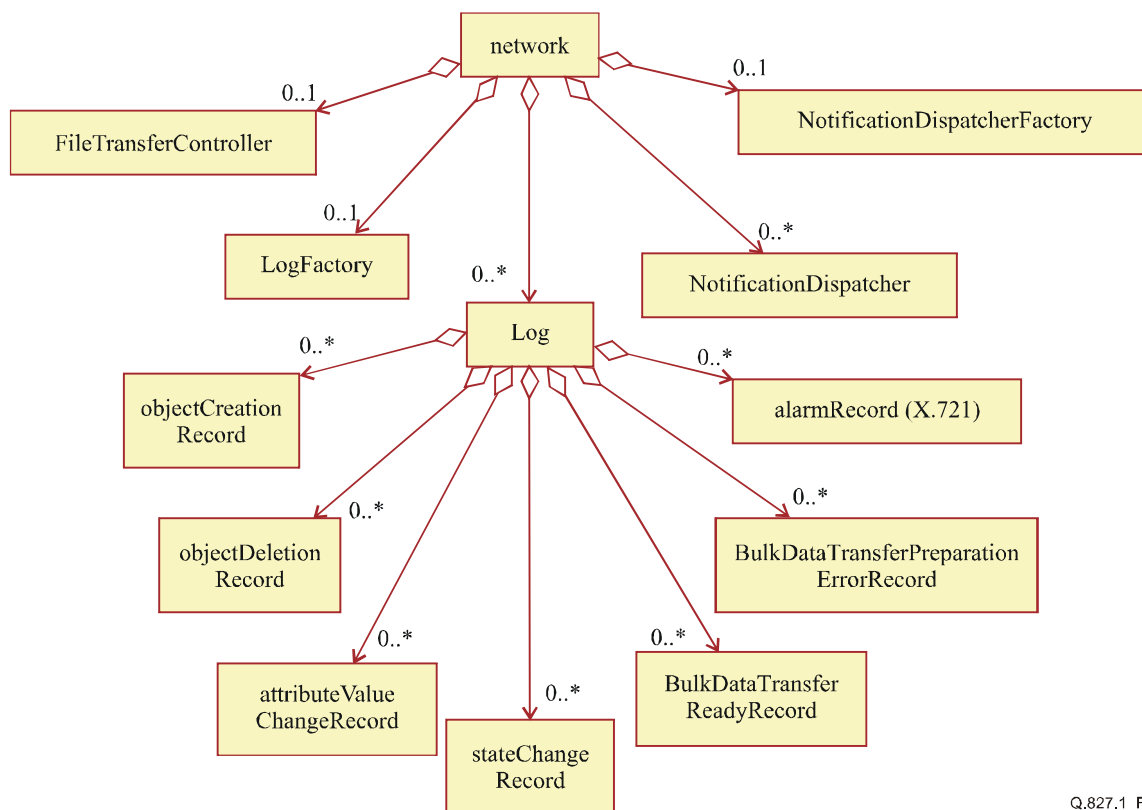
Figure 5-2 Q.827.1 Containment diagram of common management

5.2 Class Diagrams of ITU-T Q.840.1 Carrier Ethernet Specific Management Entities

Figure 5-3, Figure 5-4, and Figure 5-5 are the inheritance diagram derived from ITU-T Q.840.1 [34] of the management entities providing the topology view, connectivity view, and reference data.
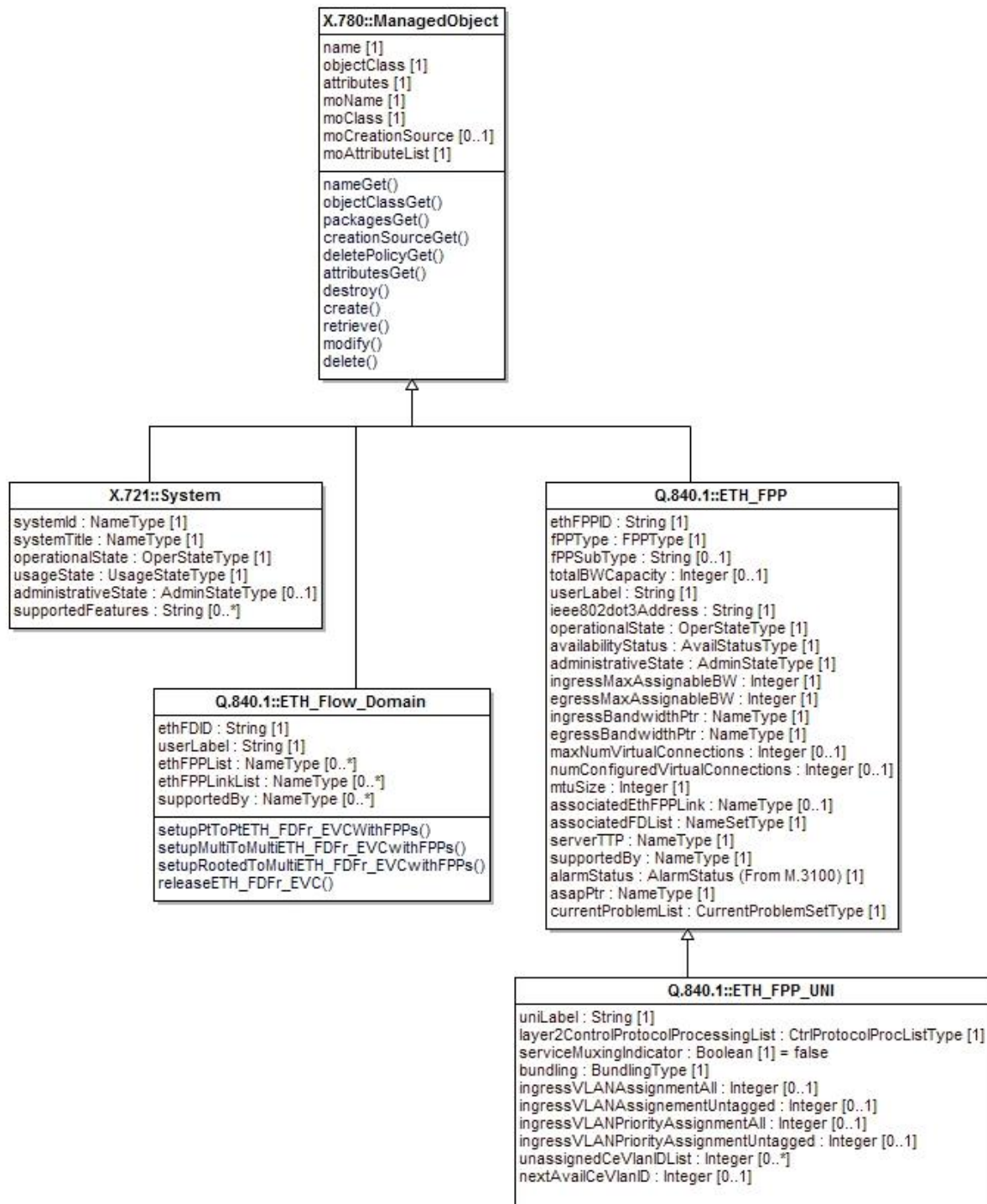
Figure 5-3 Inheritance Diagram of Ethernet Managed Entities: Topology View
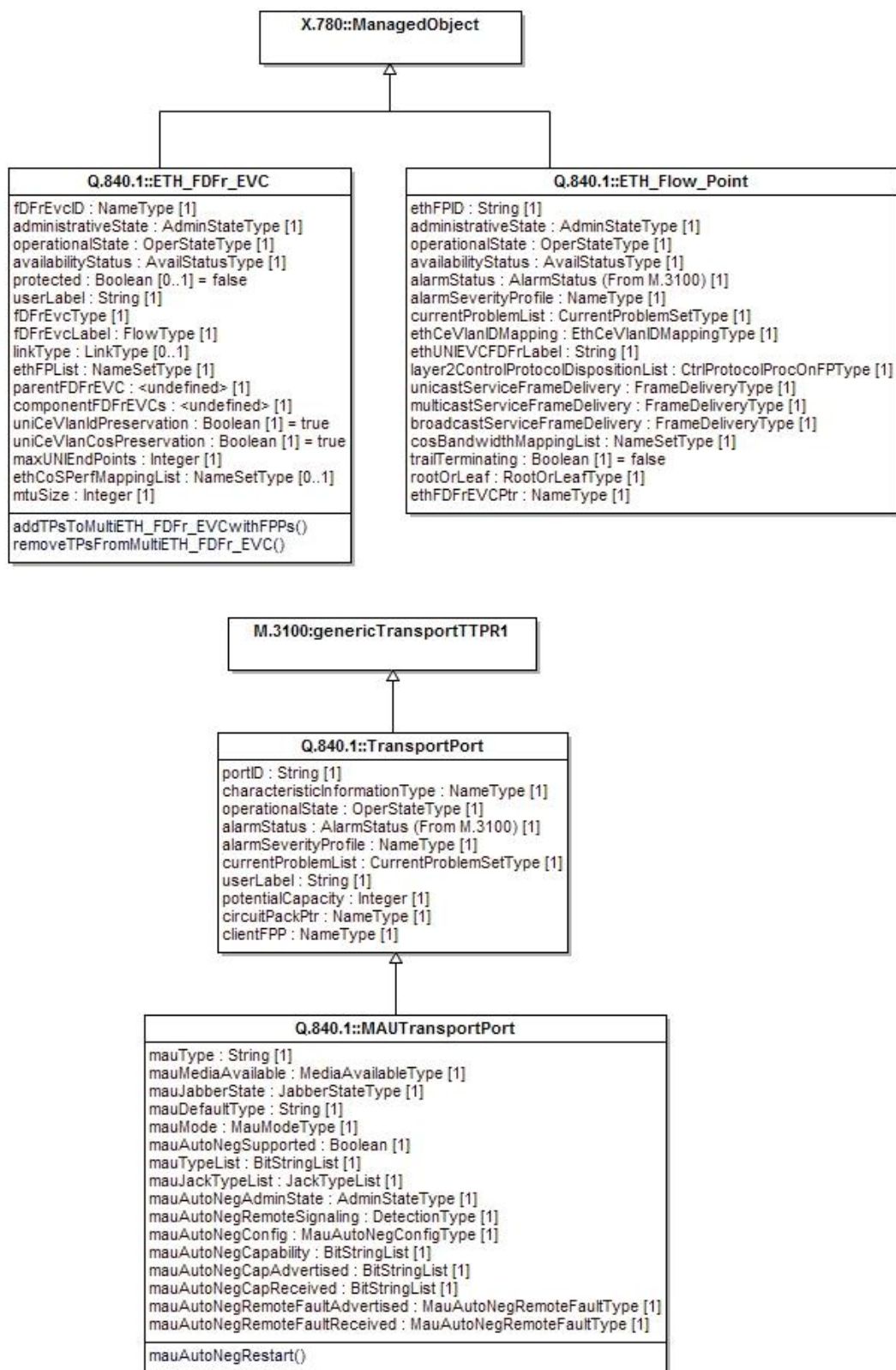
Figure 5-4 Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Connectivity View
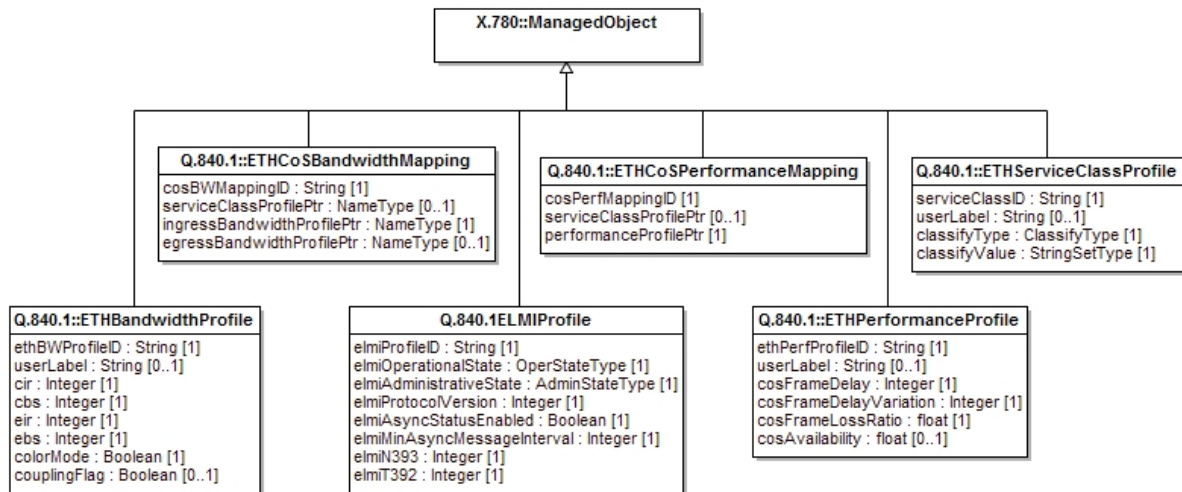
Figure 5-5 Q.840.1 Inheritance Diagram of Ethernet Managed Entities: Reference Data

Figure 5-6 and Figure 5-7 are the relationship diagrams (including containment) derived from Q.840.1 of the network view, equipment view, and the service configuration view.
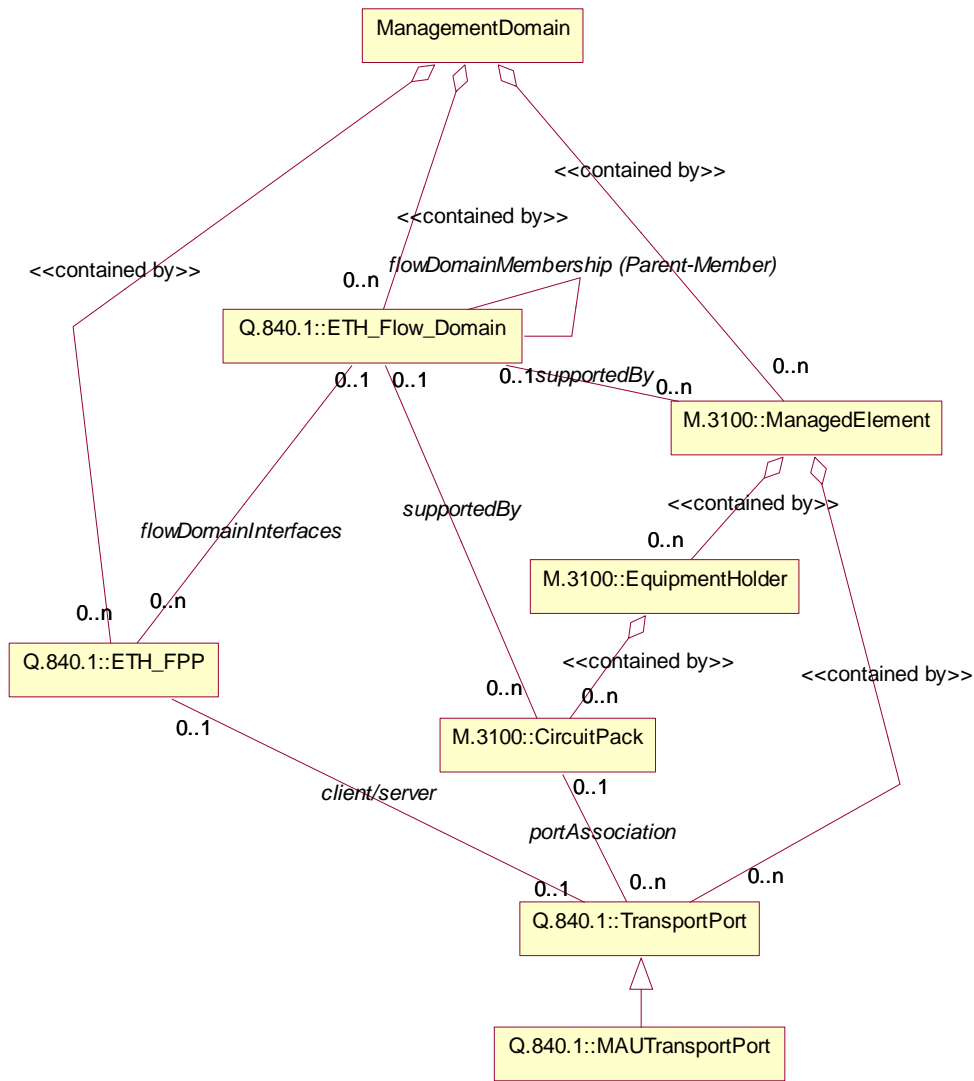
Figure 5-6 Q.840.1 Relationship Diagram of Ethernet Network View and Equipment View
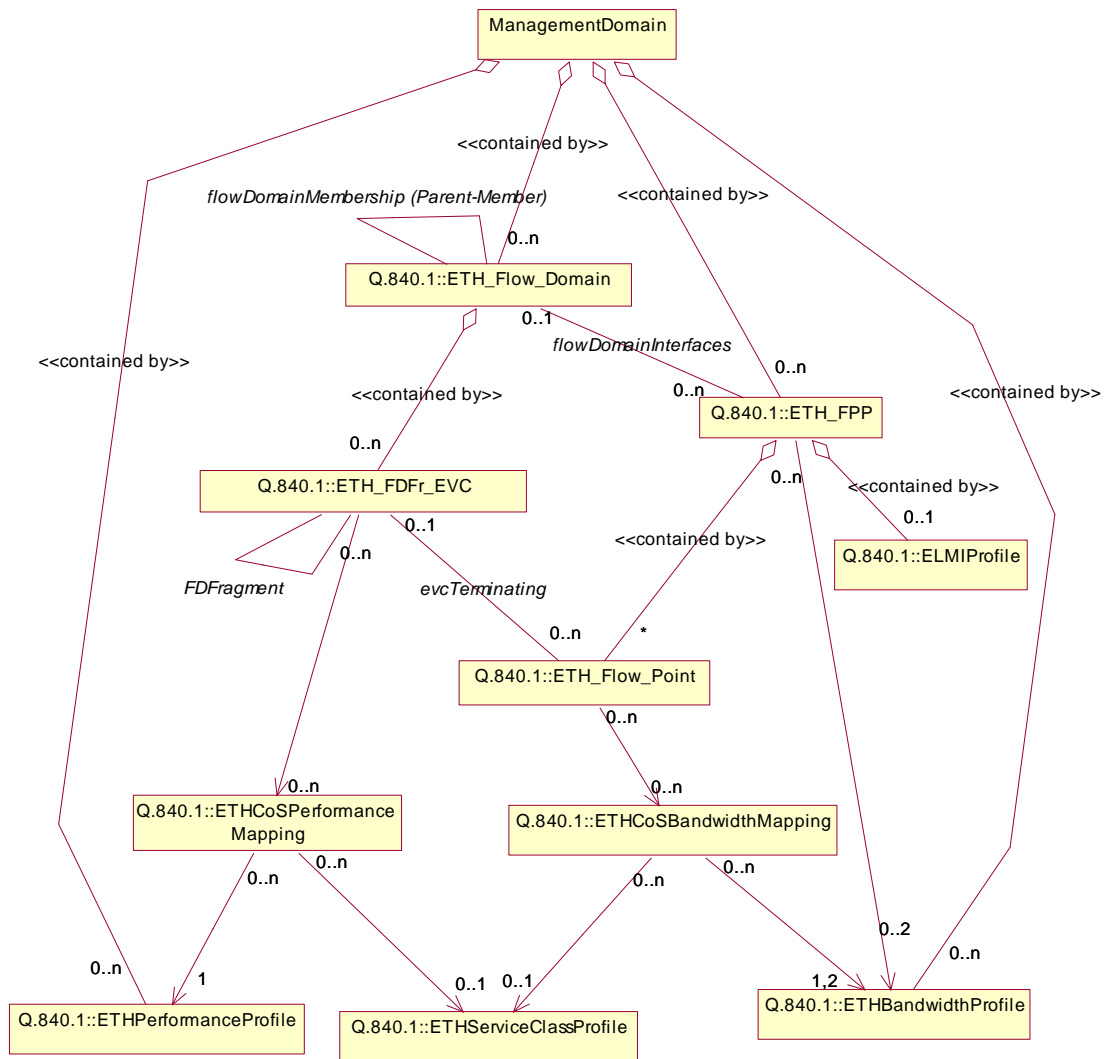
Figure 5-7 Q.840.1 Relationship Diagram of Ethernet Service Configuration Managed Entities

6 Carrier Ethernet Management Information Model

This section identifies the managed entities that apply to the Carrier Ethernet Management Information Model along their source references. The associated interface profile specifications refer to this model, but additionally provide the requirements for the specific management interface. Table 6-1 identifies the management entities necessary to manage Carrier Ethernet. The performance data sets for Carrier Ethernet are described in Table 6-2.

6.1 Conventions

In this section, when describing the applicability of managed entities and their management operations to Carrier Ethernet, 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 6-1, each management entity is described as being Mandatory (denoted by M), Optional (denoted by O), or Conditional (denoted by C) with respect to applicability for Carrier Ethernet.

Table 6-1 Table of Relevant Management Entities

Management Entity	Reference (Where Defined)	Applicability to Carrier Ethernet
ManagedObject (superclass)	X.780	M (abstract superclass)
ManagementDomain	MTOSI Rel 2.1, X.749	O
Network	M.3100	O
ManagedElement	M.3100	O
Equipment	M.3100	O
EquipmentHolder	M.3100	O
CircuitPack	M.3100	O
Alarm Severity Assignment Profile	M.3100	O
GenericTransportTTP	M.3100	O
Log	X.721	O
LogRecord (superclass)	X.721	O
EventLogRecord (superclass)	X.721	O
AlarmRecord	X.721	O
System	X.721	O
CurrentData	Q.822	O
HistoryData	Q.822	O
ThresholdData	Q.822	O
FileTransferController	Q.827.1	O
LogFactory	Q.827.1	O
Log	Q.827.1	O
NotificationDispatcher	Q.827.1	O
NotificationDispatcherFactory	Q.827.1	O
ObjectCreationRecord	Q.827.1	O
ObjectDeletionRecord	Q.827.1	O
AttributeValueChangeRecord	Q.827.1	O
StateChangeRecord	Q.827.1	O
BulkDataTransferReadyRecord	Q.827.1	O
BulkDataTransferPreparationRecord	Q.827.1	O
EMS	Q.827.1 Amd 1	C
ETH_Flow_Domain	Q.840.1	M
ETH_FPP (superclass)	Q.840.1	M (abstract superclass)
ETH_FPP_UNI	Q.840.1	M
ETH_FPP_Link	Q.840.1	O
ETH_FDFr_EVC	Q.840.1	M
ETH_Flow_Point	Q.840.1	M
ETHBandwidthProfile	Q.840.1	M
ETHServiceClassProfile	Q.840.1	M
ETHCoSBandwidthMapping	Q.840.1	M
ETHPerformanceProfile	Q.840.1	M
ETHCoSPerformanceMapping	Q.840.1	M
ELMIProfile	Q.840.1	C
TransportPort	Q.840.1	C
MAUTransportPort	Q.840.1	C
ETH_FPP_ENNI	This Specification	M
ETH_FPP_VUNI	This Specification	M

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ETH_OVC	This Specification	M
ETH_OVC_End_Point	This Specification	M
EthMe	This Specification	C
EthMeg	This Specification	C
EthMp (superclass)	This Specification	C
EthMep	This Specification	C
EthMip	This Specification	C
EthMd	This Specification	C
EthMepPeerInfo	This Specification	C
EthOamDmCfg	This Specification	C
EthOamDmProactiveOneWayThreshold	This Specification	C
EthOamDmProactiveTwoWayThreshold	This Specification	C
EthOamLmCfg	This Specification	C
EthOamLbCfg	This Specification	C
EthOamLbStats	This Specification	C
EthOamCcCfg	This Specification	C
EthOamCcStats	This Specification	C
EthOamAisCfg	This Specification	C
EthOamAisStats	This Specification	C
EthOamLtCfg	This Specification	C
EthOamLtrStats	This Specification	C
EthOamLckCfg	This Specification	C
EthOamTestCfg	This Specification	C
EthOamTestStats	This Specification	C
EthVnidUniCfg	This Specification	C
EthVnidOvcEndPointCfg	This Specification	C
EthVnidRmi	This Specification	C
EthVnidRpe	This Specification	C
EthDiscardedDroppedFramesThreshold	This Specification	C

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In this specification, only the performance measurement parameters (grouped by performance data set) specific to Carrier Ethernet are provided. Applicable performance data sets for Carrier Ethernet Services are described in Table 6-2. Further information on performance management functionality can be found in section 7.3 of Q.827.1 [31]. Within this Carrier Ethernet Management Information 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. For this logical model, the duration of the interval and amount of history to be stored are not specified. These may be specified within the management interface profiles and/or implementation agreements that make use of this model.

Table 6-2 Table of Required Performance Data Sets

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

7   MEF Specific Object Definitions

7.1   Conventions

In this section, when describing the applicability of managed entities to Carrier Ethernet, the following abbreviations are applied to indicate the modifier of attributes, notifications or operation parameters.

- M: Mandatory.

- O: Optional.

- C: Conditional.

- NA: Not applicable

- R: Read Only

- R/W: Readable and Writable

- R/S: Readable, Set at instance Creation

7.2   ENNI and VUNI Related Object Definitions
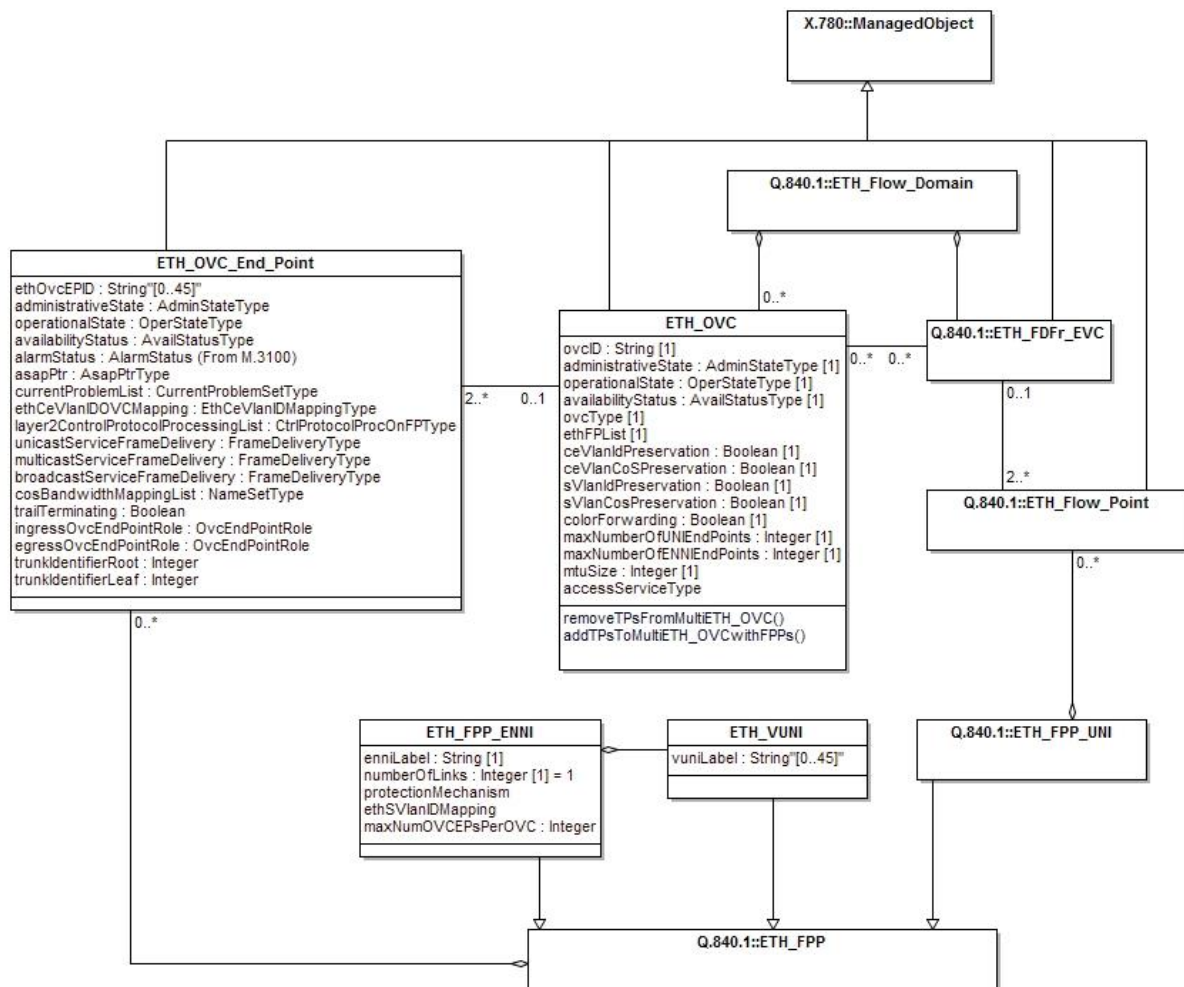
Figure 7-1 ENNI Related Object Classes
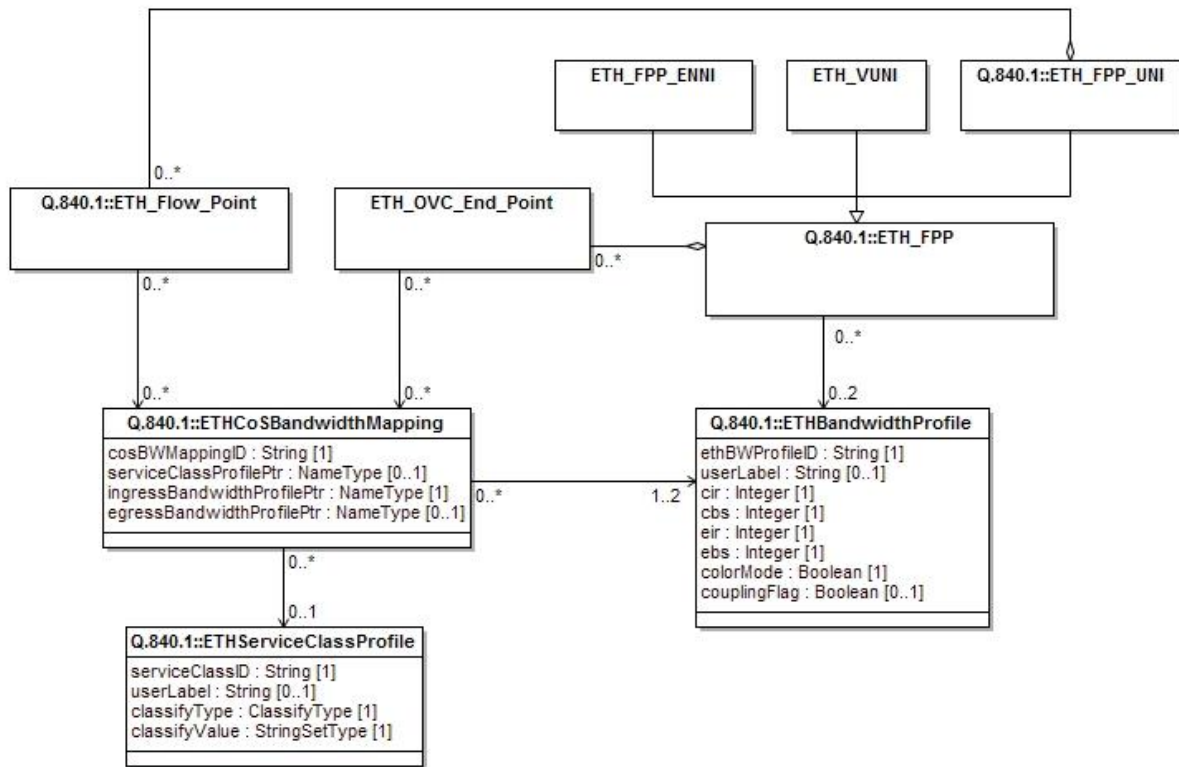
Figure 7-2 ENNI Related Bandwidth Profiles

7.2.1 ETH_FPP_ENNI

Behavior:
This managed entity is used to represent the ETH_FPP_ENNIs that provide MEF ENNI functionality. The ETH_FPP_ENNI is a subclass of the general Q.840.1 ETH_FPP class.

Attributes			
Name	**Description**	**Type**	**Qualifier**
enniLabel	Describes the ENNI within the scope of the Ethernet provider domain. The ENNI Label attribute is a value that is assigned to the ENNI by the Ethernet Provider. It MAY have any string as a value.	String (max 45 bytes)	M, R/W
numberOfLinks	The number of physical links in the ENNI. (set by managed system and ServerTTP relationship)	Integer (value 1 or 2)	M, R
protectionMechanism	The method for protection, if any, against a failure.	Enum {Link Aggregation, Active-Active, Active-Standby, none, or other}	M, R/W
ethSVlanIDMappin	The map that associates each S-Tagged ENNI	EthSVlanID	M, R/W

g	Frame with an End Point. The End Point Type within an End Point Map for ENNI frames mapped to an OVC MUST take the value of "OVC". The End Point Type within an End Point Map for ENNI frames mapped to a VUNI MUST take the value of "VUNI". The End Point Type within an End Point Map for ENNI frames mapped to a vNID RMI MUST take the value of "RMI"	MappingType // A table with rows of the form <S-VLAN ID value, End Point Identifier, End Point Type>}	
maxNumOVCEPsPerOVC	The Maximum Number of OVC End Points per OVC provides an upper bound on the number of 631 OVC End Points that are associated by an OVC that the Operator can support at the ENNI. 632 Note that if the Maximum Number of OVC End Points per OVC is one, then hairpin switching 633 cannot be supported at the ENNI.	Integer (value greater than or equal to 1)	M, R/W

Relationships:

The ETH_FPP_ENNI object is contained under ManagementDomain.

An ETH_FPP_ENNI object may contain instances of:

- ETH_OVC_End_Point (that terminates an ETH_OVC at the ETH_FPP_ENNI)

Associations inherited from ETH_FPP:

- *SupportingElements: SupportedBy* – the elements that support the ETH_FPP_ENNI (e.g., CircuitPack) (GET, REPLACE, ADD, REMOVE),
- *ServerTTP : Client/Server*– The relationship between the ETH_FPP_ENNI and the supporting TRAN layer termination point (could be a TransportPort, etc.) (GET, REPLACE) [NOTE: In support of LAG, this relationship should identify each link as *active* or *standby*.
- **ETH_Flow_Domains:** *FlowDomainInterfaces* – the ETH_FPP_ENNI is one of the ETH_FPP_ENNIs that delineate the associated ETH_Flow_Domains (a single ETH_FPP_ENNI may act as an interface of multiple ETH_Flow_Domains, e.g., both the parent ETH_Flow_Domain and a member ETH_Flow_Domain) (GET, REPLACE, ADD, REMOVE)
- **ETHBandwidthProfile:** *IngressBwCharacterization* – The ingress bandwidth profile for all service frames at the ETH_FPP_ENNI in the ingress direction. (GET, REPLACE, ADD, REMOVE)
- **ETHBandwidthProfile:** *EgressBwCharacterization* – The egress bandwidth profile for all service frames at the ETH_FPP_ENNI in the egress direction. (GET, REPLACE, ADD, REMOVE)

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O
stateChange	O

7.2.2 ETH_ OVC

Behavior:
This managed entity represents an instantiation of an OVC, i.e., a transport entity which transfers information across a single ETH_Flow_Domain (between ENNIs, or between ENNIs and UNIs). It is formed by the association (and mappings) of ETH_OVC_End_Points at the boundary of the ETH_Flow_Domain.
An ETH_FDFr_EVC may be comprised of a series of component ETH_ OVCs.
The ETH_ OVC associates the ETH_OVC_End_Points identified in the A end of the OvcTerminating relationship and the ETH_OVC_End_Points(s) listed in the Z end of the OvcTerminating relationship. For rooted multipoint connections multiple A end (roots) ETH_OVC_End_Points may be associated with the ETH_ OVC

Attributes

Name	Description	Type	Qualifier
ovcID	This attribute identifies the name of an ETH_ OVC instance.	String (max 45 bytes)	M,R/S
operationalState	This attribute denotes the operational state of the ETH OVC as working "Enabled" or not-working "Disabled".	ENUM (enabled, disabled)	M, R
availabilityStatus	The availability status attribute is read only and indicates that the ETH_ OVC is functioning properly. May be mapped to RFC 2863 [52], The Interfaces Group MIB IfOperstatus. Values for availability status include: inTest, failed, powerOff, degraded, notInstalled.	ENUM (inTest, failed, powerOff, degraded, notInstalled)	M, R
ovcType	Describes the ETH OVC as: MultipointToMultipoint, _PointToPoint, or RootedMultipoint	ENUM (mp2mp, p2p, rooted)	M, R/S
ethEPList	Indicates the ETH_OVC_End_Points that terminate the ETH_ OVC.	Set of Name	M, R/W
ceVlanIdPreservation	This Boolean attribute describes the relationship between the format and certain field values of the frame at one External Interface and the format and certain field values of the corresponding frame at another External Interface that allows the CE-VLAN ID value of the UNI Service Frame to be derived from the ENNI Frame and vice versa.	Boolean	M, R/W
ceVlanCoSPreservation	This Boolean attribute describes the relationship between the format and certain field values of the frame at one External Interface and the format and certain field values of the corresponding frame at another External Interface that allows the CE-VLAN CoS ID value of the UNI Service Frame to be derived from the ENNI Frame and vice versa.	Boolean	M, R/W
sVlanIdPreservation	A relationship between the S-VLAN ID value of a frame at one ENNI and the S-VLAN ID value of the corresponding frame at another ENNI.	Boolean	M, R/W
sVlanCosPreservation	A relationship between the S-VLAN PCP value of a frame at one ENNI and the S-VLAN PCP value of the corresponding frame at another ENNI.	Boolean	M, R/W
colorForwarding	The relationship between the Color of an egress ENNI Frame and the Color of the corresponding ingress ENNI Frame or Service Frame.	Boolean	M, R/W

maxNumberOfUNI EndPoints	The bound on the number of OVC End Points at different UNIs that can be associated by the OVC.	Integer $\geqslant 0$	M, R/W
maxNumberOfENN IEndPoints	The bound on the number of OVC End Points at ENNIs that can be associated by the OVC.	Integer $\geqslant 1$	M, R/W
mtuSize	This attribute describes the maximum transmission unit size for the OVC.	Integer $\geqslant$ 1526	M, R/W
accessServiceType	Characterizes the type of Access Service that is supported by the OVC. (e.g., none, UTA, Access EPL, Access EVPL)	String	M, R/W

Operations / Methods:	
Name	**Description**
addTPsToMultiETH _OVCwithFPPs	This method is used to add endpoints to a multipoint ETH OVC across an ETH_Flow_Domain.
removeTPsFromMu ltiETH_OVC	This method is used to remove endpoints from a multipoint ETH OVC across an ETH_Flow_Domain.

Relationships:

The ETH_ OVC object is contained under ETH_Flow_Domain.

ETH_OVC is associated with:
- **ETH_OVC_End_Points:** *OvcTerminating* – the ETH_ OVC is terminated by two or more ETH_OVC_End_Points.
  - Terminating EP List (for multi-point connections there are multiple terminating EndPoints, only two for point to point connections) (GET, SET-BY-CREATE, ADD, REMOVE)
- **ETH_FDFr_EVCs:** *FD Fragment* – an ETH_FDFr_EVC may be made up of component FD Fragments (ETH_ OVCs).   An ETH_FDFr_EVC may play the following roles in this relationship:
  - Composite ETH_FDFr_EVC – the ETH_FDFr_EVC made up of Component ETH_ OVCs (GET, SET-BY-CREATE)
  - Component ETH_ OVC –the ETH_ OVCs of the Composite ETH_FDFr_EVC (GET, SET-BY-CREATE)
- **ETHSLS:** *CoSPerfMappingCharacterization* –Indicates the Service Level Specification for specific CoS. (GET, REPLACE, ADD, REMOVE)

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O
stateChange	O

7.2.3   ETH_OVC_End_Point

Behavior:

This managed entity is used to represent the termination of an ETH_ OVC on an ETH_Flow_Domain (i.e., an ITU-T G.809 [36] FP).   An instance of the ETH_ OVC managed entity may be used to relate two instances of the ETH_OVC_End_Point managed entity (i.e., for point-to-point connections), or multiple ETH_OVC_End_Points for multipoint ETH_OVCs.

Instances of this managed entity may be created automatically by the ETH_Flow_Domain, as a result of a OVC setup request.   Similarly, instances of this managed entity may be deleted automatically by the ETH_Flow_Domain, as a result of an OVC release request, or explicitly by the management system.

Attributes

Name	**Description**	**Type**	**Qualifier**

ethOvcEPID	This attribute identifies the name of an ETH_OVC_End_Point instance.	String (Max 45 bytes)	M,R/S
administrativeState	This attribute denotes the administrative state of the trail terminating ETH_OVC_End_Point. This is a read/write attribute. The values supported are Locked, and Unlocked.	ENUM (locked, unlocked)	M, R/W
operationalState	This attribute denotes the operational state of the ETH_OVC_End_Point as working "Enabled" or not-working "Disabled".	ENUM (disabled, enabled)	M, R
availabilityStatus	The availability status attribute is read only and indicates that the ETH_OVC_End_Point is functioning properly. May be mapped to RFC 2863 [52], The Interfaces Group MIB IfOperstatus. Values for availability status include: inTest, failed, degraded.	ENUM (inTest, failed, degraded)	M, R
alarmStatus	The alarm status attribute is read only and indicates the occurrence of an abnormal condition. Values for alarm status include: critical, major, minor, indeterminate, warning, pending, and cleared.	ENUM (critical, major, minor, indeterminate, warning, pending, cleared)	M, R
asapPtr	The alarm severity profile associated with the ETH_OVC_End_Point to assign alarm severity to specific alarms.	Name	M, R/W
currentProblemList	Identifies the current existing problems (probable cause), with severity, associated with the ETH_OVC_End_Point.	Set of CurrentProblemType	M, R
ethCeVlanIDOVCMapping	The ethCeVlanIDOVCMapping attribute represents a list of unique values that map each Customer Edge VLAN ID (CE-VLAN ID) to at most one ETH_OVC for a Service Frame. To support Bundling, multiple CE VLAN IDs may be mapped to a single OVC. This is accomplished by providing multiple entries in the ethCeVlanIDList attribute. An OVC with more than one CE-VLAN ID mapping to it MUST have the CE-VLAN ID Preservation Service Attribute and the list of CE-VLAN IDs mapped to the OVC MUST be the same at each UNI (VUNI) in the OVC. Possible special values of a CE VLAN ID include: "Untagged", "All-to-One", and "AllOthers". If "All-to-One" is used, the allToOneIndicator attribute in the ETH_FPP_UNI should be set to TRUE, and the ETH_FPP_UNI of the UNI shall support only a single ETH_Flow_Point."AllOthers" indicates that all frames not mapped to other OVCs on the UNI are mapped to the OVC represented by this end point. This value of this mapping attribute is: • a list of CE_VLAN_IDs that may include the special valued of "untagged"; • the special value "allToOne"; • or the special value "allOthers"	EthCeVlanIDMappingType. See 7.3.3	C, R/W (not applicable to OVC EPs associated directly with ENNI)

layer2ControlProtocolProcessingList	The layer2ControlProtocolProcessingList attribute provides a list that describes Layer 2 control protocols, along with the frame processing disposition: ⇒ Discard: The Service Frame is discarded. ⇒ Tunnel: No matter what the content (assuming correct FCS) of the Service Frame, it is delivered across the other (egress) UNI(s).	Set of CtrlProtocolProcOnFPType.(See 7.3.3)	M, R/W
unicastServiceFrameDelivery	Describes the service frame delivery option for Unicast Service Frames as: Discard, DeliveryUnconditionally, or DeliveryConditionally. In the Type definition, the String is to describe the condition for DeliveryConditionally.	FrameDeliveryType. See 7.3.3	M, R/W
multicastServiceFrameDelivery	Describes the service frame delivery option for Multicast Service Frames as: Discard, DeliveryUnconditionally, or DeliveryConditionally. In the Type definition, the String is to describe the condition for DeliveryConditionally.	FrameDeliveryType. See 7.3.3	M, R/W
broadcastServiceFrameDelivery	Describes the service frame delivery option for Broadcast Service Frames as: Discard, DeliveryUnconditionally, or DeliveryConditionally. In the Type definition, the String is to describe the condition for DeliveryConditionally.	FrameDeliveryType. See 7.3.3	M, R/W
cosBandwidthMappingList	This attribute indicates the bandwidths for different ETH services at the ETH OVC End Point.	Set of ETHCoSBandwidthMappingID	C, R/W (Condition: not applicable to OVC EPs associated directly with ENNI)
trailTerminating	If TRUE, describes End Point as a point where frame flow terminates (i.e., a G.809 [36] TFP) and is adapted into the APP layer. Otherwise shall be set to FALSE.	Boolean (default value is FALSE)	O, R/S
ingressOvcEndPointRole	An OVC End Point has one of three possible Roles; Root, Leaf, or Trunk. At a UNI must be either Root or Leaf. At an ENNI must be one of Root, Leaf, or Trunk. Note that the OVC End Role will always have the value Root when the associating OVC is not of the type Rooted-Multipoint	ENUM (root, leaf, trunk)	M, R/W
egressOvcEndPointRole	An OVC End Point has one of three possible Roles; Root, Leaf, or Trunk. At a UNI must be either Root or Leaf. At an ENNI must be one of Root, Leaf, or Trunk. Note that the OVC End Role will always have the value Root when the	ENUM (root, leaf, trunk)	M, R/W

	associating OVC is not of the type Rooted-Multipoint		
trunkIdentifierRoot	For a Trunk OVC End Point, specifies the S-VLAN ID value used on the ENNI to distinguish frames originating at a Root UNI.	Integer	C, R/W (Condition: Only OVC EPs at ENNI)
trunkIdentifierLeaf	For a Trunk OVC End Point, specifies the S-VLAN ID value used on the ENNI to distinguish frames originating at a Leaf UNI.	Integer	C, R/W (Condition: Only OVC EPs at ENNI)

Relationships:
The ETH_OVC_End_Point object is contained under ETH_FPP.

ETH_OVC_End_Point is associated with:
- *ASAP: SeverityAssignment* – the ETH_OVC_End_Point may be associated with an alarm severity assignment profile in order to assign alarm severity to specific alarms. (GET, REPLACE)
- **ETH_OVC:** *OvcTerminating* – ETH_OVC that is terminated by two or more ETH_OVC_End_Points.   Each associated ETH_OVC_End_Point may be either:
  - A-End EP (GET, SET-BY-CREATE)
  - Z-End EPs (for multi-point connections there are multiple z-end EPs, only one for point to point connections)   (GET, SET-BY-CREATE)
- **ETHCoSBandwidthMapping:** *CoSBWMappingCharacterization* –Indicates the bandwidth for specific CoS in the ingress and egress direction. (GET,REPLACE,ADD,REMOVE)
- **ETH_Flow_Points:** *TunnelAccess* – The ETH_ OVC_End_Point (tunnel end point) may be associated with the ETH_Flow_Points of the EVCs being tunneled (supporting vNID). (GET, REPLACE, ADD, REMOVE)
- *EAFProfiles[2]***:** *AdaptationCharacterization* – The ETH_OVC_End_Point (trail terminating) may be associated with adaptation profiles (TBD). (GET, REPLACE)
- *APPLinkEnd[3]***:** *Client/Server* – The ETH_ OVC_End_Point (trail terminating) may be associated with an APP Layer Link End (TBD). (GET, REPLACE, ADD, REMOVE)

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O
stateChange	O
comminicationsAlarm	M

7.2.4   ETH_FPP_VUNI

Behavior:
This managed entity is used to represent the ETH_FPP_VUNIs that provide MEF VUNI functionality. The ETH_FPP_VUNI is a subclass of the general Q.840.1 ETH_FPP class.

Attributes			
Name	**Description**	**Type**	**Qualifier**
vuniLabel	Describes the VUNI within the scope of the Ethernet provider domain. The VUNI Label attribute is a value that is assigned to the VUNI by the Ethernet Provider. It MAY have any string as a value.	String (max 45 bytes)	M, R/W

---

[2] The detailed definition of the EAFProfile object class is for future study
[3] The detailed definition of the APPLinkEnd object class is for future study

Relationships:

The ETH_FPP_VUNI object is contained under ETH_FPP_ENNI.

An ETH_FPP_VUNI object may contain instances of:

- ETH_OVC_End_Point (that terminates an ETH_OVC at the ETH_FPP_VUNI)
- ELMIProfile (conditionally required if the FPP_VUNI supports ELMI)

Associations inherited from ETH_FPP:

- **SupportingElements:** *SupportedBy* – the elements that support the ETH_FPP_VUNI (e.g., CircuitPack) (GET, REPLACE, ADD, REMOVE),
- **ServerTTP:** *EthTunneling* – The relationship between the ETH_FPP_VUNI and the supporting ENNI where the S-VLAN-ID is mapped to this VUNI (GET, REPLACE)
- **ETH_Flow_Domains:** *FlowDomainInterfaces* – the ETH_FPP_VUNI is one of the ETH_FPP_VUNIs that delineate the associated ETH_Flow_Domains (GET, REPLACE, ADD, REMOVE)
- **ETHBandwidthProfile:** *IngressBwCharacterization* – The ingress BW profile parameters to be applied to all incoming ENNI Frames mapped to the ETH_FPP_VUNI. (GET, REPLACE, ADD, REMOVE)
- **ETHBandwidthProfile:** *EgressBwCharacterization* – The egress BW profile parameters to be applied to all egress ENNI Frames mapped to the ETH_FPP_VUNI. (GET, REPLACE, ADD, REMOVE)

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O
stateChange	O

7.3   vNID Related Object Definitions
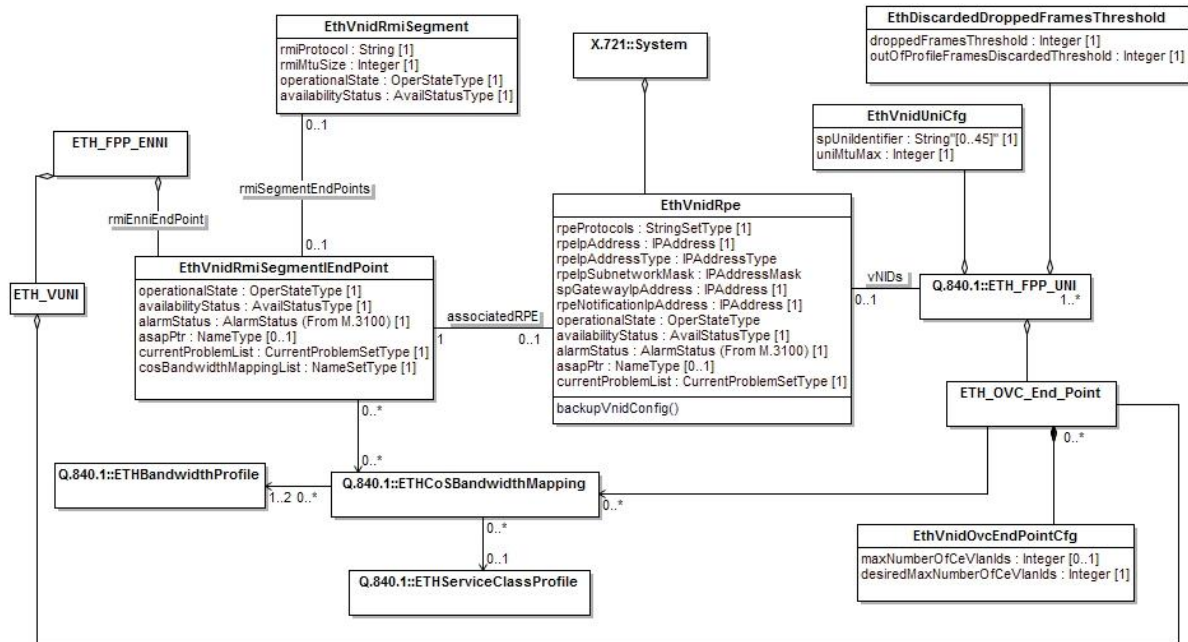
Figure 7-3 vNID Related Object Classes

7.3.1 EthVnidUniCfg

Behavior:			
This managed entity is used to configure the additional vNID Service Attributes of a UNI associated with a vNID service.			

Attributes			
Name	**Description**	**Type**	**Qualifier**
spUniIdentifier	Describes the UNI ID within the scope of the Ethernet service provider domain. The SP UNI Identifier attribute is a value that is assigned to the VUNI by the Ethernet Service Provider. In a vNID service this attribute is controlled by the Service Provider via the RMI.	String (max 45 bytes)	M, R/W
uniMtuMax	Maximum MTU size supported by the UNI as defined by the Access Provider. The UNI MTU Max MUST be specified to have a value $\geqslant$ 1522 bytes. In a vNID service this attribute is controlled by the Access Provider.	Integer $\geqslant$ 1522	M, R/W

Relationships:	
The EthVnidUniCfg object is contained under ETH_FPP_UNI (conditionally required if the vNID service is provided by the UNI).	

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O

7.3.2 EthVnidOvcEndPointCfg

Behavior:			
This managed entity is used to configure the additional vNID Service Attributes of a ETH_OVC_End_Point associated with a vNID service.			

Attributes			
Name	**Description**	**Type**	**Qualifier**
maxNumberOfCeVlanIds	Describes the maximum number of CE-VLAN IDs on the OVC at the UNI. Supported for vNID Case A.	Integer	O, R
desiredMaxNumberOfCeVlanIds	Describes the desired maximum number of CE-VLAN IDs on the OVC at the UNI. Supported for vNID Case A.	Integer	M, R

Relationships:	
The EthVnidOvcCfg object is contained under ETH_OVC_End_Point (conditionally required if the vNID service is provided by the associated OVC and UNI).	

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O

7.3.3   EthVnidRmiSegment

Behavior:
This managed entity is used to represent the vNID service Remote Management Interface (RMI) Segment that allows a Service Provider to configure those parameters and variables that they are permitted to set or change as a part of the vNID offering. The RMI Segment associates the RMI Endpoint at the ENNI and the Remote Processing Entity (RPE). An RMI Segment may exist for each vNID UNI or there may be one RMI per SP-AP pairing.

Attributes			
Name	**Description**	**Type**	**Qualifier**
rmiProtocol	This attribute identifies the protocol used across the RMI. In a vNID service this attribute is controlled by the Access Provider.	String	M,R/W
rmiMtuSize	This attribute describes the maximum transmission unit size for the RMI.	Integer $\geqslant$ 1526	M, R/W
operationalState	This attribute denotes the operational state of the EthVnidRmi as working "Enabled" or not-working "Disabled".	ENUM (disabled, enabled)	M, R
availabilityStatus	The availability status attribute is read only and indicates that the EthVnidRmi is functioning properly. May be mapped to RFC 2863 [52], The Interfaces Group MIB IfOperstatus. Values for availability status include: inTest, failed, degraded.	ENUM (inTest, failed, degraded)	M, R

Relationships:

EthVnidRmiSegment is associated with:
  ▪ rmiSegmentEndponts: The EthVnidRmiSegment is associated with at most 1 EthVnidRmiSegmentEndPoint at the ENNI.
  ▪ *EthVnidRmiEndPoint*: *rmiSegmentEndPoints* – Associates the RMI channel with its endpoints at the ENNI and at the RPE. (GET, REPLACE)

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O
stateChange	O

7.3.4   EthVnidRmiSegmentEndPoint

Behavior:
This managed entity is used to represent a vNID service Remote Management Interface (RMI) Segment End Point that allows a Service Provider to configure those parameters and variables that they are permitted to set or change as a part of the vNID offering. The RMI Segment End Point may be contained in either an ENNI, or an RPE.

Attributes			
Name	**Description**	**Type**	**Qualifier**
operationalState	This attribute denotes the operational state of the EthVnidRmi as working "Enabled" or not-working "Disabled".	ENUM (disabled, enabled)	M, R

availabilityStatus	The availability status attribute is read only and indicates that the EthVnidRmi is functioning properly. May be mapped to RFC 2863 [52], The Interfaces Group MIB IfOperstatus. Values for availability status include: inTest, failed, degraded.	ENUM (inTest, failed, degraded)	M, R
alarmStatus	The alarm status attribute is read only and indicates the occurrence of an abnormal condition. Values for alarm status include: critical, major, minor, indeterminate, warning, pending, and cleared.	ENUM (critical, major, minor, indeterminate, warning, pending, cleared)	M, R
asapPtr	The alarm severity profile associated with the EthVnidRmi to assign alarm severity to specific alarms.	Name	O, R/W
currentProblemList	Identifies the current existing problems (probable cause), with severity, associated with the EthVnidRmi.	Set of CurrentProblemType	M, R
cosBandwidthMappingList	This attribute indicates the bandwidth profiles for the RMI End Point.	ETHCoSBandwidthMappingID	M, R/W

Relationships:
The EthVnidRmiSegmentEndPoint object is contained under ETH_FPP_ENNI.

EthVnidRmiSegmentEndPoint is associated with:
- EthVnidRmiSegment
- EthVnidRpe: *associatedRPE* - the EthVnidRmiSegmentEndPoint may be associated with an EthVnidRpe (GET, REPLACE)
- *ASAP: SeverityAssignment* – the EthVnidRmiSegmentEndPoint may be associated with an alarm severity assignment profile in order to assign alarm severity to specific alarms. (GET, REPLACE)
- ETHCoSBandwidthMapping: *CoSBWMappingCharacterization* –Indicates the bandwidth for each specific CoS in the ingress and egress direction at the RMI Segment End Point. (GET,REPLACE,ADD,REMOVE)

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O
stateChange	O
comminicationsAlarm	M

7.3.5 EthVnidRpe

Behavior:
This managed entity is used to represent the vNID service Remote Processing Entity (RPE) that terminates the RMI within the AP network. There is always a one to one relationship between a RMI and a Remote Processing Entity (RPE).

Attributes			
Name	**Description**	**Type**	**Qualifier**
rpeProtocols	This attribute identifies the protocols supported by the RPE. In a vNID service this attribute is controlled by the	List of ENUM (SNMPv2C	M,R/W

	Access Provider.	ARP ICMP Ping & trace route RMI Protocol FTP SFTP UDP TCP SSHv2 NETCONF)	
rpeIpAddress	Any valid public or private IP address identified by the SP to the RPE. (Read only for RMI)	IP Address	M, R/W
rpeIpAddressType	The AP **MUST** support an IPv4 format address as an RPE IP address. The AP **SHOULD** support an IPv6 format address as an RPE IP address. (Read only for RMI)	List ENUM (IPv4, IPv6)	M, R/W
rpeIpSubnetworkMask	The IP Subnetwork Mask for the RPE. (Read only for RMI)	IP Address Mask	M, R/W
rpeGatewayIpAddress	The RPE IP Gateway Address. (Read only for RMI)	IP Address	M, R/W
rpeNotificationIpAddress	The RPE IP Notification Address. The destination IP address that notifications are sent to. (Read only for RMI)	IP Address	M, R/W
operationalState	This attribute denotes the operational state of the EthVnidRpe as working "Enabled" or not-working "Disabled".	ENUM (disabled, enabled)	M, R/W
availabilityStatus	The availability status attribute is read only and indicates that the EthVnidRpe is functioning properly. May be mapped to RFC 2863 [52], The Interfaces Group MIB IfOperstatus. Values for availability status include: inTest, failed, degraded.	ENUM (inTest, failed, degraded)	M, R
alarmStatus	The alarm status attribute is read only and indicates the occurrence of an abnormal condition. Values for alarm status include: critical, major, minor, indeterminate, warning, pending, and cleared.	ENUM (critical, major, minor, indeterminate, warning, pending, cleared)	M, R
asapPtr	The alarm severity profile associated with the EthVnidRpe to assign alarm severity to specific alarms.	Name	M, R/W
currentProblemList	Identifies the current existing problems (probable cause), with severity, associated with the EthVnidRpe.	Set of CurrentProblemType	M, R

Operations / Methods:

Name	Description
backupVnidConfig (in vNIDIdentifier::ethFPPID)	This optional method allows the SP to request a backup of the vNID configuration via RMI protocol.

Relationships:
The EthVnidRpe object is contained under ManagementDomain.

EthVnidRpe is associated with:
- EthVnidRmiSegmentEndPoint: *associatedRPE* - the EthVnidRpe is associated with an EthVnidRmiSegmentEndPoint (GET, REPLACE)
- *ASAP: SeverityAssignment* – the EthVnidRpe may be associated with an alarm severity assignment profile in order to assign alarm severity to specific alarms. (GET, REPLACE)
- *ETH_FPP_UNIs*: vNID – Associates the EthVnidRpe with the vNIDs that the RPE is responsible for managing (via UNI association) (GET, REPLACE, ADD, REMOVE)

Reportable Notifications:	
objectCreation	O
objectDeletion	O
attributeValueChange	O
stateChange	O
comminicationsAlarm	M
backupCompleted	M

7.3.5.1 EthDiscardedDroppedFramesThreshold

Behavior:
This object class provies the list of Discarded and Dropped Frame threshold values for proactive Performance Monitoring of the vNID service.

Attributes			
Name	**Description**	**Type**	**Qualifier**
outOfProfileFrame sDiscardedThresho ld	This attribute provides a threshold of discarded red frames per UNI and/or per EVC. The threshold is based upon the sum of the following counts for ETH Ingress (/Egress) Traffic Management Performance Data Set (ITU-T Q.840.1): ingressRedFrameCount and engressRedFrameCount	Integer	M, R/W
droppedFramesTh reshold	This attribute provides a threshold of of dropped frames due to abnormalities per UNI. The threshold is based upon the sum of the following counts for ETH UNI Anomalies Performance Data Set: Undersized Frames, Oversized Frames, Fragments, FCS and Alignment Errors, Invalid CE-VLAN IDengressRedFrameCount.	Integer	M, R/W

Relationships:
The **EthDiscardedDroppedFramesThreshold** object contined in **ETH_FPP_UNI**.

Reportable Notifications:	
objectCreation	O
objectDeletion	O
thresholdCrossingAlert	R

7.4 Common OAM Objects

This section defines a Service OAM information model based on the following inputs shown in the figure below.
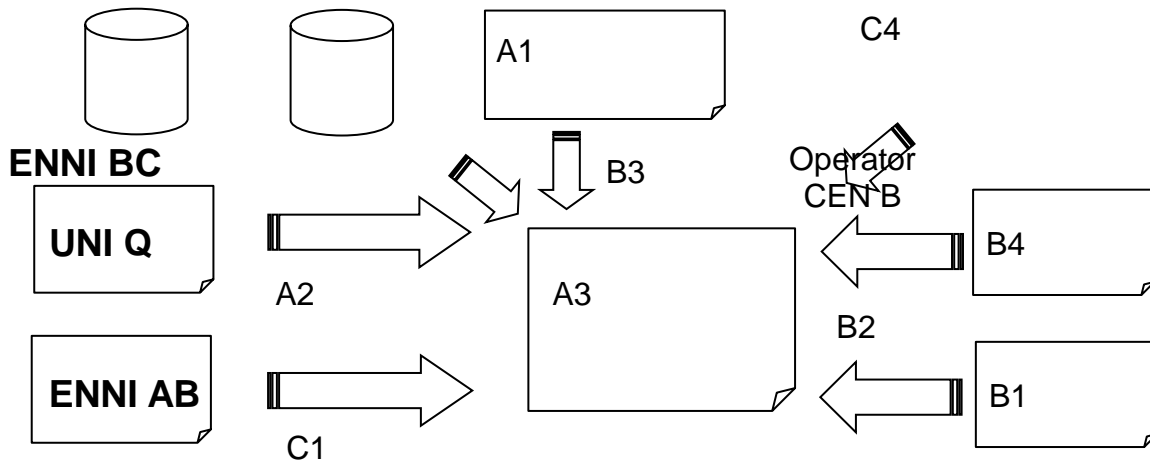
Figure 7-4 SOAM Information Model Approach

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.

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 [15].
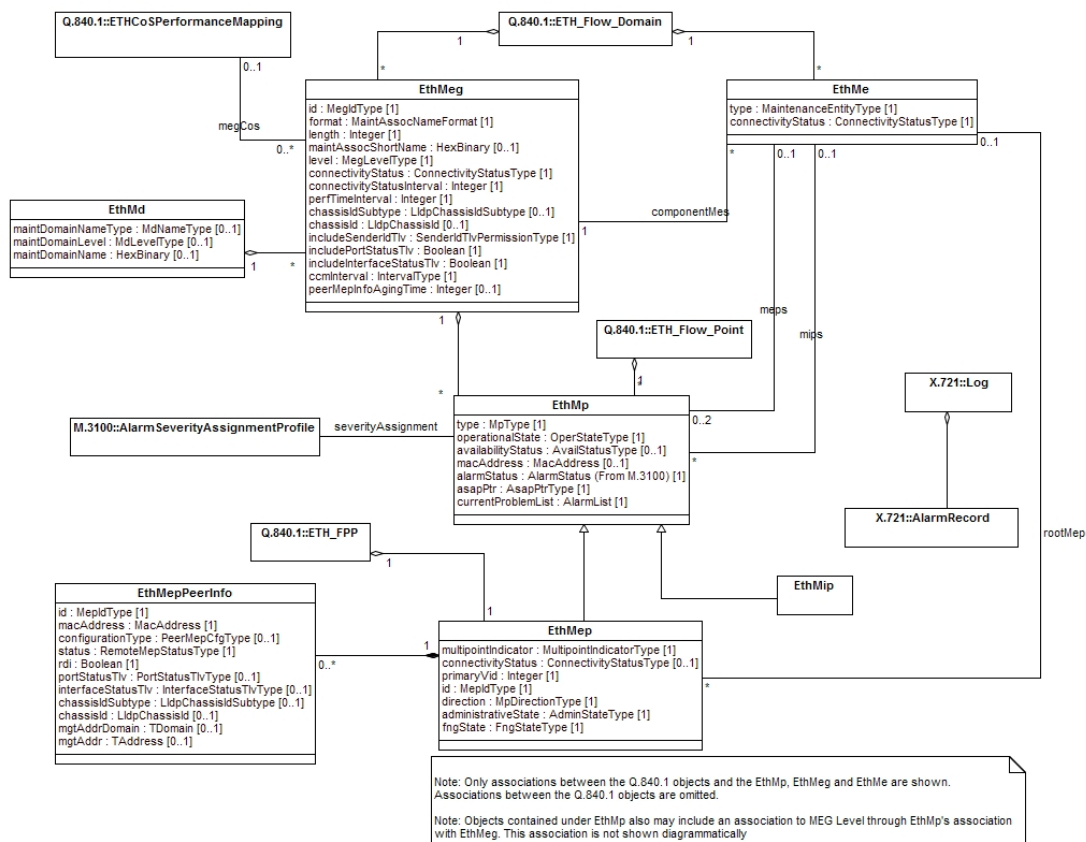
Figure 7-5 Common Service OAM Object Class Diagram

7.4.1 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 consists 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 Management System when ETH_FPPs or ETH_FDFr_EVCs are created. Instances of this managed object may be created and deleted by request of the Management System.

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. (note: this is a reflection of the connectivity status of the associated MEPs)	ConnectivityStatusType		M, R

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)
EthMep: *RootMep* – The MEG End Points that act as a root MEP (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

7.4.2 EthMeg (Maintenance Entity Group)

Behavior:
This object represents the Maintenance Entity Group (Y.1731) or Maintenance Association (802.1Q). 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 Management System when ETH_FPPs or ETH_FDFr_EVCs are created.   Instances of this managed object may be created and deleted by request of the Management System. |

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.	LldpChassisId Subtype		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.	ConnectivitySt atusType		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 CEN 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.	SenderIdTlvPe rmissionType	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.	MegLevelTyp e		M, R/W
format	This attribute represents the MEG ID (Y.1731) or Short MA Name (802.1ag) format.	MaintAssocNa meFormat		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
perfMeasurementInterval Duration	The length of the period of time associated with a Measurement Interval. Units are minutes.	Integer	15	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

Relationships:

The **EthMeg** object is contained under **ETH_Flow_Domain** defined in Q.840.1. OR under EthMd.

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: *Contains* – The EthMeg contains ETH Maintenance Points
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

7.4.3   EthMep (MEG 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 Management System when ETH_FPPs or ETH_Flow_Points are created.   Instances of this managed object may be created and deleted by request of the Management System.

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
administrativeState	This attribute specifies the administrative state of the EthMep. In the Locked state Service OAM frame flow through the EthMep is prohibited.	AdminStateType		M, R/W
connectivityStatus	This attribute indicates the connectivity status for a MEP in 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

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
direction	This attribute specifies the direction in which the Maintenance Association (MEP only) 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 MEP ID as defined in Y.1731. A small integer, unique over a given Maintenance Association for identifying a specific MEP (802.1ag).	MepIdType		M, R/W
fngState	Indicates the different states of the MEP Fault Notification Generator State Machine. (802.1 CFM-MIB)	FngStateType		M, R

Relationships:

The **EthMep** object is a specialization 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) (inherited)

EthMe: *RootMEP* – The MEG End Point is the root of a multipoint MEG. (GET, REPLACE)

EthMepPeerInfo: *Peer MEP List* – A list of staticly configured or dynamically learned peer MEPs.

objectCreation	O
objectDeletion	O

7.4.4   EthMip (MEG 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 Management System when ETH_FPPs or ETH_Flow_Points are created. Instances of this managed object may be created and deleted by request of the Management System.	

Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**

Relationships:
The **EthMip** object is a specialization of the **EthMp** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.4.5 EthMp (Maintenance Point)

Behavior:				
This object defines ETH Maintenance Points representing either a MEP or a MIP (via a subclass). Abstract Superclass.				
Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**
alarmStatus	This attribute indicates the occurrence of an abnormal condition relating to a MEP or MIP. 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.	AvailStatus Type		O, R
currentProblemList	This attribute identifies the current existing problems associated with the EthMp.	AlarmList		M, R

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 or MIP.	MpType		M, R

Relationships:
The **EthMp** object is contained under the **EthMeg**.
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)
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)
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

7.4.6   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

Relationships:
The **EthMd** object contains zero or more **EthMeg** object instances.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.4.7   EthMepPeerInfo (MEP Peer Information)

Behavior:
This object defines a set of attributes for storing the MEG 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 recursively 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 Continuity Check (CC), Loopback (LBM/LBR), Link Trace (LTM/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 Management System when EthMep object is created. Instances of this managed object may be created and deleted by request of the Management System.

Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**

id	This attribute specifies the MEP 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 Management System.	PeerMepCfg Type	dynamic	O, R/W
status	This attribute indicates the status of the remote MEP to which this instance applies.	RemoteMep StatusType		M, R
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
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.	PortStatusTl vType	notIncluded	O, R
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.	InterfaceStat usTlvType	notIncluded	O, R
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.	LldpChassisI dType		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.	LldpChassisI d		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	Taddress		O, R

attribute should return a zero-length OCTET STRING.			
Relationships: **EthMepPeerInfo** is contained under the **EthMep** object.			
Reportable Notifications:			
objectCreation		O	
objectDeletion		O	

7.5   Fault Management Objects

The following diagram illustrates the Fault Management objects (UML classes) and their relationships as defined in this specification.
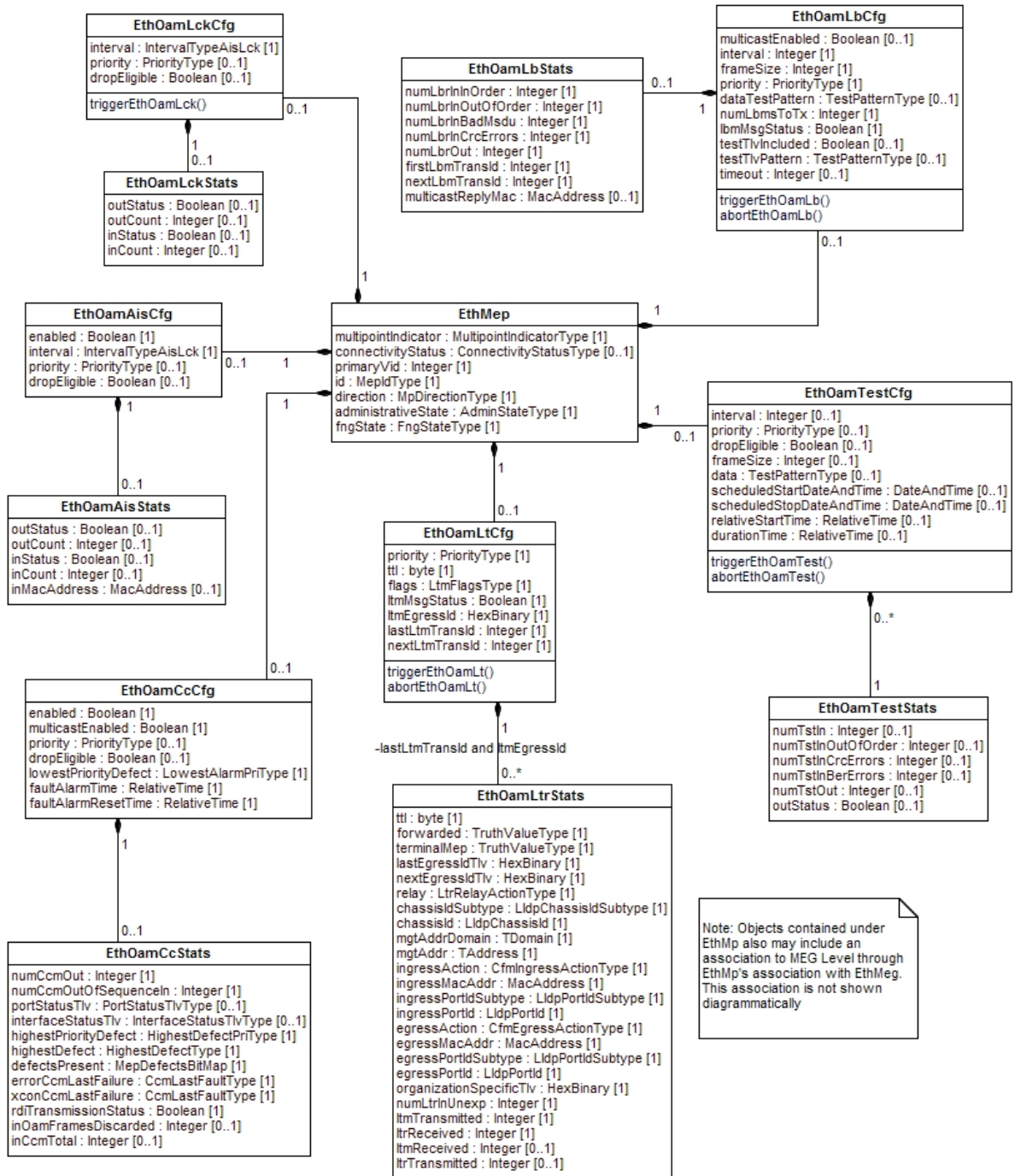
Figure 7-6 Fault Management Class Diagram

7.5.1   Continuity Check
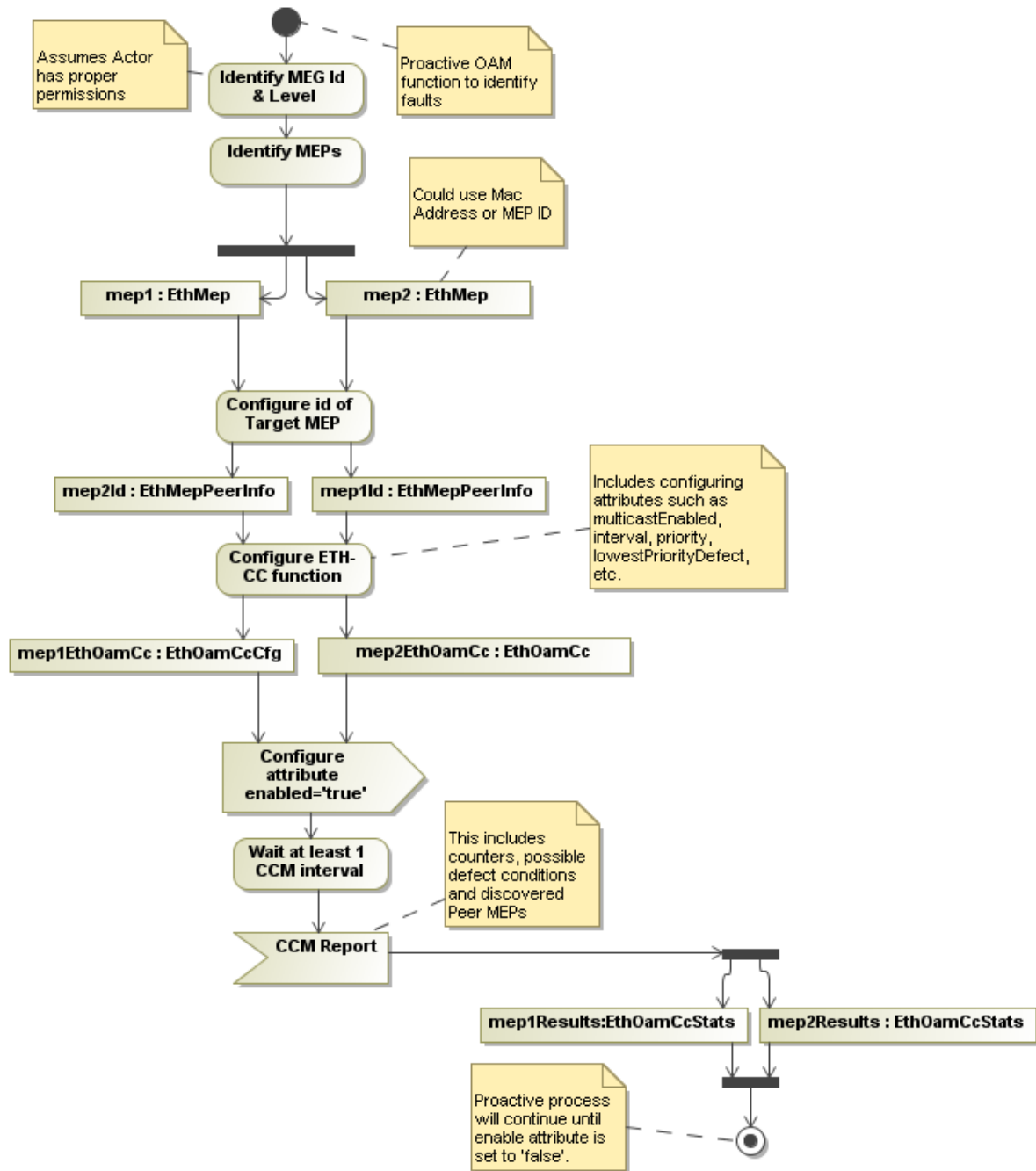
Figure 7-7 Continuity Check Activity Diagram

7.5.1.1 EthOamCcCfg (Ethernet Continuity Check Configuration)

Behavior:

This object includes configuration attributes and operations for the proactive Ethernet OAM Fault Management 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 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 Management System when EthMp is created. Instances of this managed object may also created and deleted by request of the Management System.

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
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.	RelativeTi me	10 seconds	M, R/W
dropEligible	This attribute specifies the eligibility of frames with ETH-CC 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

Relationships:

The **EthOamCcCfg** object is contained under the **EthMep** object.
The **EthOamCcCfg** object contains the **EthOamCcStats** object.

EthOamCcCfg is associated with:

Reportable Notifications:

objectCreation	O
objectDeletion	O

7.5.1.2   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 Management System 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	PortStatusTlv	notIncluded	O, R

	enumerated value of the Port status TLV sent in the CCM from the local MEP.	Type		
interfaceStatusTlv	This attribute indicates an enumerated value of the Interface Status TLV sent in the CCM from the local MEP.	InterfaceStatus TlvType	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 the defect named in the variable highestDefect	HighestDefect PriType		M, R
defectsPresent	See dot1agCfmMepDefects.	MepDefectsBi tMap		M, R
errorCcmLastFailure	This attribute indicates the last-received CCM that triggered an DefErrorCCM fault.	CcmLastFault Type		M, R
xconCcmLastFailure	This attribute indicates the last-received CCM that triggered a DefXconCCM fault.	CcmLastFault Type		M, R
rdiTransmissionStatus	This attribute indicates whether the local MEP is generating the RDI bit	Boolean		M, R
inOamFramesDiscarded	This attribute indicates whether the number of ingress OAM frames discarded	Integer		O, R
inCcmTotal	This attribute indicates the number of ingress CCM frames received	Integer		O, R

Relationships:
The **EthOamCcStats** object is contained under the **EthOamCcCfg** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.5.2   Loopback

Figure 7-8 Loopback Activity Diagram

7.5.2.1 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 Management System when EthMp is created. Instances of this managed object may also be created and deleted by request of the Management System.

Attributes

Name	Description	Type	Default Value	Qualifier
multicastEnabled	This attribute specifies whether a MEP uses unicast or multicast to send the ETH-LB messages (LBM/LBR). A MEP can send ETH-LB 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)

dataTestPattern	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.	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 Management System can initiate an LB Session. A Management System should verify this attribute is 'true' before triggering a Loopback request message. A Management System should set this attribute to 'false' to lock out other Management Systems while it performs an LB Session. Once a Management System has completed an LB Session, it should set this attribute back to 'true'.	Boolean	true	M***, R/W (*** Defined in IEEE 802.1ag)
testTlvIncluded	This attribute specifies whether the Test TLV or Data TLV is to be used during LBM transmissions	Boolean	false	O, R/W
testTlvPattern	This attribute specifies the type of Test TLV to be included in the LBM	TestPatternType	null	O, R/W
timeout	This attribute specifies the maximum amount of time to receive a response from a LBM	Integer (ms)	5000	O, R/W
Operations / Methods:				
Name	**Description**			
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.
The **EthOamLbCfg** contains the **EthOamLbStats** object.

EthOamLbCfg is associated with:

Reportable Notifications:	
objectCreation	M
objectDeletion	M

7.5.2.2 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 Management System initiates an LB Session).

Attributes

Name	Description	Type	Default Value	Qualifier
numLbrInInOrder	This attribute contains the count of the total number of valid, in order Loopback reply messages received.	Integer	0	M, R

numLbrInOutofOrder	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 [55])
numLbrInBadMdsu	This attribute contains the count of the total number of Loopback reply messages received whose mac_service_data_unit did not match (except for the OpCode) that of the corresponding Loopback request message.	Integer	0	M***, R (*** Defined in CFM MIB)
numLbrInCrcErrors	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 Test TLV (Test Pattern).	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)
multicastReplyMac	This attribute contains the reply MAC address that was sent in response to a multicast LBM	MacAddress		O,R

Relationships: The **EthOamLbStats** object is contained under the **EthOamLbCfg** object.	
Reportable Notifications:	
objectCreation	O
objectDeletion	O

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7.5.3 Link Trace

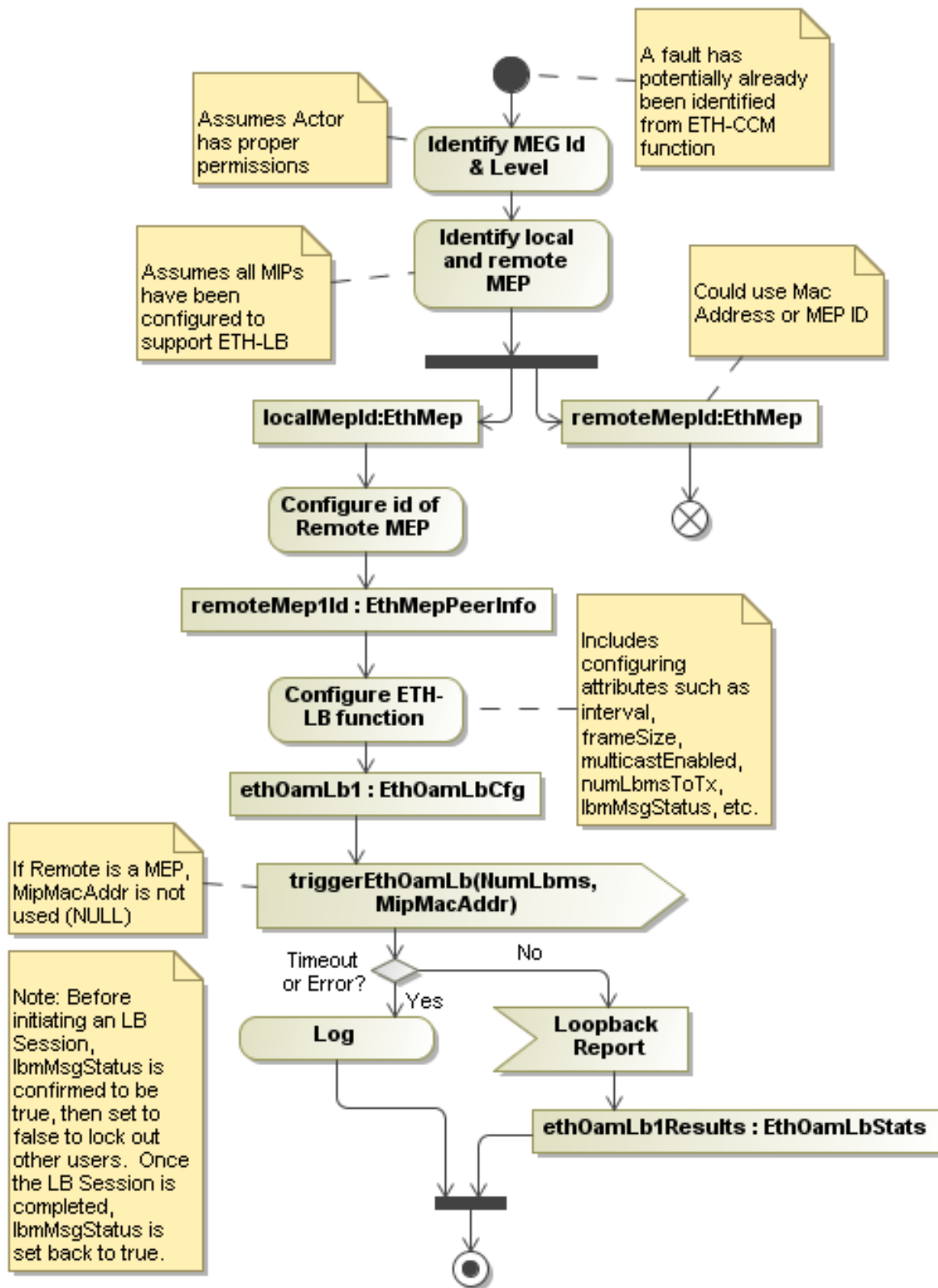# Figure 7-9 Link Trace Activity Diagram

7.5.3.1 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 Management System when EthMp is created. Instances of this managed object may also be created and deleted by request of the Management System.

Attributes

Name	Description	Type	Default Value	Qualifier
priority	This attribute specifies the priority of frames with ETH-LT request information.	PriorityType		M, 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

ltmMsgStatus	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 Management System can initiate an LT Session. An Management System should verify this attribute is 'true' before triggering a Link Trace request message. An Management System should set this attribute to 'false' to lock out other Management System s while it performs an LT Session. Once an Management System has completed an LT Session, it should set this attribute back to 'true'.	Boolean	true	M, R/W
ltmEgressId	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/S
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
Operations / Methods:				
Name	**Description**			
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. The **EthOamLtCfg** object contains the **EthOamLtrStats** object. **EthOamLtCfg** is associated with:					
Reportable Notifications:					
objectCreation				M	
objectDeletion				M	

7.5.3.2 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., a Management System 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.	Boolean		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.	Boolean		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 Link Trace 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 indicates 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.	LldpChassisId Subtype		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
numLtrlnUnexp	This attribute indicates the total number of unexpected LTRs received.	Integer		M, R
ltmTransmitted	This attribute indicates the total number of LTM messages transmitted by the MEP	Integer		M, R
ltrReceived	This attribute indicates the total number of LTR messages received by the MEP	Integer		M, R
ltmReceived	This attribute indicates the total number of LTM messages received by the MEP	Integer		O, R
ltrTransmitted	This attribute indicates the total number of LTR messages transmitted by the MEP	Integer		O, R

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

7.5.4   Signal Functions
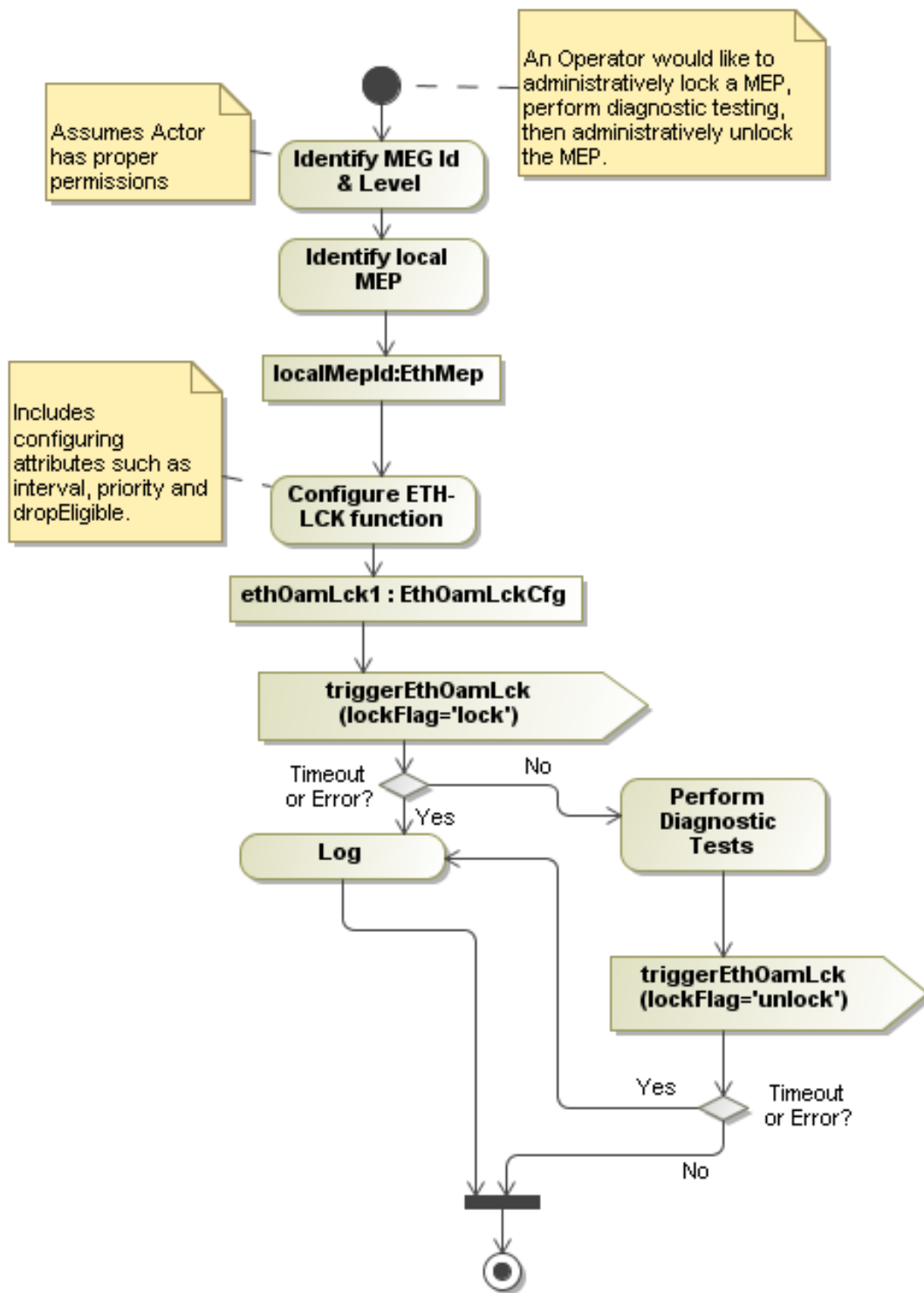
Figure 7-10 Locked Activity Diagram
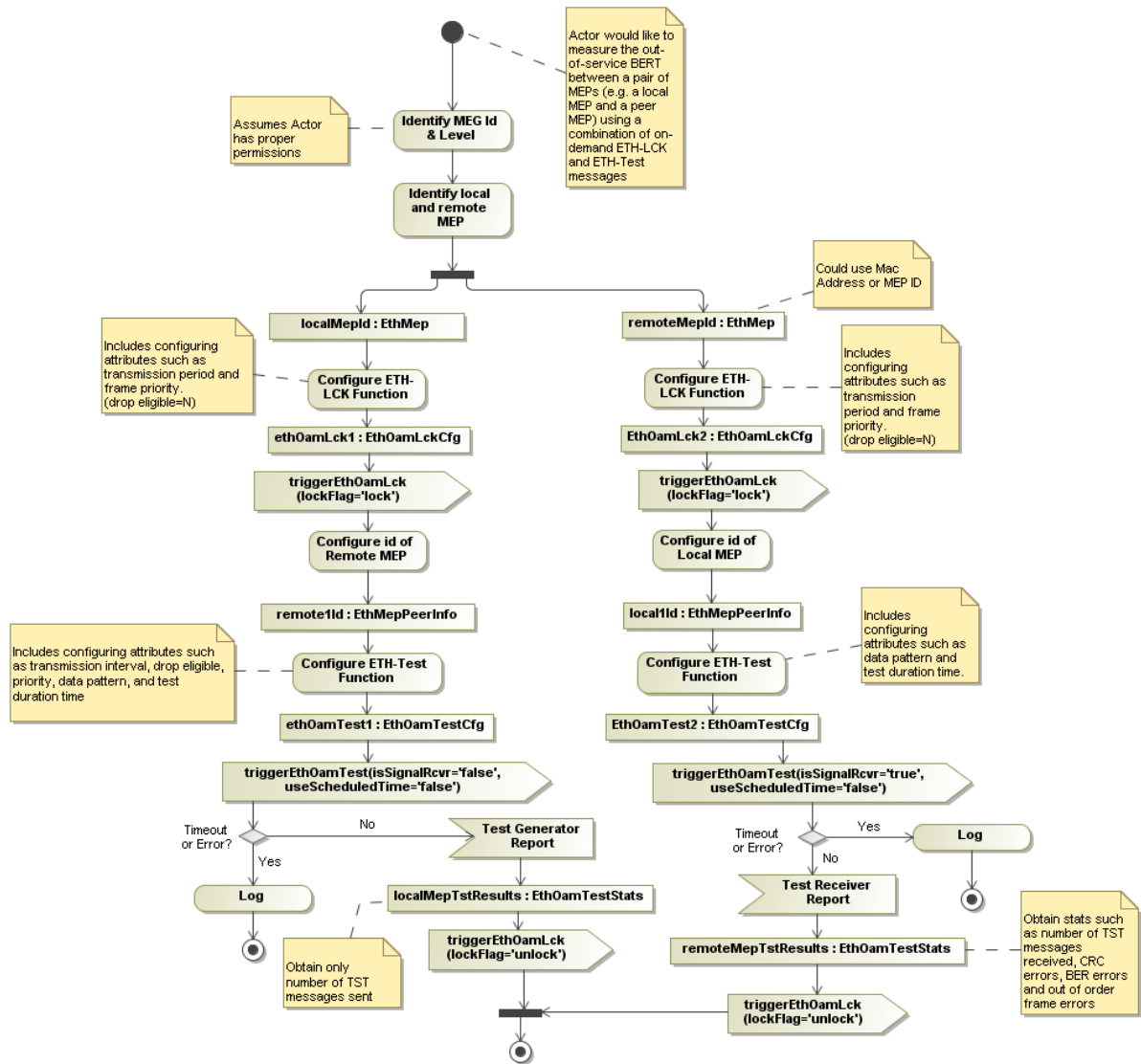
Figure 7-11 Test Activity Diagram

7.5.4.1 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-AIS 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 Management System when EthMp is created. Instances of this managed object may also be created and deleted by request of the Management System.

Attributes

Name	Description	Type	Default	Qualifier

			Value		
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.	IntervalType AisLck	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
mdLevel	This attribute specifies the Maintenance Domain/MEG level of the client ETH-AIS PDU	MdLevelType e	0	O, R/W

Relationships:	
The **EthOamAisCfg** object is contained under the **EthMep** object. **EthOamAisCfg** is associated with:	
Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.5.4.2   ethOamAisStats (Ethernet Alarm Indication Signal Statistics)

Behavior:
This object contains the counter and status attributes for the ETH-AIS function.   Instances of this managed object are created automatically by the Management System when EthMp is created.

Instances of this managed object may also be created and deleted by request of the Management System.

Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**
outStatus	This attribute indicates the current AIS transmission status of the MEP	Boolean		O, R
outCount	This attribute contains the count of the total AIS messages sent by the MEP to a peer or a client	Integer		O, R
inStatus	This attribute indicates whether the current AIS receive status of the MEP	Boolean		O, R
inCount	This attribute contains the count of the total AIS messages received by the MEP	Integer		O, R
inMacAddress	This attribute contains the Source MAC address of the last received ETH-AIS PDU	MacAddress		O, R

Relationships:
The **EthOamAisStats** object is contained under the **EthOamAisCfg** object. There may exist zero or more (0..*) EthOamAisStats object instances for each instance of the EthOamAisCfg object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.5.4.3 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 Management System when EthMp is created. Instances of this managed object may also be created and deleted by request of the Management System.

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
mdLevel	This attribute specifies the Maintenance Domain/MEG level of the client ETH-AIS PDU	MdLevelType	0	O, R/W

Operations / Methods

Name	Description
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

7.5.4.4   ethOamLckStats (Ethernet Lock Signal Statistics)

Behavior:
This object contains the counter and status attributes for the ETH-LCK function.

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

Attributes

Name	Description	Type	Default Value	Qualifier
outStatus	This attribute indicates whether LCK frames are being transmitted by the MEP	Boolean		O, R
outCount	This attribute contains the count of the total LCK messages sent by the MEP	Integer		O, R
inStatus	This attribute indicates whether LCK frames are being received by the MEP	Boolean		O, R

inCount	This attribute contains the count of the total LCK messages received by the MEP	Integer		O, R

Relationships:

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

There may exist zero or more (0..*) EthOamLckStats object instances for each instance of the EthOamLckCfg object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.5.4.5 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 Base-lining OAM Use Case. This function is only applicable to MEPs.

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

Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**
interval	This attribute specifies the ETH-Test transmission period in milliseconds. Range for this attribute is 1,000,000-60,000,000 us.	Integer	1000000 us	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 Test TLV, if the Test 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.	TestPatternType	None	O, R/W
startTimeType	This attribute specifies the type of start type as immediate, fixed, or relative	TimeType	None	O, R/W
scheduledStartDateAndTime	This attribute specifies the fixed scheduled start date/time to perform the on-demand ETH-Test operations.	DateAndTime	None	O, R/W
scheduledStopDateAndTime	This attribute specifies the fixed 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. In centi-seconds.	Integer (in centi-seconds)	None	O, R/W
durationTime	This attribute specifies the duration of the Locking. The	Integer (in centi-seconds)	None	O, R/W

	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. In centi-seconds.			
outEnabled	This attribute specifies the ETH-Test transmit function	Boolean	false	O, R/W
inEnabled	This attribute specifies the ETH-Test receive function	Boolean	false	O, R/W
inService	This attribute specifies whether the ETH-Test function is in-service or out-of-service	Boolean	false	O, R/W
macAddress	This attribute specifies the destination MAC address of the ETH-Test responder	MacAddress		O, R/W
mepId	This attribute specifies the destination MEP ID of the ETH-Test responder	MEP ID		O, R/W

Operations / Methods:	
Name	**Description**
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

7.5.4.6   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. a Management System initiates a ETH-Test Session).   This object is used to capture statistics for both the sending and receiving MEP.st of the Management System.

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	Integer	0	O, R

	expected sequence number. This attribute is only applicable to the MEP receiving ETH-Test messages.			
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
outStatus	This attribute specifies whether a ETH-Test operation is active	Boolean	false	O, R

Relationships:		
The **EthOamTestStats** object is contained under the **EthOamTestCfg** object.		
Reportable Notifications:		
objectCreation	O	
objectDeletion	O	

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

EthOamPerfMonCfg

startTimeType : TimeType [1]
scheduledStartDateAndTime : DateAndTime [1]
relativeStartTime : RelativeTime [1]
stopTimeType : TimeType [1]
scheduledStopDateAndTime : DateAndTime [1]
relativeStopTime : RelativeTime [1]
sessionType : Integer [1]
enabled : Boolean [1]
measurementEnabled : AttributeList [1]
interval : IntervalType [1]
measurementInterval : Integer [1]
numIntervalsStored : Integer [1]
priority : PriorityType [1]
frameSize : Integer [1]
dataPattern : SoamTcDataPatternType [1]
repetitionPeriod : RelativeTime [1]
version : Integer [0..1]
testTlvIncluded : Boolean [0..1]
testTlvPattern : SoamTcDataPatternType [0..1]
alignMeasurementIntervals : Boolean [0..1]
alignMeasurementOffset : Integer [0..1]
operationalState : OperStateType [1]

EthOamLmLastReceivedResults

forwardFlr : Integer [0..1]
backwardFlr : Integer [0..1]
availForwardStatus : SoamTcAvailabilityType [0..1]
availBackwardStatus : SoamTcAvailabilityType [0..1]
availForwardLastTransitionTime : DateAndTime [0..1]
availBackwardLastTransitionTime : EthOamLmStatsPerfDataSet [0..1]

reset()

EthOamDmLastReceivedResults

frameDelayTwoWay : Integer [0..1]
frameDelayForward : Integer [0..1]
frameDelayBackward : Integer [0..1]
ifdvTwoWay : Integer [0..1]
ifdvForward : Integer [0..1]
ifdvBackward : Integer [0..1]

reset()

EthOamLmCfg

type : LossMeasType [1]
availabilityMeasurementInterval : Integer [1]
availabilityNumConsecutiveMeasPdus : Integer [1]
availabilityThreshold : float [1]
availabilityNumConsecutiveIntervals : Integer [1]
availabilityNumConsecutiveHighFlr : Integer [0..1]

triggerEthOamLm()
abortEthOamLm()

EthOamDmCfg

clockSyncFlag : Boolean [0..1]
measBinThreshold : BinThresholdType [1]
numMeasBinsPerFrameDelayInterval : Integer [1]
numMeasBinsPerInterFrameDelayVariationInterval : Integer [1]
numMeasBinsPerFrameDelayRangeInterval : Integer [1]
interFrameDelayVariationSelectionOffset : Integer [0..1]
type : DelayMeasType [1]

triggerEthOamDm()
abortEthOamDm()

EthOamLmStatsPerfDataSet

forwardTransmittedFrames : Integer [0..1]
forwardReceivedFrames : Integer [0..1]
forwardMinFlr : Integer [0..1]
forwardMaxFlr : Integer [0..1]
forwardAveFlr : Integer [0..1]
backwardTransmittedFrames : Integer [0..1]
backwardReceivedFrames : Integer [0..1]
backwardMinFlr : Integer [0..1]
backwardMaxFlr : Integer [0..1]
backwardAveFlr : Integer [0..1]
soamPdusSent : Integer [1]
soamPdusReceived : Integer [1]

reset()

EthOamLmAvailStatsPerfDataSet

+forwardHighLoss : Integer [0..1]
+backwardHighLoss : Integer [0..1]
+forwardConsecutiveHighLoss : Integer [0..1]
+backwardConsecutiveHighLoss : Integer [0..1]
+forwardAvailable : Integer [1]
+backwardAvailable : Integer [1]
+forwardUnavailable : Integer [1]
+backwardUnavailable : Integer [0..*]
+forwardMinFlr : Integer [0..1]
+forwardMaxFlr : Integer [0..1]
+forwardAveFlr : Integer [0..1]
+backwardMinFlr : Integer [0..1]
+backwardMaxFlr : Integer [0..1]
+backwardAveFlr : Integer [0..1]
+forwardAvailableRatio : Integer [1]
+backwardAvailableRatio : Integer [1]

reset()

EthOamDmStatsPerfDataSet

frameDelayTwoWayMin : Integer [1]
frameDelayTwoWayMax : Integer [1]
frameDelayTwoWayAve : Integer [1]
frameDelayForwardMin : Integer [1]
frameDelayForwardMax : Integer [1]
frameDelayForwardAve : Integer [1]
frameDelayBackwardMin : Integer [1]
frameDelayBackwardMax : Integer [1]
frameDelayBackwardAve : Integer [1]
ifdvForwardMin : Integer [1]
ifdvForwardMax : Integer [1]
ifdvForwardAve : Integer [1]
ifdvBackwardMin : Integer [1]
ifdvBackwardMax : Integer [1]
ifdvBackwardAve : Integer [1]
ifdvTwoWayMin : Integer [0..1]
ifdvTwoWayMax : Integer [0..1]
ifdvTwoWayAve : Integer [0..1]
FrameDelayRangeForwardMax : Integer [1]
FrameDelayRangeForwardAve : Integer [1]
FrameDelayRangeBackwardMax : Integer [0..1]
FrameDelayRangeBackwardAve : Integer [0..1]
FrameDelayRangeTwoWayMax : Integer [1]
FrameDelayRangeTwoWayAve : Integer [1]
soamPdusSent : Integer [1]
soamPdusReceived : Integer [1]

reset()

EthOamDmBinStatsPerfDataSet

twoWayFrameDelayBins : BinStatsList [0..1]
forwardFrameDelayBins : BinStatsList [0..1]
backwardFrameDelayBins : BinStatsList [0..1]
twoWayIfdvBins : BinStatsList [0..1]
forwardIfdvBins : BinStatsList [0..1]
backwardIfdvBins : BinStatsList
twoWayFrameDelayRangeBins : BinStatsList [0..1]
forwardFrameDelayRangeBins : BinStatsList [0..1]
backwardFrameDelayRangeBins : BinStatsList [0..1]

reset()

EthOamLmStatsCurrentData

EthOamLmStatsHistoryData

EthOamLmAvailStatsCurrentData

EthOamLmAvailStatsHistoryData

EthOamDmBinStatsCurrentData

EthOamDmBinStatsHistoryData

EthOamDmStatsCurrentData

EthOamDmStatsHistoryData

Q.822::CurrentData

Q.822::HistoryData

Figure 7-12 Performance Monitoring Class Diagram

7.6.1 Abstract Performance Monitoring Objects

This section defines abstract PM objects which are used by LM and DM objects through 160pecialization (inheritance)

7.6.1.1 EthOamPerfMonCfg

Behavior:
This object includes configuration attributes and operations common to the ETH-DM and ETH-LM OAM operations.
Attributes

Name	Description	Type	Default Value	Qualifier
startTimeType	This attribute specifies the type of start type as immediate, fixed, or relative	TimeType	immediate	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
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		M, R/W
stopTimeType	This attribute specifies the type of stop type as none, fixed, or relative	TimeType	none	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
relativeStopTime	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
sessionType	Indicates whether this PM session is defined to be 'Proactive' or 'On-Demand'.	Enum {proactive, onDemand}		M, R/SetByCreate

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	M, R/W
measurementEnabled	A list of attribute identifiers used to indicate the types of SOAM LM or SOAM DM counters that are enabled for collection. Only counters that are to be collected are included in the list. This list may be updated to include or remove specific counters.	AttributeList	none	M, 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
numIntervalsStored	This attribute specifies the number of completed Measurement Intervals to store as history. At least 32 completed Measurement Intervals should be stored. 96 Measurement Intervals are recommended to be stored.	Integer (2..1000)	32	M, R/W
priority	This attribute specifies the priority of frames with Performance Monitoring OAM message information.	PriorityType	Highest allowed on the bridge port	M, R/W
frameSize	This attribute specifies the LM or DM frame size between 64 bytes and the maximum transmission unit of the EVC. The range of frame sizes from 64 through 2000 octets need to be supported, and the range of frame sizes from 2001 through 9600 octets is suggested to be supported. The adjustment to the frame size of the standard frame size is accomplished by the addition of a Data or Test TLV. A Data or Test TLV is only	Integer (64..9600)		M, R/W

	added to the frame if the frame size is greater than 64 bytes. This attribute is only used for the when transmitting the the Loss Measurement frames, type 'lmSlm', or the Delay Measurement frames (dmDmm, dm1DmTx) and is ignored by the entity receiving frames.			
dataPattern	This attribute specifies the LM or DM data pattern included in a Data TLV when the size of the LM or DM frame is determined by the frameSize attribute and TestTlvIncluded is 'false'. If the frame size attribute does not define the LM frame size or testTlvIncluded is 'true' the value of this attribute is ignored.	SoamTcDataPatternType		M, 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
version	This attribute indicates the version of the PDUs used to perform SOAM LM or DM. The value is placed in the Version field of the PDU and indicates that the PDU format used is the format defined in Y.1731 with that version.	Integer		O, R/W
testTlvIncluded	This attribute indicates whether a Test TLV or Data TLV is included when the size of the LM or DM frame is determined by the frameSize attribute. A value of 'true' indicates that the Test TLV is to be included. A value of 'false' indicates that the Data TLV is to be included. If the frame size attribute does not define the frame size the value of this object is ignored.	Boolean		O, R/W

testTlvPattern	This attribute specifies the type of test pattern to be sent in the LM or DM frame Test TLV when the size of LM or DM PDU is determined by the frameSize attribute and testTlvIncluded is 'true'. If the frame size attribute does not define the LM frame size or testTlvIncluded is 'false' the value of this object is ignored.	SoamTcTestPatternType		O, R/W
alignMeasurementIntervals	This attribute specifies whether the Measurement Intervals for the LM or DM session are aligned with a zero offset to real time. The value 'true' indicates that each Measurement Interval starts at a time which is aligned to NE time source hour, if the repetition time (or the Measurement Interval, if the repetition time is 0) is a factor of an hour, i.e. 60min/15min = 4. The value 'false' indicates that the first Measurement Interval starts at an arbitrary time and each subsequent Measurement Interval starts at a time which is determined by repetitionPeriod.	Boolean		O, R/W
alignMeasurementOffset	This attribute specifies the offset in minutes from the time of day value if alignMeasurementIntervals is 'true' and the repetition time is a factor of 60 minutes. If not, the value of this object is ignored.	Integer (0..525600) (Minutes)		O, R/W
operationalState	This attribute denotes the operational state of the SOAM DM or LM session as active "Enabled" or not-active "Disabled".	ENUM (enabled, disabled)		M, R

Relationships:
The **EthOamPerfMonCfg** object is an abstract object.

Reportable Notifications:

7.6.2 Loss Measurement

Figure 7-13 On-Demand Single-Ended Synthetic and Service Loss Measurement Activity Diagram

7.6.2.1 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-Loss) 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-Loss request (includes both ETH-LM and ETH-SLM). The OAM PDU used for single-ended ETH-Loss reply is LMR. The OAM PDU used for dual-ended ETH-Loss 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 Management System when EthMp is created. Instances of this managed object may also be created and deleted by request of the Management System.

Attributes

Name	Description	Type	Default Value	Qualifier
type	This attribute specifies what type of Loss Measurement will be performed. lmLmm: LMM SOAM PDU generated and received LMR responses tracked lmSlm: SLM SOAM PDU generated and received SLR responses tracked lmCcm: CCM SOAM PDU generated and received CCM PDUs tracked The lmSlm value is required. The lmLmm and lmCcm values are optional. The lmCcm loss measurement values are only valid for a point-to-point MEG. Multipoint MEGs may give unreliable loss measurements.	LossMeasType	lmSlm	M, R/W
availabilityMeasurementInterval	This attribute specifies the availability Measurement Interval in minutes. A Measurement Interval of 15 minutes is to be supported, other intervals can be supported.	Integer (1..525600)		M, R/W
availabilityNumConsecutiveMeasPdus	This attribute specifies a configurable number of consecutive loss measurement PDUs to be used in evaluating the availability/unavailability status of an availability indicator per [MEF 10.2.1]. Loss Measurement PDUs (LMMs, CCMs or SLMs) are sent regularly with a period defined by the messagePeriod. Therefore, this attribute, when multiplied by messagePeriod, is equivalent to the Availability parameter of 'delta_t' as specified by MEF 10.2.1. If the mefSoamLmCfgType is lmLMM or lmCCM, this object defines the number	Integer	10	M, R/W

	of LMM or CCM PDUs transmitted during each 'delta_t' period. The Availability flr for a given 'delta_t' can be calculated based on the counters in the last LMM/R or CCM during this 'delta_t' and the last LMM/R or CCM in the previous 'delta_t'. If the mefSoamLmCfgType is lmSLM, this object defines the number of SLM PDUs transmitted during each 'delta_t' period. The Availability flr for a given 'delta_t' is calculated based on the number of those SLM PDUs that are lost. If the mefSoamLmCfgType is lmLMM or lmCCM, the number range of 1 through 10 must be supported. The number range of 10 through 1000000 may be supported, but is not mandatory. If the mefSoamLmCfgType is lmSLM, the number range of 10 through 100 must be supported. The number range of 100 through 1000000 may be supported, but is not mandatory.			
availabilityThreshold	This attribute specifies a configurable availability threshold to be used in evaluating the availability/unavailability status of an availability indicator per [MEF 10.2.1]. The availability threshold range of 0.00 through 1.00 is supported.]. This parameter is equivalent to the Availability parameter of 'C' as specified by [MEF 10.2.1].	Float (0.00..1.00)	0.50	M, R/W
availabilityNumCons ecutiveIntervals	This attribute specifies a configurable number of consecutive availability indicators to be used to determine a change in the availability status as indicated by MEF 10.2.1. This parameter is equivalent to the Availability parameter of 'n' as specified by MEF 10.2.1. The number range of 1 through 10 must be supported. The number range of 1 through 1000 may be supported, but is not mandatory.	Integer (1..1000)	10	M, R/W

availabilityNumCons ecutiveHighFlr	This attribute specifies a configurable number of consecutive availability indicators to be used for assessing CHLI. This parameter is equivalent to the Resilency parameter of 'p' as specified by MEF 10.2.1. availabilityNumConsecutiveHighFlr must be strictly less than availabilityNumConsecutiveIntervals. If not, the count of high loss intervals over time, mefSoamLmAvailabilityHighLoss, and the count of consecutive high loss levels, availabilityConsecutiveHighLoss is disabled. The number range of 1 through 10 must be supported. The number range of 1 through 1000 may be supported, but is not mandatory.	Integer (1..1000)	5	O, R/W

Operations / Methods:

Name	Description
abortEthOamLoss()	This operation provides the ability to abort a currently running or scheduled single-ended on-demand ETH-Loss function. This operation is not applicable to dual-ended proactive ETH-Loss.
triggerEthOamLoss()	This operation provides the ability to trigger single-ended on-demand or dual-ended proactive ETH-Loss based on the configured values of type, start date/time, and end date/time. For the dual-ended proactive ETH-Loss operation, the input parameter 'useScheduledTime' is ignored since it only applies for the single-ended on-demand ETH-Loss operation. This operation blocks until the Loss 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-Loss operation. A value of 'true' indicates ETH-LM or ETH-SLM message(s) will be (or has been) transmitted. A value of 'false' indicates message(s) will not be sent.	Boolean		out

Relationships:
The **EthOamLmCfg** object is contained under the EthMep object and is a specialization of the **EthOamPerfMonCfg** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.6.2.2 EthOamLmLastReceivedResults

Behavior:				
An instance of this object class represents the Loss Measurement statistic information from the last received SOAM PDU. It is created automatically when a LM session is created (contained in EthOamLmCfg)				

Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**
forwardFlr	This attribute contains the Frame Loss Ratio in the forward direction calculated by this MEP from the last received SOAM PDU. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer, Optionally Thresholded		O, R
backwardFlr	This attribute contains the Frame Loss Ratio in the backward direction calculated by this MEP from the last received SOAM PDU. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer, Optionally Thresholded		O, R
availForwardStatus	This attribute indicates the availability status (the outcome of the last availability indicator) in the forward direction based upon the last received SOAM PDU.	SoamTcAvailabilityType		O, R
availBackwardStatus	This attribute indicates the availability status (the outcome of the last availability indicator) in the backward direction based upon the last received SOAM PDU.	SoamTcAvailabilityType		O, R
availForwardLastTransitionTime	This attribute indicates the time of the last transition between available and unavailable in the forward direction. If there have been no transitions since the Loss Measurement Session was started, this is set to 0	DateAndTime		O, R
availBackwardLastTransitionTime	This attribute indicates the time of the last transition between available and unavailable in the back direction. If there have been no transitions since the Loss Measurement Session was started, this is set to 0	DateAndTime		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.
Relationships: The **EthOamLmLastReceivedResults** object is contained under the **EthOamLmCfg** object.	
Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.6.3 Delay Measurement
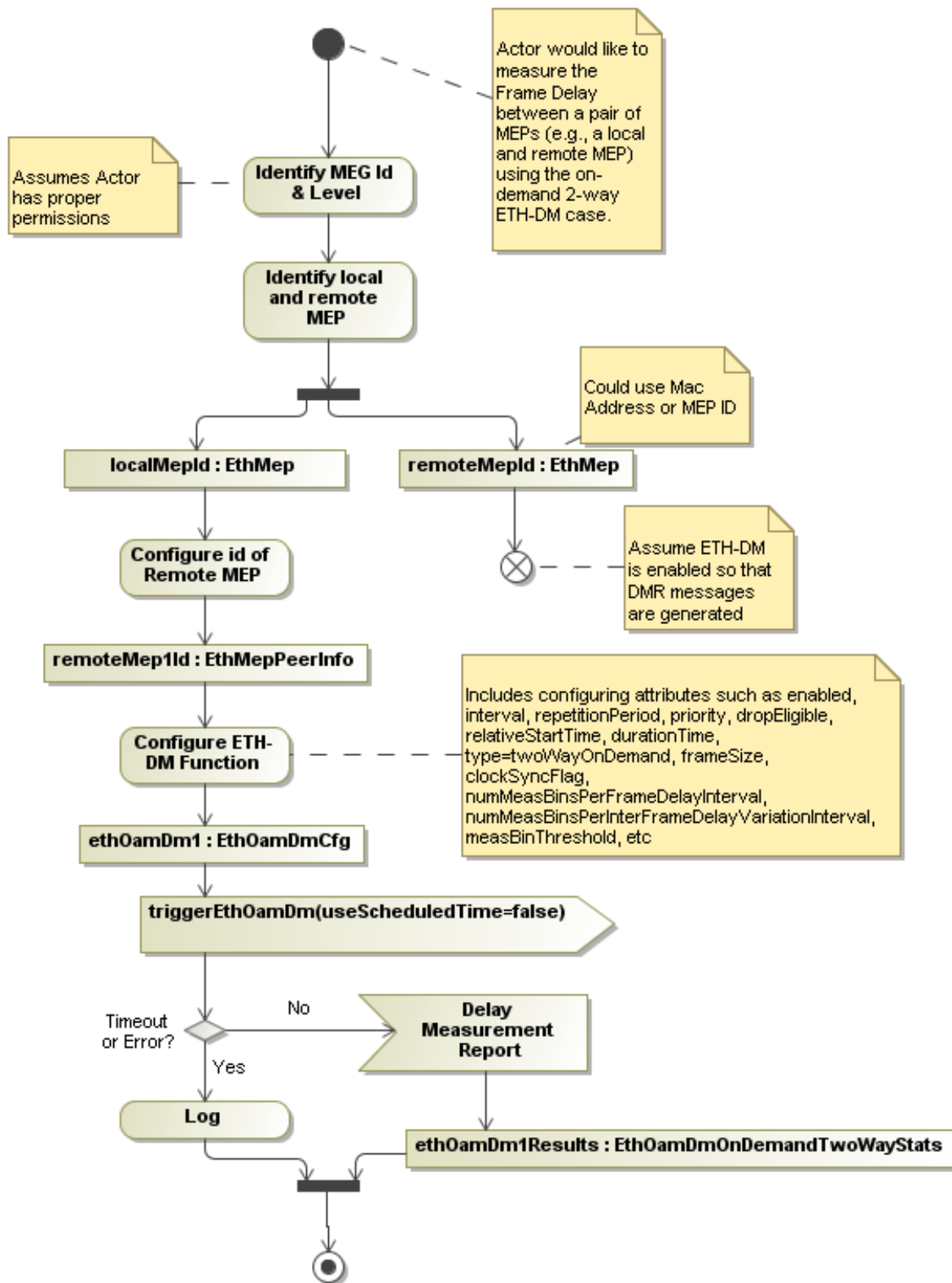
Figure 7-14 On-Demand 2-Way Delay Measurement Activity Diagram
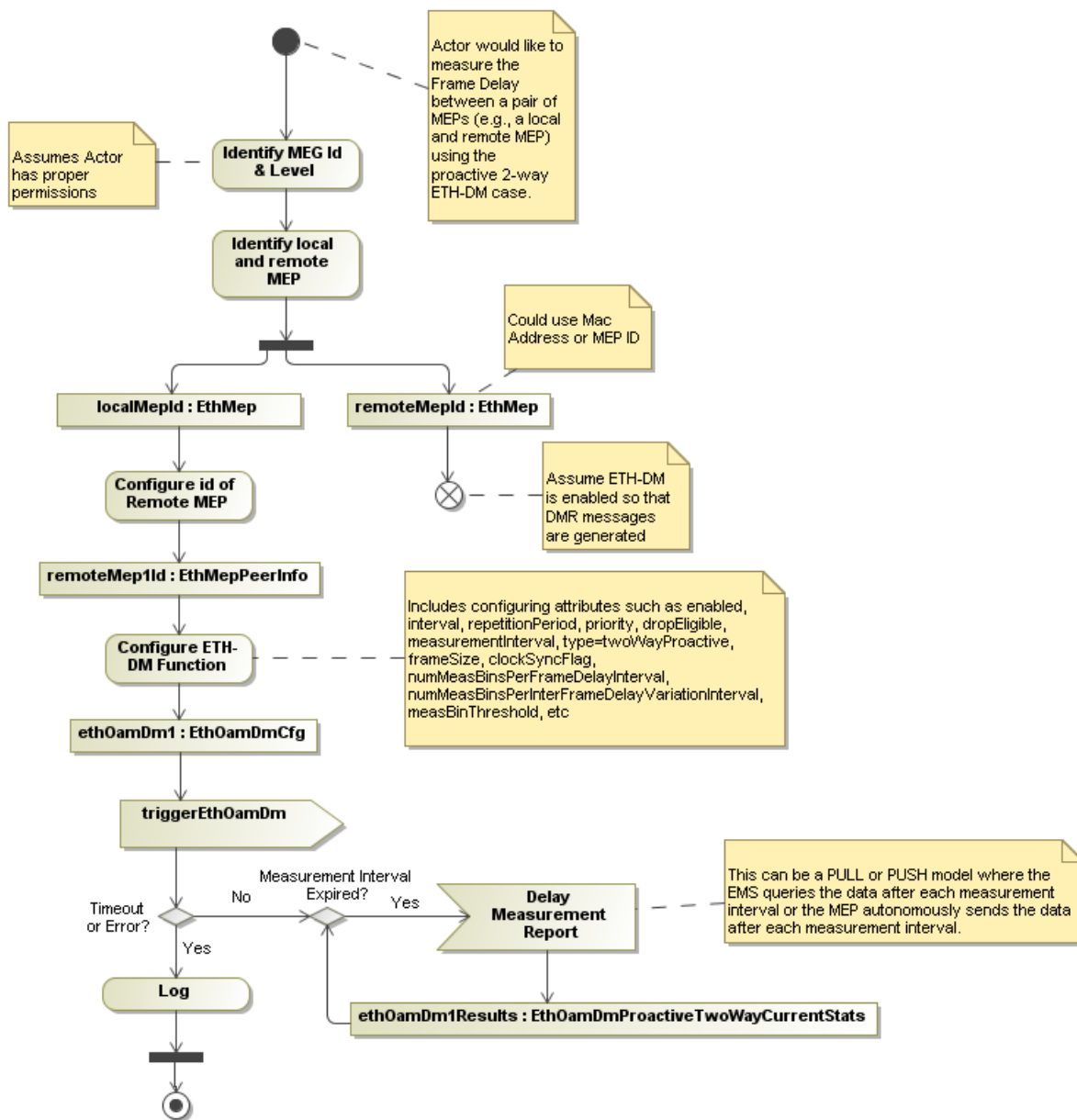
Figure 7-15 Proactive 2-Way Delay Measurement Activity Diagram

7.6.3.1 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 Management System when EthMp is created. Instances of this managed object may also be created and deleted by request of the Management System.

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
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 measurement threshold of the preceding measurement bin.	BinThresholdType		M, R/W
numMeasBinsPerFrameDelayInterval	This attribute specifies the number of measurement bins per measurement interval for Frame Delay measurements. The valid range of values is 2..100 bins.	Integer (2..100)	3	M, R/W

numMeasBinsPerInte rFrameDelayVariatio nInterval	This attribute specifies the number of measurement bins per measurement interval for Inter-Frame Delay Variation measurements. The valid range of values is 2..100 bins.	Integer (2..100)	2	M, R/W
numMeasBinsPerFra meDelayRangeInterva l	This attribute specifies the number of measurement bins per measurement interval for Frame Delay Range measurements. The valid range of values is 2..100 bins.	Integer (2..100)	2	M, R/W
interFrameDelayVari ationSelectionOffset	This attribute specifies the selection offset for Inter-Frame Delay Variation measurements. If this value is set to n, then the IFDV is calculated by taking the difference in frame delay between frame F and frame (F+n).	Integer (1..100)	1	O, R/W
type	This attribute indicates the type of delay measurement to be performed.	DelayMeasTyp e	dmDmm	M, R/W

Operations / Methods:

Name	Description
abortEthOamDm()	This operation provides the ability to abort a currently running or scheduled ETH-DM function.
triggerEthOamDm()	This operation provides the ability to trigger one-way and two-way on-demand and proactive Performance Monitoring Frame Delay Measurement function (ETH-DM) defined in Y.1731. based on the configured values of type, start date/time, and end date/time. 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.This operation blocks until the DM 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 174specialization of the **EthOamPerfMonCfg** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.6.3.2 EthOamDmLastReceivedResults

Behavior:				
An instance of the object class represents the Delay Measurement statistic information from the last received SOAM PDU. It is created automatically when a DM session is created (contained in EthOamDmCfg)				

Attributes				
Name	**Description**	**Type**	**Default Value**	**Qualifier**
frameDelayTwoWay	This attribute contains the two-way frame delay calculated by this MEP from the last received SOAM PDU. This object is undefined when the measurement-type is dm1-transmitted or dm1-received.	Integer, Optionally Thresholded		O, R
frameDelayForward	This attribute contains the frame delay in the forward direction calculated by this MEP from the last received SOAM PDU. The value of this object may not be accurate in the absence of sufficiently precise clock synchronization. This object is undefined when the measurement-type is dm1-transmitted.	Integer, Optionally Thresholded		O, R
frameDelayBackward	This attribute contains the frame delay in the backward direction calculated by this MEP from the last received SOAM PDU. The value of this object may not be accurate in the absence of sufficiently precise clock synchronization. This object is undefined when the measurement-type is dm1-transmitted or dm1-received.	Integer, Optionally Thresholded		O, R
ifdvTwoWay	This attribute contains the last two-way inter-frame delay interval calculated by this MEP. The value of this object is undefined when measurement-type is dm1-transmitted or dm1-received.	Integer, Optionally Thresholded		O, R
ifdvForward	This attribute contains the last one-way inter-frame delay interval in the forward direction calculated by this MEP. The value of this object is undefined when measurement-type is dm1-transmitted.";	Integer, Optionally Thresholded		O, R
ifdvBackward	This attribute contains the last one-way inter-frame delay interval in the backward direction calculated by this MEP. The value of this object is undefined when measurement-type is dm1-transmitted or dm1-received.	Integer, Optionally Thresholded		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.	

Relationships: The **EthOamDmLastReceivedResults** object is contained under the **EthOamDmCfg** object.	

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.6.4   Data Sets

7.6.4.1   Additional Performance Management Data 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 by applying specific performance data sets to currentData and historyData, defined in ITU-T Q.822.   The thresholdData object class from ITU-T Q.822 may be used to support a thresholding mechanism for individual counters defined in the Performance Data Sets. The tables in this section identify if thresholding should be supported for each counter. 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 interface profile, protocol specific interface and/or implementation agreement that makes use of this logical model.

7.6.4.2   EthOamLmStatsPerfDataSet (SOAM LM Performance Data)

Behavior: This performance data set contains the results for a Measurement Interval in a SOAM Loss Measurement session gathered during an interval indicated by measurement interval (defined in EthOamLmCfg). Current and history data for this performance data set should be contained within an instance of EthOamLmCfg.				
Attributes				
Name	**Description**	**Type**	**Threshold**	**Qualifier**
forwardTransmittedFrames	This attribute contains the number of frames transmitted in the forward direction by this MEP. For a PM Session of types lmm or ccm this includes Ethernet Service Frames and SOAM PDUs that are in a higher MEG level only. For a PM Session of type slm this includes the count of SOAM ETH-SLM frames only..	Counter		O, R
forwardReceivedFrames	This attribute contains the number of frames received in the forward direction by this MEP. For a PM Session of types lmm or ccm this includes Ethernet Service Frames and SOAM PDUs that are in a higher MEG level only. For a PM Session of type slm this includes the count of SOAM	Counter		O, R

	ETH-SLM frames only.			
forwardMinFlr	This attribute contains the minimum one-way frame loss ratio in the forward direction calculated by this MEP for this Measurement Interval. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Guage (0..100000)		O, R
forwardMaxFlr	This attribute contains the maximum one-way frame loss ratio in the forward direction calculated by this MEP for this Measurement Interval. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Guage (0..100000)	M	O, R
forwardAveFlr	This attribute contains the average one-way frame loss ratio in the forward direction calculated by this MEP for this Measurement Interval. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Guage (0..100000)	M	O, R
backwardTransmittedFrames	This attribute contains the number of frames transmitted in the backward direction by this MEP. For a PM Session of type lmm or ccm this includes Ethernet Service Frames and SOAM PDUs that are in a higher MEG level only. For a PM Session of type slm this includes the count of SOAM ETH-SLM frames only.	Counter		O, R
backwardReceivedFrames	This attribute contains the number of frames received in the backward direction by this MEP. For a PM Session of type lmm this includes Ethernet Service Frames and SOAM PDUs that are in a higher MEG level only. For a PM Session of type slm this includes the count of SOAM ETH-SLM frames only.	Counter		O, R

backwardMinFlr	This attribute contains the minimum one-way frame loss ratio in the backward direction calculated by this MEP for this Measurement Interval. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent	Guage (0..100000)		O, R
backwardMaxFlr	This attribute contains the maximum one-way frame loss ratio in the backward direction calculated by this MEP for this Measurement Interval. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Guage (0..100000)	M	O, R
backwardAveFlr	This attribute contains the average one-way frame loss ratio in the backward direction calculated by this MEP for this Measurement Interval. The FLR value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Guage (0..100000)	M	O, R
soamPdusSent	This attribute contains the count of the number of SOAM PDUs sent during this Measurement Interval. This object applies when type is lmm, slm or ccm. It indicates the number of LMM, CCM, or SLM SOAM frames transmitted.	Counter		M, R
soamPdusReceived	This attribute contains the count of the number of SOAM PDUs received during this Measurement Interval. This object applies when type is lmm, slm or ccm. It indicates the number of LMM, CCM, or SLM SOAM frames received.	Counter		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.

Relationships:
The **EthOamLmStatsPerfDataSet** object is contained within the **EthOamLmCfg** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.6.4.3 EthOamLmAvailStatsPerfDataSet (SOAM LM Availability Performance Data)

Behavior:				
This performance data set contains the results for availability measurements during a Measurement Interval in a SOAM Loss Measurement session gathered during an interval indicated by measurement interval (defined in EthOamLmCfg). Current and history data for this performance data set should be contained within an instance of EthOamLmCfg.				
Attributes				
Name	**Description**	**Type**	**Threshold**	**Qualifier**
forwardHighLoss	This attribute contains the number of high loss intervals (HLI) over time in the forward direction. The value starts at 0 and increments for every HLI that occurs. This parameter is equivalent to 'L Sub T' found in MEF 10.2.1.	Counter	O	O, R
backwardHighLoss	This attribute contains the number of high loss intervals (HLI) over time in the backward direction. The value starts at 0 and increments for every HLI that occurs. This parameter is equivalent to 'L Sub T' found in MEF 10.2.1.	Counter	O	O, R
forwardConsecutiveHighLoss	This attribute contains the number of consecutive high loss intervals (CHLI) over time in the forward direction. The value starts at 0 and increments for every HLI that occurs that is determined to fall within a CHLI. This parameter is equivalent to 'B Sub T' found in MEF 10.2.1.	Counter	O	O, R
backwardConsecutiveHighLoss	This attribute contains the number of consecutive high loss intervals (CHLI) over time in the backward direction. The value starts at 0 and increments for every HLI that occurs that is determined to fall within a CHLI. This parameter is equivalent to 'B Sub T' found in MEF 10.2.1.	Counter	O	O, R
forwardAvailable	This attribute contains the number of availability indicators during a small time interval evaluated as available (low frame loss) in the forward direction by this MEP during this measurement interval.	Integer		M, R

backwardAvailable	This attribute contains the number of availability indicators during a small time interval evaluated as available (low frame loss) in the backward direction by this MEP during this measurement interval.	Integer		M, R
forwardUnavailable	This attribute contains the number of availability indicators during a small time interval evaluated as unavailable (high frame loss) in the forward direction by this MEP during this measurement interval.	Integer	M	M, R
backwardUnavailable	This attribute contains the number of availability indicators during a small time interval evaluated as unavailable (high frame loss) in the backward direction by this MEP during this measurement interval.	Integer	M	M, R
forwardMinFlr	This attribute contains the minimum one-way availability flr in the forward direction, from among the set of availability flr values calculated by the MEP in this Measurement Interval. There is one availability flr value for each 'delta_t' time period within the Measurement Interval, as specified in MEF 10.2.1. The flr value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer (0..100000)		O, R
forwardMaxFlr	This attribute contains the maximum one-way availability flr in the forward direction, from among the set of availability flr values calculated by the MEP in this Measurement Interval. There is one availability flr value for each 'delta_t' time period within the Measurement Interval, as specified in MEF 10.2.1. The flr value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer (0..100000)		O, R

forwardAveFlr	This attribute contains the average one-way availability flr in the forward direction, from among the set of availability flr values calculated by the MEP in this Measurement Interval. There is one availability flr value for each 'delta_t' time period within the Measurement Interval, as specified in MEF 10.2.1. The flr value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer (0..100000)		O, R
backwardMinFlr	This attribute contains the minimum one-way availability flr in the backward direction, from among the set of availability flr values calculated by the MEP in this Measurement Interval. There is one availability flr value for each 'delta_t' time period within the Measurement Interval, as specified in MEF 10.2.1. The flr value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer (0..100000)		O, R
backwardMaxFlr	This attribute contains the maximum one-way availability flr in the backward direction, from among the set of availability flr values calculated by the MEP in this Measurement Interval. There is one availability flr value for each 'delta_t' time period within the Measurement Interval, as specified in MEF 10.2.1. The flr value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer (0..100000)		O, R

backwardAveFlr	This attribute contains the average one-way availability flr in the backward direction, from among the set of availability flr values calculated by the MEP in this Measurement Interval. There is one availability flr value for each 'delta_t' time period within the Measurement Interval, as specified in MEF 10.2.1. The flr value is a ratio that is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00). Units are in milli-percent, where 1 indicates 0.001 percent.	Integer (0..100000)		O, R
forwardAvailableRatio	The availability ratio can be calculated from the values of forwardAvailable and forwardUnavailable. Used for thresholding.	Integer (Derrived)	M	M, R
backwardAvailableRatio	The availability ratio can be calculated from the values of backwardAvailable and backwardUnavailable. Used for thresholding.	Integer (Derrived)	M	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.

Relationships:
The **EthOamLmAvailStatsPerfDataSet** object is contained within the **EthOamLmCfg** object.

Reportable Notifications:	
objectCreation	O
objectDeletion	O

7.6.4.4 EthOamDmStatsPerfDataSet (SOAM DM Performance Data)

Behavior:				
This performance data set contains the results for performance measurements during a Measurement Interval in a SOAM Delay Measurement session gathered during an interval indicated by measurement interval (defined in EthOamDmCfg). Current and history data for this performance data set should be contained within an instance of EthOamDmCfg.				
Attributes				
Name	**Description**	**Type**	**Threshold**	**Qualifier**
frameDelayTwoWayMin	This attribute contains the minimum two-way frame delay in microseconds calculated by this MEP for this Measurement Interval. Undefined if measurement	Integer		M, R

	type is dm1DmTx or dm1DmRx.			
frameDelayTwoWayMax	This attribute contains the maximum two-way frame delay in microseconds calculated by this MEP for this Measurement Interval. Undefined if measurement type is dm1DmTx or dm1DmRx.	Integer	M	M, R
frameDelayTwoWayAve	This attribute contains the average two-way frame delay in microseconds calculated by this MEP for this Measurement Interval. Undefined if measurement type is dm1DmTx or dm1DmRx.	Integer	M	M, R
frameDelayForwardMin	This attribute represents the minimum one-way frame delay in the forward direction in microseconds calculated by this MEP for this Measurement Interval. The value may not be accurate in the absence of sufficiently precise clock synchronization. Undefined if measurement type is dm1DmTx.	Integer		M, R
frameDelayForwardMax	This attribute represents the maximum one-way frame delay in the forward direction in microseconds calculated by this MEP for this Measurement Interval. The value may not be accurate in the absence of sufficiently precise clock synchronization. Undefined if measurement type is dm1DmTx.	Integer	M	M, R
frameDelayForwardAve	This attribute represents the average one-way frame delay in the forward direction in microseconds calculated by this MEP for this Measurement Interval. The value may not be accurate in the absence of sufficiently precise clock synchronization. Undefined if measurement type is dm1DmTx.	Integer	M	M, R
frameDelayBackwardMin	This attribute represents the minimum one-way frame delay in the backward direction in microseconds calculated by this MEP for this Measurement Interval. The	Integer		M, R

	value may not be accurate in the absence of sufficiently precise clock synchronization. Undefined if measurement type is dm1DmTx or dm1DmRx.			
frameDelayBackwardMax	This attribute represents the maximum one-way frame delay in the backward direction in microseconds calculated by this MEP for this Measurement Interval. The value may not be accurate in the absence of sufficiently precise clock synchronization. Undefined if measurement type is dm1DmTx or dm1DmRx.	Integer	M	M, R
frameDelayBackwardAve	This attribute represents the average one-way frame delay in the backward direction in microseconds calculated by this MEP for this Measurement Interval. The value may not be accurate in the absence of sufficiently precise clock synchronization. Undefined if measurement type is dm1DmTx or dm1DmRx.	Integer	M	M, R
ifdvForwardMin	This attribute represents the minimum one-way inter-frame delay interval in the forward direction in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx.	Integer		M, R
ifdvForwardMax	This attribute represents the maximum one-way inter-frame delay interval in the forward direction in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx.	Integer	M	M, R
ifdvForwardAve	This attribute represents the average one-way inter-frame delay interval in the forward direction in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is	Integer	M	M, R

	dm1DmTx.			
ifdvBackwardMin	This attribute represents the minimum one-way inter-frame delay interval in the backward direction in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer		M, R
ifdvBackwardMax	This attribute represents the maximum one-way inter-frame delay interval in the backward direction in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer	M	M, R
ifdvBackwardAve	This attribute represents the average one-way inter-frame delay interval in the backward direction in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer	M	M, R
ifdvTwoWayMin	This attribute represents the minimum two-way inter-frame delay interval in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer		O, R
ifdvTwoWayMax	This attribute represents the maximum two-way inter-frame delay interval in microseconds calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer	O	O, R
ifdvTwoWayAve	This attribute represents the average two-way inter-frame delay interval in microseconds calculated by this MEP for this Measurement Interval.	Integer	O	O, R

	The value is undefined when the measurement type is dm1DmTx or dm1DmRx.			
FrameDelayRangeForwardMax	This attribute represents the maximum one-way frame delay range in the forward direction calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx.	Integer	M	M, R
FrameDelayRangeForwardAve	This attribute represents the average one-way frame delay range in the forward direction calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx.	Integer	M	M, R
FrameDelayRangeBackwardMax	This attribute represents the maximum one-way frame delay range in the backward direction calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer	M	O, R
FrameDelayRangeBackwardAve	This attribute represents the average one-way frame delay range in the backward direction calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer	M	O, R
FrameDelayRangeTwoWayMax	This attribute represents the maximum two-way frame delay range calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer	O	M, R
FrameDelayRangeTwoWayAve	This attribute represents the average two-way frame delay range calculated by this MEP for this Measurement Interval. The value is undefined when the measurement type is dm1DmTx or dm1DmRx.	Integer	O	M, R

soamPdusSent	This attribute contains the count of the number of SOAM PDUs sent during this Measurement Interval. This attribute applies when type is dmDmm or dm1DmTx and is undefined if type is dm1DmRx. It indicates the number of DMM or 1DM SOAM frames transmitted.	Integer		M, R
soamPdusReceived	This attribute contains the count of the number of SOAM PDUs received during this Measurement Interval. This attribute applies when type is dmDmm or dm1DmRx and is undefined if type is dm1DmTx. It indicates the number of DMM or 1DM SOAM frames transmitted.	Integer		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.			

Relationships:				
The **EthOamDmStatsPerfDataSet** object is contained within the **EthOamDmCfg** object.				

Reportable Notifications:				
objectCreation				O
objectDeletion				O

7.6.4.5 EthOamDmBinStatsPerfDataSet (SOAM DM Binned Performance Data)

Behavior:
This performance data set contains the results for binned performance measurements during a Measurement Interval in a SOAM Delay Measurement session gathered during an interval indicated by measurement interval (defined in EthOamDmCfg). Current and history data for this performance data set should be contained within an instance of EthOamDmCfg.

Attributes				
Name	**Description**	**Type**	**Threshold**	**Qualifier**
twoWayFrameDelayBins	This attribute contains measurement bins for two-way frame delay.	BinStatsList	O	O, R
forwardFrameDelayBins	This attribute contains measurement bins for one-way frame delay in the forward direction.	BinStatsList	O	O, R
backwardFrameDelayBins	This attribute contains measurement bins for one-way frame delay in the forward direction.	BinStatsList	O	O, R
twoWayIfdvBins	This attribute contains measurement bins for	BinStatsList	O	O, R

	two-way Inter-frame Delay Variation.			
forwardIfdvBins	This attribute contains measurement bins for one-way Inter-frame Delay Variation in the forward direction.	BinStatsList	O	O, R
backwardIfdvBins	This attribute contains measurement bins for one-way Inter-frame Delay Variation in the backward direction.	BinStatsList	O	O, R
twoWayFrameDelayRangeBins	This attribute contains measurement bins for two-way Frame Delay Range.	BinStatsList	O	O, R
forwardFrameDelayRangeBins	This attribute contains measurement bins for one-way Frame Delay Range in the forward direction.	BinStatsList	O	O, R
backwardFrameDelayRangeBins	This attribute contains measurement bins for one-way Frame Delay Range in the backward direction.	BinStatsList	O	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.			
Relationships: The **EthOamDmBinStatsPerfDataSet** object is contained within the **EthOamDmCfg** object.				
Reportable Notifications:				
objectCreation			O	
objectDeletion			O	

8 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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APPENDIX I: Data Type Definitions

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

I.1 Primitives

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.			
Counter	A counter is regarded as associated with some internal event, which may be, but is not in general, a defined event represented in management information. The current value is incremented by 1 when this event occurs. It can take any values in its range	Integer		ITU-T X.721
Guage	The gauge is the management abstraction of the value of a dynamic variable, such as the number of connections currently operated by a protocol machine or the rate of change of a traffic counter.	Choice { Integer Integer, real Real }		ITU-T X.721
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

Data Type Name	Description	Base Type	Permitted Values	Reference
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.	Unsigned Integer	0..7	IEEE 802.1ap
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

I.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, 15minAvgNearEndIfdv, 15minMaxNearEndIfdv, 15minAvgFarEndIfdv, 15minMaxFarEndIfdv, 24hrAvgBiDirectionalFd, 24hrMaxBiDirectionalFd, 24hrAvgNearEndIfdv, 24hrMaxNearEndIfdv, 24hrAvgFarEndIfdv, 24hrMaxFarEndIfdv, 24hrMaxNearEndIfdvOneWay, 24hrAvgNearEndIfdvOneWay,	

			24hrAvgFarEndIfd vOneWay, 24hrMaxFarEndIfd vOneWay	
DelayMeasType		Enumeration	dmDmm, dm1DmTx, dm1DmRx	
FngStateType		Enumberation	fngReset, fngDefect, fngReportDefect, fngDefectReported, fngDefectClearing	IEEE 802.1 CFM-MIB
FppType	Extends enumeration defined in ITU-T Q.840.1	Enumeration	unconfigured, uNI, eNNI, vUNI	ITU-T Q.840.1
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	lmLmm , lmSlm , lmCcm	ITU-T Y.1731
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	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
SoamTcAvailabilityType	This enumeration data type defines the availability of a session, measured by a loss measurement session	Enumeration	available, unavailable, unknown	
SoamTcDataPatternType	This enumeration data type indicates the type of data pattern to be sent in an OAM PDU Data TLV.	Enumeration	zeroPattern, onesPattern	

SoamTcTestPatternType	This enumeration data type indicates the type of test pattern to be sent in an OAM PDU Test TLV.	Enumeration	null, nullCrc32, prbs, prbsCrc32	
TestPatternType	This enumeration data type indicates the type of test pattern to be sent in an OAM PDU Test 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
Boolean	This enumeration data type defines a Boolean value.	Enumeration	false, true	RFC 2579

I.3 Complex

Type Name	Description	Type Definition
AlarmList	This complex data type represents a set of AlarmRecord instances. AlarmRecord is defined in X.721.	List of Struct { alarm: AlarmRecord, id: Integer }
AssignableCoSBWType	Indicates the assignable bandwidth per CoS. Where the Name is a pointer to ETHServiceClassProfile object.	Struct { serviceClass: Name, bandwidth: Integer (Units: bits per second) }
BinStatsList	This complex data type represents a set of one or more bin number and bin count pairs.	List of BinStatsType
BinStatsType	This complex data type represents specific bin, including the low and high values that delimit the bin, the bin number describer the order of the bin in a list, and the bin counter.	Struct { binLowValue: Integer, //delimits the bin binHighValue: Integer, binNumber: Integer, //order of bin binCounter: Integer //counter }
BinThresholdType	This complex data type represents a set of one or more bin threshold and bin number pairs.	Struct { binNumber: Integer, threshold: Integer }
CtrlProtocolProcType	Indicates the layer 2 control protocol processing. In an Ethernet frame the EtherType Field (two octets, defined in IEEE 802.3[44]) indicates the nature of the MAC client protocol. It may be used along with the destination MAC address to identify some Ethernet Layer 2 Control Protocols.	Struct { controlProtocol : String, destMAC : String, etherType : String, processing: ENUM (Discard, Peer, Pass, Peer&Pass), fDFrEVCPtr: Name // used only when processing is set to Pass or Peer&Pass }

CtrlProtocolProcOnF PType	Indicates the layer 2 control protocol processing for the ETH_Flow_Points.	Struct { layer2Protocol: String, frameDisposition: ENUM(discard, tunnel) }
CurrentProblemType	Identifies the problem (probable cause), with severity. This type is defined in M.3100 [19].	Struct { problem: ProbableCause, alarmStatus: AlarmStatus }
DateAndTime	This complex data type represents an abstract, or scheduled, date and time.	Struct { day: Integer, // 1..7 day of week hour: Integer, //0..23 minute: Integer, //0..59 second: Integer //0..59 }
DelayMeasThreshold ListType	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.	List of Struct { clearThreshold: Integer, countertype: DelayMeasCounterType, crossThreshold: Integer }
EthCeVlanIDMappin gType	Indicates the VLAN ID mapping. Where String can be a VLAN_ID or "untagged".	Choice of { Set of String, // String is a <CE_VLAN_ID>, "untagged" can also be used ENUM ("allToOne", "allOthers") }
EthSVlanIDMapping Type	The map that associates each S-Tagged ENNI Frame with an End Point. <S-VLAN ID value, End Point Identifier, End Point Type>	Struct { sVlanIdValue: Integer, endPointIdentifer: NameType, endPointType: ENUM (ovc, vuni) }
EvcEndParametersTy pe	Indicates the a-end or z-end parameters of an EVC, e.g. when creating an EVC. In Type Definition, the evcEndETH_FPP specifies the a-end or z-end ETH_FPP. The trailEndpointIndicator indicates the trailTerminating attribute of the a-end or z-end ETH_Flow_Point. The ceVLANIdMapping specifies the ethCeVlanIDMapping attribute in the a-end or z-end ETH_Flow_Point. The endEthUNIEVCName is an arbitrary string administered by the Service Provider that is used to identify an FDFr / EVC at the UNI. It is intended for management and control purposes. The ethCoSBandwidthMapping indicates the cosBandwidthMappingList attribute at the a-end or z-end ETH_Flow_Point	Struct { evcEndETH_FPP: Name, trailEndpointIndicator: Boolean, ceVLANIdMapping: EthCeVlanIDMappingType, endEthUNIEVCName: String, ethCoSBandwidthMapping: Set of Name }
RelativeTime	This complex data type is used to specify a	Struct

	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.
		{
		hours: Integer, //0..23
		minutes: Integer, //0..59
		seconds: Integer //0..59
		}

APPENDIX II
Informational: State Management Mapping

The Management Information Model 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".