MEF Standard
MEF 7.4

MEF Services Model:
Information Model for Carrier Ethernet Services

December 2020

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1 List of Contributing Members

The following members of the MEF participated in the development of this document and have requested to be included in this list.

- *CenturyLink*
- *Cisco*
- *NEC/Netcracker*
- *Tata Communications*
- *Nokia*

2 Abstract

The MEF Services Model (MSM) is an information and data model representation of multiple object model efforts for the following services: Carrier Ethernet, IP, Layer 1 and SD-WAN. The object definitions, object attributes and relationships specified in the MSM are based on MEF standards that define the given services. For Carrier Ethernet, the MSM is based on MEF 6.3 [1] and MEF 10.4 [2] for Subscriber Ethernet Services and MEF 26.2 [3] and MEF 51.1 [5] for Operator Ethernet Services. MEF 45.1 [4] is included for Layer 2 Control Protocol support for Ethernet Services. This document defines UML classes, data types and enumerations for representing Ethernet Services.

This document normatively includes the content of the following Papyrus [6] UML files as if they were contained within this document (pull request #167**,** GitHub Repository [7]):

- Carrier_Ethernet.di
- Carrier_Ethernet.notation
- Carrier_Ethernet.uml

3 Terminology and Abbreviations

This section defines the terms used in this document. In many cases, the normative definitions to terms are found in other documents. In these cases, the third column is used to provide the reference that is controlling, in other MEF or external documents. Terms in defined in MEF 10.4[1] are included in this document by reference and not repeated in the table below.

Term	Definition	Reference
Broadcast Data EI Frame	A Data EI Frame with a Broadcast Destination MAC Address.	MEF 26.2 [3]
Bundled OVC	A Point-to-Point or Multipoint-to-Multipoint OVC that associates an OVC End Point that has more than one S-VLAN ID value that maps to it.	MEF 26.2 [3]
DEI	Drop Eligible Indicator.	IEEE Std 802.1Q – 2018 [13]
DSCP	Differentiated Services Code Point.	RFC 3260 [11]
Information Model	Models managed objects at a conceptual level, independent of any specific implementations or protocols used to transport the data. MEF uses UML Class Diagrams to model Information Models.	IETF RFC 3444 [8]
Information Rate	The average bit rate of Ethernet frames at the measurement point, where each Ethernet frame is measured as starting with the first MAC address bit and ending with the last FCS bit.	Adapted from ITU Y.1564 [21]
LAG	Link Aggregation Group.	IEEE Std 802.1AX – 2014 [3]
Link Number ID	An integer ≥1 that is uniquely assigned to each physical link at a given UNI.	Adapted from IEEE Std 802.1 AX – 2014 [3]
Link Selection Priority List	A sequence of Link Number IDs, in the order of usage preference, highest to lowest, for the link that is to carry the Service Frames corresponding to a given Port Conversation ID.	Adapted from IEEE Std 802.1 AX – 2014 [3]
PCP	Priority Code Point.	IEEE Std 802.1Q – 2018 [13]
Port Conversation ID	An identifier for a set of Service Frames that are selected to pass over a physical link at a given UNI.	Adapted from IEEE Std 802.1 AX – 2014 [3]
SOAM	Service Operations Administration and Maintenance.	MEF 30.1 [32]
TPID	Tag Protocol Identifier.	IEEE Std 802.1Q – 2018 [13]
Unified Modeling Language (UML)	The Unified Modeling Language (UML) is a unified model for object-oriented analysis and design.	OMG [15]

Table 1-Terminology and Abbreviations

4 Introduction

The MEF Services Model (MSM) Carrier Ethernet is a service model intended to support management of Ethernet services. The model is based on MEF 10.4 and MEF 6.3 for Subscriber Ethernet Services and MEF 26.2 and MEF 51.1 for Operator Ethernet Services. The MSM includes common classes and type definitions from MEF-Common and MEF-Types models that can be used by other MEF models. Figure-1 illustrates the model relationships.

The MSM is intended to be used at multiple LSO interface reference points for multiple API development efforts. Relevant interface reference points include: Sonata, Cantata, Allegro, Interlude and Legato. Each of these interfaces can use the common objects, attributes and relationships defined in the MSM.

The MSM can be used with TM Forum APIs where the JSON payload is derived from the MSM, by YANG-based APIs (via NETCONF or RESTCONF) where the YANG model is derived from the MSM or by OpenAPI based APIs where the OpenAPI specification is derived from the MSM.

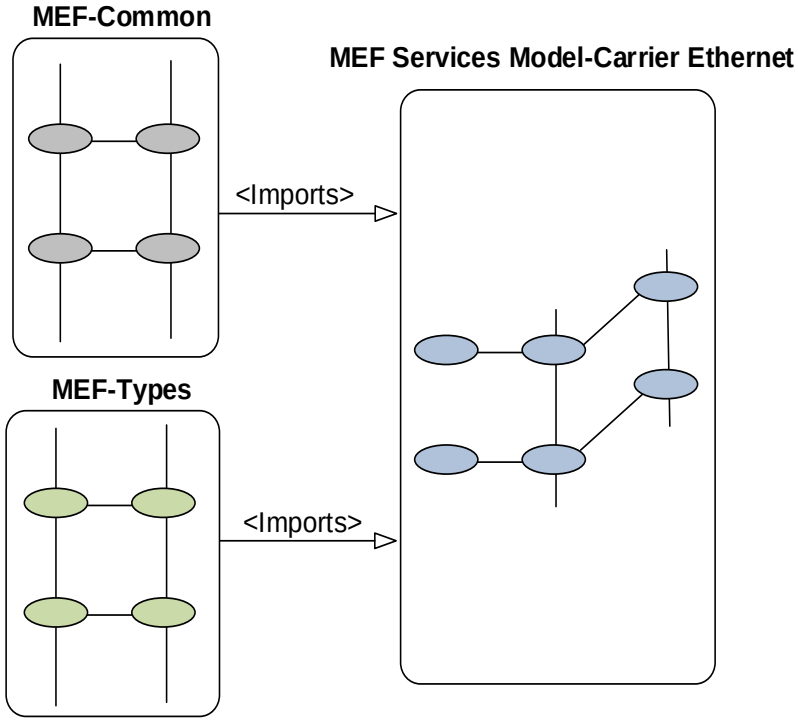

Figure 1-MEF Services Model-Carrier Ethernet and other model associations

4.1 Attribute References

The attribute descriptions in the tables in the following sections refer to standards found in the Reference section of this document.

5 Service Information Model Overview

The service information model consists of a set of object classes, data types, enumerations their attributes and the relationships among them. The object classes defined in this document are modeled based on the services defined in the service related MEF Standards, for supporting Subscriber Ethernet Services and Operator Ethernet Services. In the following, Figure 2 and Figure 3 illustrate the overviews of object classes, data types, enumerations and their relationships for Subscriber Ethernet Services and Operator Ethernet Services respectively. To simplify the overview, some of the minor supporting classes, data type and enumerations are not shown in the figures.

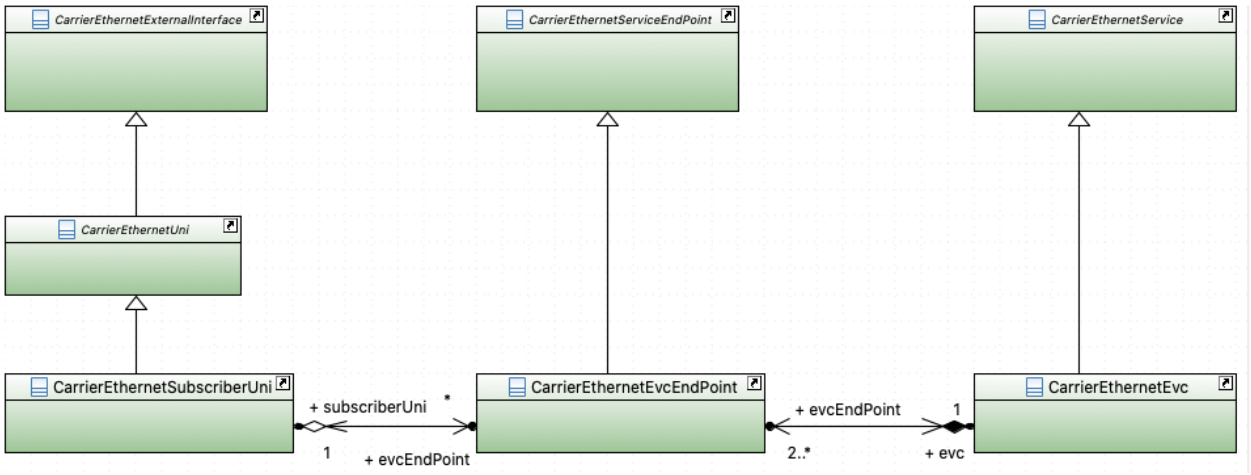

Figure 2-Subscriber Ethernet Services Overview

The Subscriber Ethernet Services model has three main classes, CarrierEthernetSubscriberUni, CarrierEthernetEvcEndPoint and CarrierEthernetEvc. A Subscriber Ethernet Service is defined as having an EVC and two or more UNIs. The EVC will have an association with two or more EVC End Points. Each EVC End Point is associated with a single Subscriber UNI.

The main classes are subclassed from superclasses that hold common attributes that are used in both the Subscriber Ethernet Services and Operator Ethernet Services models.

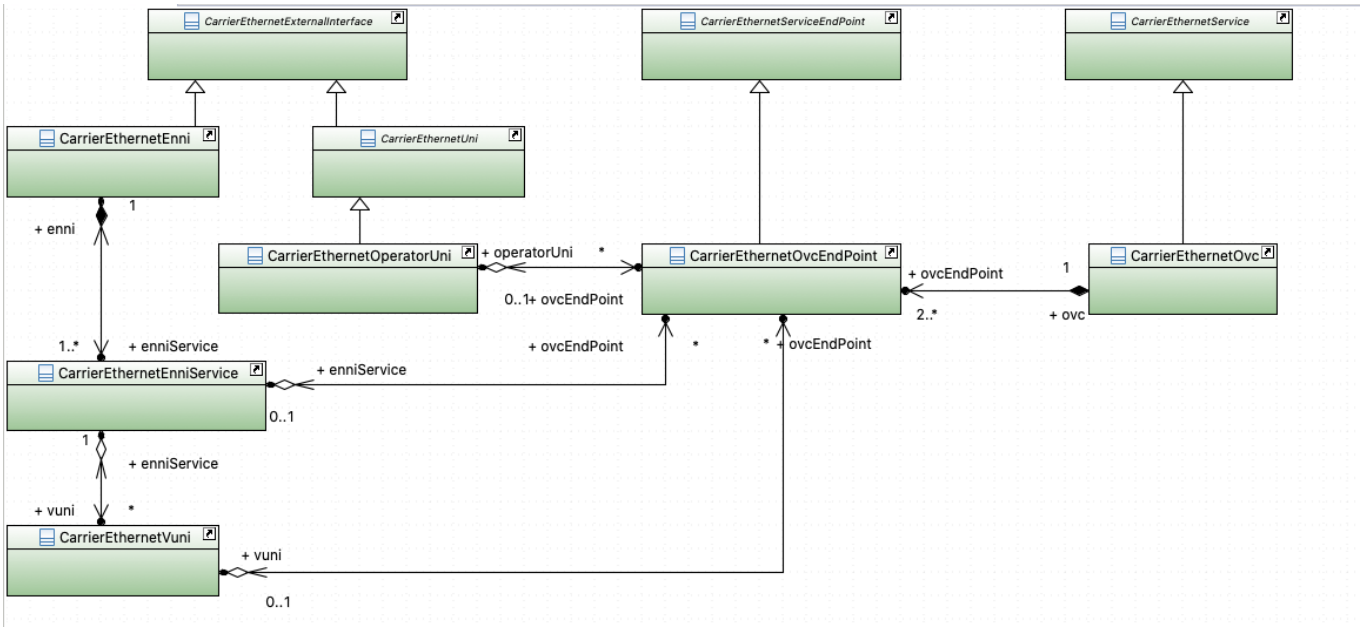

Figure 3-Operator Ethernet Services Overview

The Operator Ethernet Services model has six main classes, CarrierEthernetOperatorUni, CarrierEthernetEnniService, CarrierEthernetEnni, CarrierEthernetVuni, CarrierEthernetOvcEndPoint and CarrierEthernetOvc. An Operator Ethernet Service is defined as having an OVC and two or more OVC End Points. The OVC will have an association with two or more OVC End Points. The OVC End Point associations to interfaces will depend on the Operator Ethernet Service type as defined in MEF 51.1 [6]. The main classes are subclassed from superclasses that hold common attributes that are used in both the Subscriber Ethernet Services and Operator Ethernet Services models.

6 MEF-Types and MEF-Common Data Types and Enumerations

This section details the data types and enumerations imported from MEF-Types that are used by the Carrier Ethernet model.

6.1 AdminState

This enumeration is for Administrative states. Refer to ITU-T X.731.
Contains Enumeration Literals:

- LOCKED:
  - The resource is administratively prohibited from performing services for its users.
- UNLOCKED:
  - The resource is administratively permitted to perform services for its users.

6.2 AggLinkDepth

This is a pair of <VLAN ID, link depth> indicating that a given VLAN ID maps to a given number of links in the Port Conversation ID to Aggregation Link Map.

Attribute Name	Type	Mult.	Description
vlanId	VlanId	1	Ingress frame VLAN ID.
linkDepth	PositiveInteger	1	The number of links for the aggregation link.

Table 2-AggLinkDepth Attributes

6.3 AvailableMegLevel

This enumeration is for available MEG level, with value 0-7. NONE indicates that SOAM EI Frames are not guaranteed to pass over at any MEF level. Reference MEF 10.4 Section 8.11 EVC Available MEG Level and MEF 26.2 Section 12.15 OVC Available MEG Level Service Attribute.
Contains Enumeration Literals:

- 0-7:
  - MEG Level 0-7

6.4 BwpFlow

The BwpFlow object class represents the Bandwidth Profile Flow which includes the bandwidth profile parameters such as CIR, CIRmax, EIR, EIRmax, CBS, EBS, Coupling Flag, Color Mode, etc. The BwpFlow is associated with one of CarrierEthernetOperatorUni, CarrierEthernetSubscriberUni, CarrierEthernetVuni, BandwidthProfilePerClassOfServiceName, BandwidthProfilePerEecName; and with Envelope. Reference MEF 10.4 Section 12 Bandwidth Profiles and MEF 26.2 Section 17 Bandwidth Profiles.

Attribute Name	Type	Mult.	Description
envelope	Envelope	1	Identifies the Envelope that the Bandwidth Profile Flow belongs to.
cbs	NaturalNumber	1	Attribute represents Committed Burst Size. Limits by how much, and for how long, the amount of traffic declared Green for this Bandwidth Profile Flow in the short term can exceed the committed bandwidth made available to this Bandwidth Profile Flow over the long term in bytes.
cir	NaturalNumber	1	Attribute represents Committed Information Rate. When added to unused committed bandwidth* provided from higher-ranked Bandwidth Profile Flows (depending on the value of *CF* for the higher-ranked Bandwidth Profile Flows), limits the average rate in bits per second at which Service Frames for this Bandwidth Profile Flow can be declared Green.
cirMax	NaturalNumber	1	Attribute represents Maximum Committed Information Rate. Limits the average rate in bits per second at which Service Frames for this Bandwidth Profile Flow can be declared Green (regardless of unused committed bandwidth* from higher-ranked Bandwidth Profile Flows).
colorMode	ColorMode	1	Attribute represents color mode. Indicates whether Service Frames for this Bandwidth Profile Flow that are identified as Yellow on input to the Bandwidth Profile Algorithm can be declared Green or not.
couplingFlag	Boolean	1	Attribute represents coupling flag. Determines whether unused committed bandwidth for this Bandwidth Profile Flow is made available as excess bandwidth for this Bandwidth Profile Flow or as committed bandwidth for the next lower-ranked Bandwidth Profile Flow. 0/FALSE means overflow green tokens are used as green tokens in the next lowest BWP Flow in the Envelope. 1/TRUE means they are used as yellow tokens for this BWP Flow.
ebs	NaturalNumber	1	Attribute represents Excess Burst Size. Limits by how much, and for how long, the amount of traffic declared Yellow for this Bandwidth Profile Flow in the short term can exceed the excess band- width made available to this Bandwidth Profile Flow over the long term.
eir	NaturalNumber	1	Attribute represents Excess Information Rate. When added to unused excess bandwidth from higher-ranked Bandwidth Profile Flows, and to un- used committed bandwidth* (depending on the value of *CF* for this Bandwidth Profile Flow and CF^0 for the Envelope), limits the average rate in bits per sec- ond at which Service Frames for this Bandwidth Pro- file Flow can be declared Yellow.

Attribute Name	Type	Mult.	Description
eirMax	NaturalNumber	1	Attribute represents Maximum Excess Information Rate. Limits the average rate in bits per second at which Service Frames for this Bandwidth Profile Flow can be declared Yellow (regardless of unused excess bandwidth from higher-ranked Bandwidth Profile Flows or unused committed bandwidth).
envelopeRank	PositiveInteger	1	This attribute denotes the rank of the bandwidth profile flow in the envelope.
tokenRequestOffset	Integer	1	Attribute represents Token Request Offset. Adjusts the bandwidth consumed by each Service Frame in the Bandwidth Profile Flow relative to the length of the Service Frame.

Table 3-BwpFlow Attributes

6.5 ConnectionType

This enumeration indicates the roles of OVC/EVC Endpoints associated with OVC/EVC. Point-to-Point, Multipoint-to-Multipoint, or Rooted-Multipoint. Reference MEF 10.4 Section 8.3 EVC Type Service Attribute and MEF 26.2 Section 12.2 OVC Type Service Attribute.

- MULTIPOINT:
- POINT_TO_POINT:
- ROOTED_MULTIPOINT

6.6 ConversationIdToAggregationLinkMap

This is a Port Conversation ID to Aggregation Link Map as defined in IEEE Std 802.1AX-2014. Reference MEF 10.4 Section 9.6 Subscriber UNI Port Conversation ID to Aggregation Link Map Service Attribute and MEF 26.2 Section 9.6 ENNI Port Conversation ID to Aggregation Link Map Common Attribute.

Attribute Name	Type	Mult.	Description
conversationId	NaturalNumber	1..*	The conversation ID is a Vlan ID or 0 for untagged or priority tagged frames.
linkNumberIdList	PositiveInteger	1..*	The link number ID of the aggregation link.

Table 4-ConversationIdToAggregationLinkMap Attributes

6.7 ColorFieldType

This enumeration is for selecting which frame field is being used for color indication. Reference MEF 10.4 Section 10.6 EVC EP Color Map Service Attribute and MEF 26.2 Section 16.7 OVC End Point Color Identifier Service Attribute.

- DEI:
  - Using DEI field to map to the color.
- DSCP:
  - Using DSCP field to map to the color.
- END_POINT:

- Using EVC End Point or the OVC End Point to map to the color.

- PCP:
  - Using PCP field to map to the color.

6.8 ColorIdentifier

Represents the Color Identifier. The Color Identifier is a pair of the form <F,M> where F is a field in the ingress EI Frame and M is a mapping between each possible value of the field F and a Color. The ColorIdentifier object class is associated with CarrierEthernetServiceEndPoint (EvcEndPoint or OvcEndPoint), in addition to the different field F, such as SepColorIdPac, PcpColorIdPac, DeiColorIdPac and DscpColorIdPac. When the OVC End Point is at an ENNI but not in a VUNI the value of F is either S-Tag DEI or S-Tag PCP, and hence the DeiColorIdPac and PcpColorIdPac refer to the value of the S-Tag DEI and PCP fields. When the OVC End Point is in a VUNI or at a UNI, the value of F MUST be is one of OVC End Point, C-Tag DEI, PCP or DSCP, and hence the DeiColorIdPac and PcpColorIdPac refer to the value of the C-Tag DEI and PCP fields. Reference MEF 10.4 Section 10.6 EVC EP Color Map Service Attribute and MEF 26.2 Section 16.7 OVC End Point Color Identifier Service Attribute.

Attribute Name	Type	Mult.	Description
dscpColorIdPac	DscpColorIdPac	0..2	This attribute represents the relationship between the ColorIdentifier and the DscpColorIdPac (representing the choice that maps DSCP values to Color).
deiColorIdPac	DeiColorIdPac	0..1	This attribute represents the relationship between the ColorIdentifier and the DeiColorIdPac (representing the choice that maps VLAN tag DEI to Color).
pcpColorIdPac	PcpColorIdPac	0..1	This attribute represents the relationship between the ColorIdentifier and the PcpColorIdPac (represents the relationship between the ColorIdentifier and the PcpColorIdPac (representing the choice that maps VLAN tag PCPs to Color).
sepColorIdPac	SepColorIdPac	0..1	This attribute represents the relationship between the ColorIdentifier and the SepColorIdPac (representing the choice that maps EVC End Point or OVC End Point to Color).
colorFieldType	ColorFieldType	1	This attribute determines which conditional package (among EVC/OVC End Point, PCP, DEI or DSCP) to be used as the Color Identifier.

Table 5-ColorIdentifier Attributes

6.9 ColorMode

This enumeration indicates whether the Color Identifier of the Service Frame is considered by the Bandwidth Profile Algorithm.

- COLOR_AWARE:
- COLOR_BLIND:

6.10 CosIdentifier

The CosIdentifier represents the Class of Service Identifier. Each ingress EI Frame mapped to the given EVC/OVC End Point has a single Class of Service. The Class of Service can be determined from inspection of the content of the ingress EI Frame. It is associated with the SepCosIdPac, or the PcpCosIdPac or the DscpCosIdPac (when the Class of Service Identifier mapping type is Service End Point or PCP values or DSCP values respectively). In the case of PCP, when an OVC End Point is at an ENNI but not in a VUNI, the PcpCosIdPac refers to the value of the S-Tag PCP field. When an OVC End Point is at a UNI or in a VUNI, or for any EVC End Point, the PcpCosIdPac refers to the value of the C-Tag PCP field. EI Frames of L2CP protocols may be identified by a Class of Service Identifier, mapping to specified CoS Name. Reference MEF 10.4 Section 10.5 EVC EP Ingress Class of Service Map Service Attribute and MEF 26.2 Section 16.6 OVC End Point Class of Service Identifier Service Attribute.

Attribute Name	Type	Mult.	Description
cosName	String	1	This attribute denotes the Class of Service name that the CosIdentifiers map to.
l2cpProtocolList	L2cpProtocol	0..*	This attribute lists the L2CP protocols that map to the Class of Service name.
sepCosIdPac	SepCosIdPac	0..1	This attribute represents the relationship between the CosName and the SepCosIdPac when the cosMappingType in CosMap is END_POINT and the cosName is not only for L2CP.
pcpCosIdPac	PcpCosIdPac	0..1	This attribute represents the relationship between the CosName and the PcpCosIdPac when cosMappingType in CosMap is PCP and the cosName is not only for L2CP.
dscpCosIdPac	DscpCosIdPac	0..2	This attribute represents the relationship between the CosName and the DscpCosIdPac when the cosMappingType in CosMap is DSCP and the cosName is not only for L2CP.

Table 6-CosIdentifier Attributes

6.11 CosMap

The CoS Map represents the mapping from fields in an Ingress EI Frame to a CoS Name. The map can be based on the EVC or OVC End Point, the S-Tag or C-Tag PCP value, or the DSCP field if the EI Frame is carrying an IP Packet. Reference MEF 10.4 Section 10.5 EVC EP Ingress Class of Service Map Service Attribute and MEF 26.2 Section 16.6 OVC End Point Class of Service Identifier Service Attribute.

Attribute Name	Type	Mult.	Description
cosMappingType	CosMappingType	1	This attribute identifies which field is used for the CoS Mapping.
cosMapping	CosIdentifier	1..*	This attribute is a list of mappings, one per CoS Name. Each entry identifies the Cos IDs that map to the specified CoS Name.

Table 7-CosMap Attributes

6.12 CosMappingType

This enumeration is for selecting which frame field is being used in the Class of Service Map. Reference MEF 10.4 Section 10.5 EVC EP Ingress Class of Service Map Service Attribute and MEF 26.2 Section 16.6 OVC End Point Class of Service Identifier Service Attribute.

- DSCP:
  - Using DSCP field to map to the CoS Name.
- END_POINT:
  - Using EVC End Point or the OVC End Point to map to the CoS Name.
- PCP:
  - Using PCP field to map to the CoS Name.

6.13 CosNameAndColorToDeiPac

The CosNameAndColorToDeiPac represents the Egress Map that maps from CoS Name and Ingress Color to DEI. Reference MEF 26.2 Section 16.8.2 OVC End Point Egress Map Service Attribute Form CC->S-Tag DEI and Section 16.8.5 OVC End Point Egress Map Form CC->C-Tag DEI.

Attribute Name	Type	Mult.	Description
deiValue	DeiOrDiscard	1	This attribute denotes the egress frame DEI value, mapped from ingress CoS Name and ingress frame color.
ingressColor	FrameColor	1	This attribute denotes the ingress frame color as one of the determined factors for Egress Map.
ingressCosName	String	1	This attribute denotes the ingress CoS name.

Table 8-CosNameAndColorToDeiPac Attributes

6.14 CosNameAndColorToPcpPac

The CosNameAndColorToPcpPac represents the Egress Map that maps from CoS Name and Ingress Color to PCP. Reference MEF 26.2 Section 16.8.3 OVC End Point Egress Map Service Attribute Form CC->S-Tag PCP and 16.8.6 OVC End Point Egress Map Form CC->C-Tag PCP.

Attribute Name	Type	Mult.	Description
pcpValue	PcpOrDiscard	1	This attribute denotes the egress frame PCP value, mapped from ingress CoS Name and ingress frame color.
ingressColor	FrameColor	1	This attribute denotes the ingress frame color as one of the determined factors for Egress Map.
ingressCosName	String	1	This attribute denotes the ingress CoS name.

Table 9-CosNameAndColorToPcpPac Attributes

6.15 CosNameToPcpPac

The CosNameToPcpPac represents the Egress Map that maps from CoS Name to PCP. Reference MEF 26.2 Section 16.8.1 OVC End Point Egress Map Service Attribute Form CN->S-Tag PCP and Section 16.8.4 OVC End Point Egress Map Form CN->C-Tag PCP.

Attribute Name	Type	Mult.	Description
pcpValue	PcpOrDiscard	1	This attribute denotes the egress frame PCP value, mapped from ingress CoS Name.
ingressCosName	String	1	This attribute denotes the ingress CoS name.

Table 10-CosNameToPcpPac Attributes

6.16 DeiColorIdPac

This represents the Color Identifier that maps the VLAN Tag (S-Tag or C-Tag) DEI value to Color, DEI=0 for Green color and DEI=1 for Yellow color. For an EVC End Point or OVC End Point at UNI or in a VUNI, the DEI value is from C-Tag Ingress EI frames. For an OVC End Point at an ENNI and not in a VUNI, the DEI value is from S-Tag or the ingress EI frames. NOTE: This is an object with no attributes. Reference MEF 26.2 Sections 16.7.1 OVC End Point Color Identifier Service Attribute with F=S-Tag DEI, 16.7.4.1 OVC End Point Color Identifier Service Attribute with F=C-Tag DEI and MEF 10.4 Section 10.6.2 EVC EP Color Map Service Attribute with F=C-Tag DEI.

6.17 DeiOrDiscard

This enumeration lists the DEI value for color or discard and is used for Egress Map.

- 0:
  - Set egress frame DEI field to be 0 when the Egress Map determines based on CoS Name (and Ingress Color).
- 1:
  - Set egress frame DEI field to be 1 when the Egress Map determines based on CoS Name (and Ingress Color).
- DISCARD:
  - Discard the egress frame when the Egress Map determines based on CoS Name (and Ingress Color).

6.18 DscpColorIdPac

This represents the Color Identifier that maps DSCP (IPv4 or IPv6) values to Color. Reference MEF 26.2 Section 16.7.6 OVC End Point Color Identifier Service Attribute with F=DSCP and MEF 10.4 Section 10.6.4 EVC EP Color Map Service Attribute with F=DSCP.

Attribute Name	Type	Mult.	Description
dscpValueForGreenList	NaturalNumber	0..64	This attribute provides a list DSCP values map to the green ingress EI frames. The dscpValueForGreenList and the dscpValueForYellowList must disjoint and the union of the two lists must include all possible DSCP values.
dscpValueForYellowList	NaturalNumber	0..64	This attribute provides a list DSCP values map to the yellow ingress EI frames. The dscpValueForGreenList and the dscpValueForYellowList must disjoint and the union of the two lists must include all possible DSCP values.
ipVersion	IpVersion	1	This attribute denotes which IP version is used. It can be IPV4, IPV6 or IPV4_AND_IPV6.

Table 11-DscpColorIdPac Attributes

6.19 DscpCosIdPac

This represents the IP DSCP values that map to a given Class of Service Name (specifed in CosIdentifier), for either EI Frames carrying IPv4 Packets, IPv6 Packets, or both. Reference MEF 10.4 Section 10.5.1.3 EVC EP Ingress Class of Service Map Service Attribute Based on Internet Protocol and MEF 26.2 Section 16.6.2.1.3 OVC End Point Class of Service Identifier Service Attribute for Ingress Data EI Frames Based on Internet Protocol.

Attribute Name	Type	Mult.	Description
ipVersion	IpVersion	1	This attribute denotes the IP version for the DSCP. It can be IPv4, IPv6 or IPv4_AND_IPv6.
dscpValueList	DscpValue	1..*	This attribute is a list of DSCP values that maps to a CoS Name. If NO_IP_PACKET is included here, the ipVersion must be IPV4_AND_IPV6.

Table 12-DscpCosIdPac Attributes

6.20 DscpEecIdPac

This represents the IP DSCP values that map to a given Egress Equivalence Class Name (specified in EecIdentifier), for either EI Frames carrying IPv4 Packets, IPv6 Packets, or both. Reference MEF 26.2 Section 16.9.2.1.2 OVC End Point Egress Equivalence Class Identifier Service Attribute for Egress Data EI Frames Based on Internet Protocol.

Attribute Name	Type	Mult.	Description
dscpValueList	DscpValue	1..*	This attribute is a list of DSCP values that maps to the EEC Name. If NO_IP_PACKET is included here, the ipVersion must be IPV4_AND-IPV6.
ipVersion	IpVersion	1	This attribute specifies the IP version for the DSCP. It can be IPV4 IPV6 or IPV4_AND_IPV6.

Table 13-DscpEecIdPac Attributes

6.21 EecIdentifier

The EecIdentifier represents the Egress Equivalence Class Identifier. Each egress EI Frame mapped to the given OVC End Point has a single Egress Equivalence Class. The Egress Equivalence Class can be determined from inspection of the content of the egress EI Frame. It is associated with the PcpEecIdPac, or the DscpEecIdPac representing mapping to S-Tag PCP, C-Tag PCP or DSCP respectively). EI Frames of L2CP protocols may be identified by an Egress Equivalence Class Identifier, mapping to specific Egress Equivalence Class Name. It is possible to have only a single Egress Equivalence Class Name. For an OVC End Point at an ENNI that is not in a VUNI, pcpEecIdPac refers to the value of the S-Tag PCP field. For an OVC End Point at a UNI or in a VUNI, pcpEecIdPac refers to the value of the C-Tag PCP field. Reference MEF 26.2 Section 16.9 OVC End Point Egress Equivalence Class Identifier Service Attribute.

Attribute Name	Type	Mult.	Description
dscpEecIdPac	DscpEecIdPac	0..2	This attribute represents the relationship between the EecIdentifier and a DscpEecIdPac if the eecMappingType in EecMap is DSCP and the eecName is not only for L2CP.
pcpEecIdPac	PcpEecIdPac	0..1	This attribute represents the relationship between the EecIdentifier and a PcpEecIdPac if the eecMappingType in EecMap is PCP and the eecName is not only for L2CP.
eecName	String	1	This attribute denotes the Egress Equivalence Class Name that the EecIdentifier maps to.
l2cpProtocolList	L2cpProtocol	0..*	This attribute lists the L2CP protocols that map to the Egress Equivalence Class Name.

Table 14-EecIdentifier Attributes

6.22 EecMap

The Egress Equivalence Class Map represents the mapping from fields in an Egress EI Frame to an Egress Equivalence Class Name. The map can be based on the S-Tag or C-Tag PCP value, or the DSCP field if the EI Frame is carrying an IP Packet. Reference MEF 26.2 Section 16.9 OVC End Point Egress Equivalence Class Identifier Service Attribute.

Attribute Name	Type	Mult.	Description
eecMappingType	EecMappingType	1	This attribute identifies which field is used for the EEC Mapping.
eecMapping	EecIdentifier	1..*	This attribute is a list of mappings, one per EEC Name. Each entry identifies the EEC IDs that map to the specified EEC Name.

Table 15-EecMap Attributes

6.23 EecMappingType

This enumeration is for selecting which frame field being used in the Egress Equivalence Class Map. Reference MEF 26.2 Section 16.9 OVC End Point Egress Equivalence Class Identifier Service Attribute.

- DSCP:
  - Using DSCP field to map to the EEC Name.
- PCP:
  - Using PCP field to map to the EEC Name.

6.24 Envelope

This represents the UNI or ENNI Envelopes service attribute. Each Envelope consists of an Envelope ID and Envelope Coupling Flag. Defined in MEF-Common. Reference MEF 10.4 Section 12.1.1 Envelope Parameters and MEF 26.2 Section 17.1.1 Envelope Parameters.

Attribute Name	Type	Mult.	Description
bwpList	BwpFlow	1..*	List of Bandwidth Profile Flows.
couplingFlagForIndexZero	Boolean	1	This attribute denotes the coupling flag for index zero. FALSE for 0 (overflow Green tokens are discarded) and TRUE for 1 (overflow Green tokens can be used as Yellow tokens).
envelopeId	Identifier45	1	The attribute is a string that identifies the Envelope.

Table 16-Envelope Attributes

6.25 EthernetFrameFormat

This is a single value read only attribute. Reference MEF 10.4 Section 9.7 Subscriber UNI Service Frame Format Service Attribute and MEF 26.2 Section 14.7 Operator UNI Service Frame Format Service Attribute.

- ETHERNET:
  - Ethernet MAC Frame conforming to Clause 3 of IEEE 802.3-2012.

6.26 EvcEpEgressMap

Represents an entry in the Egress Map that maps the Cos Name and Color assigned to an ingress Service Frame to the PCP and DEI values to set in the C-Tag of an egress Service Frame. It is associated with EVC End Point. Reference MEF 10.4 Section 10.7 EVC End Point Egress Map Service Attribute.

Attribute Name	Type	Mult.	Description
cosName	String	1	The CoS Name assigned to the Service Frame at the ingress UNI.
color	FrameColor	1	The Color assigned to the Service Frame at the ingress UNI.
pcp	PcpOrDiscard	1	The PCP value to set in the C-tag of the egress Service Frame.

Attribute Name	Type	Mult.	Description
dei	DeiOrDiscard	1	The DEI value to set in the C-tag of the egress Service Frame.

Table 17-EvcEpEgressMap Attributes

6.27 EvcEndPointRole

This enumeration is indicating how external interface frames mapped to the EVC End Point can be forwarded. Reference MEF 10.4 Section 10.3 EVC EP Role Service Attribute:

- LEAF:
  - EVC End Point has role of leaf for EVC.
- ROOT:
  - EVC End Point has role of root for EVC.

6.28 FrameColor

This enumeration lists the Frame Color of either Green or Yellow.

- GREEN:
- YELLOW:

6.29 FrameDelivery

When the value is conditionally, the specific condition must be addressed by the users. What conditions should be supported are not in the scope. Reference MEF 10.4 Section 8.4 EVC Data Service Frame Disposition Service Attribute and MEF 26.2 Section 12.14.1 OVC Frame Disposition.

- CONDITIONALLY:
  - Frame will be delivered with specified condition.
- DISCARD:
  - Frame must be discarded.
- UNCONDITIONALLY:
  - Frame will be delivered unconditionally.

6.30 Identifier45

Data type attribute unique by network administrative domain, containing no more than 45 characters and non-null RFC Display String but not contain the characters 0x00 through 0x1F.

6.31 IpVersion

This enumeration lists the IP versions, including IPv4, IPv6 and both.

- IPV4:
- IPV6:
- IPV4_AND_IPV6

6.32 L2cpAddressSet

Enumeration listing the L2CP Address Set. Reference MEF 45.1 Section 8.1 L2CP Address Set Service Attribute.
Contains Enumeration Literals:

- CTA:
  - CE-Vlan Tag Aware, for VLAN-based services where the CE-VLAN ID is used to map a frame to a service.
- CTB:
  - C-VLAN Tag Blind (CTB), for Port-based services where the CE-VLAN ID is not used to map a frame to a service.
- CTB2:
  - C-VLAN Tag Blind Option 2 (CTB-2), for point-to-point Port-based services that support the EPL Option 2 L2CP processing.

6.33 L2cpPeering

This is a list that specifies the L2CP Protocol Identifier and the Destination Address in use by the protocol entity. Reference MEF 45.1 Section 8.2 L2CP Peering Service Attribute.

Attribute Name	Type	Mult.	Description
destinationAddress	NaturalNumber	1	Destination address for which frames will be peered.
linkIdList	Identifier45	0..*	Identifiers for the links on which the specified protocol will be peered. If no links are specified, the protocol is peered on all links.
protocolId	L2cpProtocol	1	Protocol ID for which frames will be peered.

Table 18-L2cpPeering Attributes

6.34 L2cpProtocol

This datatype defines a L2CP protocol (LLC address type or EtherType) with possible subtype. Reference MEF 45.1 Section 8.2 L2CP Peering Service Attribute.

Attribute Name	Type	Mult.	Description
L2cpProtocol	L2cpProtocolType	1	This attribute specifies the type of L2CP protocol (i.e., LLC or EtherType).
llcAddressOrEtherType	NaturalNumber	1	This attribute specifies the LLC address or the EtherType value.
subType	NaturalNumber	0..1	This attribute specifies the subtype of the L2CP protocol.

Table 19-L2cpProtocol Attributes

6.35 L2cpProtocolType

This lists the L2CP protocol types, either EtherType or LLC Address. Reference MEF 45.1 Section 8.2 L2CP Peering Service Attribute.

Contains Enumeration Literals:

- ETHERTYPE:
  - EtherType for L2CP, e.g., LLDP (0x88CC).
- LLC:
  - Logical Link Control sublayer address for L2CP, e.g., STP (0x42).

6.36 MepDirection

This lists the enumerations for MEP direction.
Contains Enumeration Literals:

- DOWN:
- UP

6.37 MepLevelAndDirection

This datatype defines the MEG Level and MEP direction. Reference MEF 26.2 Section 16.17 OVC End Point Maintenance End Point List Service Attribute.

Attribute Name	Type	Mult.	Description
direction	MepDirection	1	This is MEP direction, UP or DOWN.
level	NaturalNumber	1	This is the MEG level, value between 0..7.

Table 20-MepLevelAndDirection Attributes

6.38 OperationalState

This enumeration is for Operational states. Refer to ITU-T X.731.
Contains Enumeration Literals:

- DISABLED:
  - The resource is operationally disabled.
- ENABLED:
  - The resource is operationally enabled.

6.39 OvcEndPointRole

This enumeration is indicating how external interface frames mapped to the OVC End Point can be forwarded. Reference MEF 26.2 Section 16.4 OVC End Point Role Service Attribute.

- LEAF:
  - OVC End Point has role of leaf for OVC.

- ROOT:
  - OVC End Point has role of root for OVC.
- TRUNK:
  - OVC End Point has role of trunk for OVC.

6.40 OvcEpEgressMap

Represents the Egress that is a set of mappings that determine the content of the S-Tag or C-Tag of an egress EI Frame. It is associated with OVC End Point. Reference MEF 26.2 Section 16.8 OVC End Point Egress Map Service Attribute.

Attribute Name	Type	Mult.	Description
egressMapType	OvcEgressMapType	1	This attribute determines which form to take to apply frame color indication, among CoS name and Ingress Color to C-Tag PCP, or CoS name and Ingress Color to S-Tag PCP, or CoS Name and Ingress Color to C-Tag DEI, or CoS Name to C-Tag PCP or CoS Name to S-Tag PCP.
cosNameAndColorToDeiPacList	CosNameAndColorToDeiPac	0..*	This attribute represents the relationship between the EgressMap and the CosNameAndColorToDeiPac (representing the attribute set for using CoS Name and ingress color to egress DEI mapping).
cosNameAndColorToPcpPacList	CosNameAndColorToPcpPac	0..*	This attribute represents the relationship between the EgressMap and CosNameAndColorToPcpPac (representing the attribute set for using CoS Name and ingress color to egress PCP mapping).
cosNameToPcpPacList	CosNameToPcpPac	0..*	This attribute represents the relationship between the EgressMap and the CosNameToPcpPac (representing the attribute set for using CoS Name to egress PCP mapping).

Table 21-OvcEpEgressMap Attributes

6.41 OvcEpEgressMapType

This lists the Egress Map types, either CoS Name to PCP, or CoS Name and Ingress Color to PCP, or CoS Name and Ingress Color to DEI for S-Tag or C-Tag. Reference MEF 26.2 Section 16.8 OVC End Point Egress Map Service Attribute.

- CC_C_TAG_DEI:
  - CoS Name and Color to C-Tag DEI egress map type.
- CC_C_TAG_PCP:
  - CoS Name and Color to C-Tag PCP egress map type.
- CC_S_TAG_DEI:
  - CoS Name and Color to S-Tag DEI egress map type.
- CC_S_TAG_PCP:
  - CoS Name and Color to S-Tag PCP egress map type.
- CN_C_TAG_PCP:
  - CoS Name to C-Tag PCP egress map type.
- CN_S_TAG_PCP:

- CoS Name to S-Tag PCP egress map type.

6.42 PcpColorIdPac

Represents Color Identifier that maps VLAN Tag (S-Tag or C-Tag) PCP values to Color. For an EVC End Point or OVC End Point at UNI or in a VUNI, the PCP values are from C-Tag ingress EI frames. For an OVC End Point at an ENNI and not in a VUNI, the PCP values are from S-Tag of the ingress EI frames. Reference MEF 26.2 Section 16.7 OVC End Point Color Identifier and MEF 10.4 Section 10.6 EVC EP Color Map Service Attribute.

Attribute Name	Type	Mult.	Description
pcpValueForGreenList	NaturalNumber	0..8	This attribute provides a list PCP values map to green ingress EI frames. The pcpValueForGreenList and the pcpValueForYellowList must disjoint and the union of the two lists must include all possible PCP values.
pcpValueForYellowList	NaturalNumber	0..8	This attribute provides a list PCP values map to yellow ingress EI frames. The pcpValueForGreenList and the pcpValueForYellowList must disjoint and the union of the two lists must include all possible PCP values.

Table 22-PcpColorIdPac Attributes

6.43 PcpCosIdPac

The PcpCosIdPac object class represents the PCP values that map to a given Class of Service Name (specifed in CosIdentifier). For an EVC End Point, or an OVC End Point at UNI or in a VUNI, the PCP values are from the C-Tag in the ingress EI frames. For an OVC End Point at an ENNI and not in a VUNI, the PCP values are from the S-Tag in the ingress EI frames. Reference MEF 10.4 Section 10.5.1.2 EVC EP Ingress Class of Service Map Service Attribute Based on Priority Code Point Field and MEF 26.2 Section 16.6.2.1.2 OVC End Point Class of Service Identifier Service Attribute for Ingress Data EI Frames Based on C-Tag Priority Code Point.

Attribute Name	Type	Mult.	Description
pcpValueList	PcpOrUntagged	1..*	This attribute is a list of PCP values that map to the CoS Name.

Table 23-PcpCosIdPac Attributes

6.44 PcpEecIdPac

This represents the PCP values that map to a given Egress Equivalence Class Name (specified in EecIdentifier). For an OVC End Point at UNI or in a VUNI, the PCP values are from the C-Tag in the egress EI frames. For an OVC End Point at an ENNI and not in a VUNI, the PCP values are from the S-Tag in the egress EI frames. Reference MEF 26.2 Section 16.9.1.1 OVC End Point Egress Equivalence Class Identifier Service Attribute for Egress Data ENNI Frames Mapped to an OVC End Point at an ENNI that is not a VUNI.

Attribute Name	Type	Mult.	Description
pcpValueList	PcpOrUntagged	1..*	This attribute provides a list of PCP values that map to Egress Equivalence Class Name.

Table 24-PcpEecIdPac Attributes

6.45 PcpOrDiscard

This enumeration lists the one of PCP values or DISCARD.

- 0:
- 1:
- 2:
- 3:
- 4:
- 5:
- 6:
- 7:
- DISCARD:

6.46 PcpOrUntagged

This enumeration lists the one of PCP values or UNTAGGED.

- 0:
- 1:
- 2:
- 3:
- 4:
- 5:
- 6:
- 7:
- UNTAGGED: The EI Frame does not contain a C-Tag.

6.47 PhysicalLayer

An enumeration of all the physical layers specified in IEEE 802.3-2018[15] except for those relating to PON. Reference MEF 26.2 Section 9.2 ENNI Physical Layer Common Attribute and MEF 10.4 Section 9.4 Subscriber UNI List of Physical Links Service Attribute.

6.48 PositiveInteger

Data type with single attribute, positiveint, which is an Integer > 0.

6.49 SepColorIdPac

Represents the Color Identifier that maps to the EVC End Point or the OVC End Point to Color.

Attribute Name	Type	Mult.	Description
color	FrameColor	1	This attribute denotes the color of the EI frame, green or yellow.

Table 25-SepColorIdPac Attributes

6.50 SepCosIdPac

Represents the CoS Identifier that maps the EVC End Point or the OVC End Point to a Class of Service Name. NOTE: This object does not have attributes. Reference MEF 26.2 Section 16.6.2 OVC End Point Class of Service Identifier Service Attribute for an OVC End Point in a VUNI or at a UNI and MEF 10.4 Section 10.5.1.1 EVC EP Ingress Class of Service Map Attribute Based on EVC EP.

6.51 SourceMacAddressLimit

This limits the number of source MAC addresses that can be used in ingress external interface frame mapped to the End Point of all types over a time interval. Reference MEF 26.2 Section 16.15 OVC End Point Source MAC Address Limit Service Attribute and MEF 10.4 Section 10.12 EVC EP Source MAC Address Limit Service Attribute.

Attribute Name	Type	Mult.	Description
limit	NaturalNumber	1	This attribute denotes the maximum acceptable source MAC addresses.
interval	NaturalNumber	1	This attribute denotes the time interval in milliseconds.

Table 26-SourceMacAddressLimit Attributes

6.52 SyncModePerLink

A link may consist of one or more physical ports. This data type includes the link ID and sync mode of the physical port associated to the link id. Reference MEF 26.4 Section 14.2 Operator UNI Physical Layer Service Attribute.

Attribute Name	Type	Mult.	Description
syncModeEnabled	Boolean	1	This attribute denotes whether the Synchronous Mode is enabled on the link with the Link ID.

Table 27-SyncModePerLinkAttributes

6.53 TaggedL2cpProcessing

Enumeration representing either 802.1 compliant or not compliant. Reference MEF 45.1 Section 8.3 ENNI Tagged L2CP Frame Processing Multilateral Attribute.

- 802_1_COMPLIANT:
- 802_1_NON_COMPLIANT:

6.54 TimeIntervalT

Time interval T for PM. E.g., 1 month, 20 days, 2 weeks.

Attribute Name	Type	Mult.	Description
number	PostitiveInteger	1	This denotes the value (for the unit), e.g., 1 (month), 20 (day), etc.
unit	TimeIntervalUnit	1	Month, week, day, hour, etc.

Table 28-TimeIntervalT Attributes

6.55 TimeAndDate

Data type defined for Time and Date in UTC.

Attribute Name	Type	Mult.	Description
day	PostitiveInteger	1	This denotes the day.
hour	NaturalNumber	1	This denotes the hour.
minute	NaturalNumber	1	This denotes the minute.
month	PositiveInteger	1	This denotes the month.
second	NaturalNumber	1	This denotes the second.
year	PositiveInteger	1	This denotes the year.

Table 29-TimeAndDate Attributes

6.56 TimeIntervalUnit

This enumeration represents time interval unit, e.g., month, day, week, hour, etc.
Contains Enumeration Literals:

- DAY:
- MONTH:
- WEEK:
- YEAR:

6.57 VlanId

Data type with single attribute, vlanId which is defined as a PostiveInteger. Value 1 to 4094. Reference MEF 10.4 Section 10.4 EVC EP Map Service Attribute and MEF 26.2 Section 14.9 Operator UNI Default CE-VLAN ID Service Attribute.

6.58 VlanIdListing

The list VLAN IDs, either when type=LIST, or when type=EXCEPT (which means the VLAN IDs except the listed). When type=ALL, the VLAN ID list is not applicable. Reference MEF 26.2 Section 16.5 OVC End Point Map Service Attribute.

Attribute Name	Type	Mult.	Description
type	VlanIdMappingType	1	Can be LIST, or ALL, or EXCEPT.
vlanIdList	VlanId	0..*	This is a list of VLAN IDs.

Table 30-VlanIdListing Attributes

6.59 VlanIdListOrUntag

VLAN ID types, ALL for all VLAN IDs, LIST for a list of VLAN IDs, EXCEPT for all VLAN IDs except the listed, UNTAGGED to indicate that untagged and priority-tagged frames are mapped to this end point. Reference MEF 10.4 Section 10.4 EVC EP Map Service Attribute.

Attribute Name	Type	Mult.	Description
type	VlanIdMappingTypeOr Untag	1	Can be LIST, or ALL, or EXCEPT or UNTAGGED.
vlanIdList	VlanId	0..*	This is a list of VLAN IDs.

Table 31-VlanIdListOrUntag Attributes

6.60 VlanIdMappingType

Enumeration for VLAN ID types, ALL for all VLAN IDs, LIST for a list of VLAN IDs, EXCEPT for all VLAN IDs except the listed:

- ALL:
  - All VLAN IDs.
- EXCEPT:
  - All VLAN IDs except the listed.
- LIST:
  - List of VLAN IDs.

6.61 VlanIdMappingTypeOrUntag

Enumeration for VLAN ID types, ALL for all VLAN IDs, LIST for a list of VLAN IDs, EXCEPT for all VLAN IDs except the listed, UNTAGGED to indicate untagged and priority-tagged frames are mapped to this end point.:

- ALL:
  - All VLAN IDs.
- EXCEPT:
  - All VLAN IDs except the listed.

- LIST:
  - List of VLAN IDs.
- UNTAGGED:
  - Untagged and priority-tagged frames.

6.62 VlanIdPreservation

Enumeration for VLAN ID Preservation. Reference MEF 26.2 Section 12.7 OVC CE-VLAN ID Preservation Service Attribute.

- PRESERVE:
  - To achieve EVC CE-VLAN Preservation.
- RETAIN:
  - C-Tag, if present, is encapsulated with the C-Tag VLAN ID value retained.
- STRIP:
  - C-Tag is discarded.

7 Ethernet Superclasses

The following section defines the set of superclasses that are used by the Carrier Ethernet information models. The superclass objects are CarrierEthernetExternalInterface, CarrierEthernetServiceEndPoint, CarrierEthernetService and CarrierEthernetUni. These are superclasses for CarrierEthernetEnni, CarrierEthernetSubscriberUni, CarrierEthernetOperatorUni, CarrierEthernetEvcEndPoint, CarrierEthernetOvcEndPoint, CarrierEthernetEvc and CarrierEthernetOvc . The superclasses shown in Figure-2 are further described in subsections below.

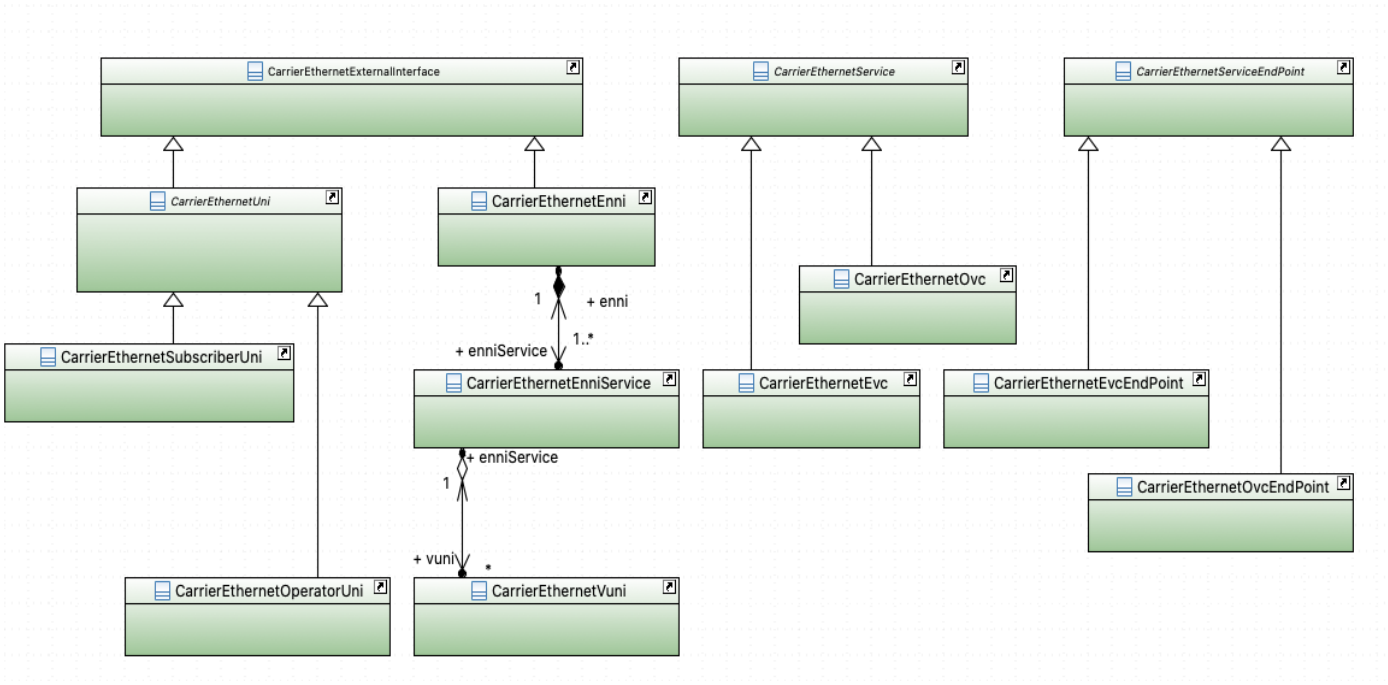

Figure 4-Subscriber and Operator Ethernet Superclasses

7.1 CarrierEthernetExternalInterface

The CarrierEthernetExternalInterface represents the physical or virtual Ethernet interface used for Ethernet services. This is an abstract class and the superclass. It contains the common attributes of ENNI, Subscriber UNI and Operator UNI.

Attribute Name	Type	Mult.	Description
administrativeState	AdminState	1	This attribute denotes the administrative state of Subscriber UNI, Operator UNI or ENNI. The values supported are LOCKED and UNLOCKED. When set to UNLOCKED, the Carrier Ethernet External Interface (Subscriber UNI, Operator UNI or ENNI) is enabled and ready to forward traffic. When set to LOCKED, the Carrier Ethernet External Interface is disabled and will block (i.e., not forward) traffic. Reference MEF-Types.

Attribute Name	Type	Mult.	Description
operationalState	OperationalState	1	This attribute denotes the operational state of the Carrier Ethernet Interface (Subscriber UNI, Operator UNI, ENNI), as working ENABLED or not working DISABLED. Reference MEF-Types.
externalInterfaceFrameFormat	EthernetFrameFormat	1	Specifies the allowed formats of External Interface Frames (i.e., Service Frames at a UNI or ENNI Frames at an ENNI). Reference MEF 10.4 Section 9.7 Subscriber UNI Service Frame Format Service Attribute and MEF 26.2 Section 14.7 Operator UNI Service Frame Format Service Attribute.
linkOam	EnabledDisabled	1	Controls when and how Link OAM per IEEE Std 802.3-2015 is run on the physical links in the External Interface. Reference MEF 10.4 Section 9.13 Subscriber UNI Link OAM Service Attribute, MEF 26.2 Section 9.9 ENNI Link OAM Common Attribute and MEF 26.2 Section 14.14 Operator UNI Link OAM Service Attribute.
l2cpPeering	L2cpPeering	0..*	Specifies the Layer 2 Control Protocols that are peered at the EI, as described in MEF 45.1. Reference MEF 10.4 Section 9.17 Subscriber UNI L2CP Peering Service Attribute, MEF 26.2 Section 10.1 ENNI L2CP Peering Multilateral Attribute. L2CP Peering applied to UNI and MEF 26.2 Section 14.21 Operator UNI L2CP Peering Service Attribute.
lagLinkMeg	EnabledDisabled	1	Indicates whether a LAG link MEG is instantiated on each physical link in the EI, if the EI has more than one physical link. Reference MEF 10.4 Section 9.15 Subscriber UNI LAG Link MEG Service Attribute, MEF 26.2 Section 9.8 ENNI LAG Link MEG Common Attribute and MEF 26.2 Section 14.16 Operator UNI LAG Link MEG Service Attribute.
meg	EnabledDisabled	1	Indicates whether a MEP is instantiated at the EI for the UNI MEG or ENNI MEG. Reference MEF 10.4 Section 9.14 Subscriber UNI MEG Service Attribute, MEF 26.2 Section 9.7 ENNI MEG Common Attribute and MEF 26.2 Section 14.15 Operator UNI MEG Service Attribute.

Attribute Name	Type	Mult.	Description
aggregationLinkMap	ConversationIdToAggregationLinkMap	0..*	A mapping of Port Conversation IDs (i.e., VLAN IDs) to physical links, if there are multiple physical links in the EI and the link aggregation is All-Active. Reference MEF 10.4 Section 9.6 Subscriber UNI Port Conversation ID to Aggregation Link Map Service Attribute, MEF 26.2 Section 9.6 ENNI Port Conversation ID to Aggregation Link Map Common Attribute and MEF 26.2 Section 14.6 Operator UNI Port Conversation ID to Aggregation Link Map Service Attribute.
maximumFrameSize	PositiveInteger	1	Specifies the maximum size of EI Frames that can be transmitted across EI. Reference MEF 10.4 Section 9.8 Subscriber UNI Maximum Service Frame Size Service Attribute, MEF 26.2 Section 14.8 Operator UNI Maximum Service Frame Size Service Attribute and MEF 26.2 Section 10.3 ENNI Maximum Frame Size Multilateral Attribute.
linkAggregation	LinkAggregation	1	The method for protection against a physical link failure, if the EI has more than one physical link. Reference MEF 10.4 Section 9.5 Subscriber UNI Link Aggregation Service Attribute, MEF 26.2 Section 9.5 ENNI Link Aggregation Common Attribute and MEF 26.2 Section 14.5 Operator UNI Link Aggregation Service Attribute.

Table 32-CarrierEthernetExternalInterface Attributes

7.2 CarrierEthernetUni

The Uni represents the Physical Interface used for Ethernet services with common attributes. This is an abstract class and the super class. It contains the common attributes of Operator UNI and Subscriber UNI.

Attribute Name	Type	Mult.	Description
maximumNumberOfEndPoints	PositiveInteger	1	An integer greater than or equal to 1 that limits the number of EVC/OVC End Points that can be located at the Subscriber UNI or Operator UNI. Reference MEF 10.4 Section 9.9 Subscriber UNI Maximum Number of EVC EPs Service Attribute and MEF 26.2 Section 14.10 Operator UNI Maximum Number of OVC End Points Service Attribute.
maximumNumberOfCtagVlanIdsPerEndPoint	PositiveInteger	1	An integer greater than or equal to 1 that limits the number of C-Tag VLAN IDs that can map to each EVC/OVC End Point. Reference MEF 10.4 Section 9.10 Subscriber UNI Maximum Number of C-Tag VLAN IDs per EVC EP Service Attribute and MEF 26.2 Section 14.11 Operator UNI Maximum Number of CE-VLAN IDs per OVC End Point Service Attribute.

Attribute Name	Type	Mult.	Description
tokenShare	EnabledDisabled	1	An attribute that indicates whether Bandwidth Profile Envelopes containing more than one Bandwidth Profile Flow are supported by the Service Provider at the Subscriber UNI or Operator UNI. Reference MEF 10.4 Section 9.11 Subscriber UNI Token Share Service Attribute or MEF 26.2 Section 14.18 Operator UNI Token Share Service Attribute.
envelopes	Envelope	0..*	The Envelopes and Envelope Coupling Flag values to which Bandwidth Profile Flows can be mapped. Reference MEF 10.4 Section 9.12 Subscriber UNI Envelopes Service Attribute and MEF 26.2 Section 14.19 Operator UNI Envelopes Service Attribute.
l2cpAddressSet	L2cpAddressSet	1	L2CP Address Set Service Attribute is defined in MEF 45.1. Reference MEF 10.4 Section 9.16 Subscriber UNI L2CP Address Set Service Attribute and MEF 26.2 Section 14.20 Operator UNI L2CP Address Set Service Attribute.

Table 33-CarrierEthernetUni Attributes

7.3 CarrierEthernetService

The CarrierEthernetService represents the EVC or the OVC. This is an abstract class and the superclass of Evc and Ovc. It contains the common attributes of Evc and Ovc.

Attribute Name	Type	Mult.	Description
administrativeState	AdminState	1	This attribute denotes the administrative state of EVC or OVC. The values supported are LOCKED and UNLOCKED. When set to UNLOCKED, the Carrier Ethernet Service (EVC or OVC) is enabled and ready to forward traffic. When set to LOCKED, the Carrier Ethernet Service (EVC or OVC) is disabled and will block (i.e., not forward) traffic. Reference MEF-Types.
operationalState	OperationalState	1	This attribute denotes the operational state of the EVC or the OVC, as working ENABLED or not working DISABLED.
cTagPcpPreservation	EnabledDisabled	1	Whether the value of the PCP field in the C-Tag in Ingress EI Frames is preserved when the Egress EI Frame also has a C-Tag. Reference MEF 26.2 Section 12.8 OVC CE-VLAN PCP Preservation Service Attribute and MEF 10.4 Section 8.5 EVC C-Tag PCP Preservation Service Attribute.

Attribute Name	Type	Mult.	Description
cTagDeiPreservation	EnabledDisabled	1	Whether the value of the DEI field in the C-Tag in Ingress Frames is preserved when the Egress EI Frame also has C-Tag. Reference MEF 26.2 Section 12.9 OVC CE-VLAN ID DEI Preservation Service Attribute and MEF 10.4 Section 8.6 EVC C-Tag DEI Preservation Service Attribute.
carrierEthernetSls	CarrierEthernetSls	0..1	Technical details of the service level in terms of Performance Objectives, agreed between the Service Provider and the Subscriber or between Service Provider and the Operator as part of the Service Level Agreement. A given SLS might contain 0,1 or more Performance Objectives for each Performance Metric. Reference MEF 10.4 Section 8.8 EVC Service Level Specification Service Attribute and MEF 26.2 Section 12.13 OVC Service Level Specification Service Attribute.
connectionType	ConnectionType	1	Indicates the roles of OVC/EVC Endpoints associated with OVC/EVC. Point-to-Point, Multipoint-to-Multipoint, or Rooted-Multipoint. Reference MEF 10.4 Section 8.3 EVC Type Service Attribute and MEF 26.2 Section 12.2 OVC Type Service Attribute.
frameDisposition	FrameDisposition	1	Indicates whether unicast, multicast and broadcast EI Frames are delivered unconditionally to other EIs, delivered conditionally or discarded. Reference MEF 10.4 Section 8.4 EVC Data Service Frame Disposition Service Attribute and MEF 26.2 Section 12.14 OVC Frame Delivery Service Attribute.
listOfCosNames	String	1..*	Used to specify all the Class of Service Names supported by an EVC or OVC. Reference MEF 10.4 Section 8.7 EVC List of Class of Service Names Service Attribute and MEF 26.2 Section 12.12 OVC List of Class of Service Names Service Attribute.
maximumFrameSize	PositiveInteger	1	Maximum size of EI frames that can be carried over the EVC or OVC. Reference MEF 10.4 Section 8.10 EVC Maximum Service Frame Size Service Attribute and MEF 26.2 Section 12.6 OVC Maximum Frame Size Service Attribute.

Attribute Name	Type	Mult.	Description
availableMegLevel	AvailableMegLevel	0..1	The lowest MEG level for which SOAM Frames are not peered or discarded by the SP or Operator. If this attribute is not present there is no such level (that is, SOAM frames are all MEG levels may be peered or discarded by the SP or Operator). Reference MEF 10.4 Section 8.11 EVC Available MEG Level Service Attribute and MEF 26.2 Section 12.15 OVC Available MEF Level Service Attribute.

Table 34-CarrierEthernetService Attributes

7.4 CarrierEthernetServiceEndPoint

The CarrierEthernetServiceEndPoint represents the EVC End Point or the OVC End Point. This is an abstract class and the superclass of CarrierEthernetEvcEndPoint and OvcEndPoint. It contains the common attributes of CarrierEthernetEvcEndPoint and OvcEndPoint.

Attribute Name	Type	Mult.	Description
administrativeState	AdminState	1	This attribute denotes the administrative state of EVC End Point or OVC End Point. The values supported are LOCKED and UNLOCKED. When set to UNLOCKED, the Carrier Ethernet Service End Point (EVC End Point or OVC End Point) is enabled and ready to forward traffic. When set to LOCKED, the Carrier Ethernet Service End Point (EVC End Point or OVC End Point) is disabled and will block (i.e., not forward) traffic. Reference MEF-Types.
operationalState	OperationalState	1	This attribute denotes the operational state of the EVC End Point or the OVC End Point, as working ENABLED or not working DISABLED.
ingressClassOfServiceMap	CosMap	1	The value is a triple of the form <F, M, P> where F is protocol field in the ingress EI Frame, M is a map that maps each possible value of the field F and absence of the field F to a Class of Service Name and P is a map of Layer 2 Control Protocol types as determined by the Protocol Identifier. NOTE: The value of F cannot be S-Tag PCP at an EVC End Point. Reference MEF 26.2 Section 16.6 OVC End Point Class of Service Identifier Service Attribute and MEF 10.4 Section 10.5 EVC EP Ingress Class of Service Map Service Attribute.

Attribute Name	Type	Mult.	Description
colorMap	ColorIdentifier	1	The mechanism by with the Color of an EI Frame is determined from context of the EI Frame for an OVC or EVC End Point. Attribute is a pair of the form <F,M> where: * F specifies which protocol field in the EI Frame is used to identify the color, * M is a map that can be used to assign Color to each Ingress EI Frame. Reference MEF 10.4 Section 10.6 EVC EP Color Map Service Attribute. Reference MEF 26.2 Section 16.7 OVC End Point Color Identifier Service Attribute.
ingressBandwidthProfilePerEndPoint	BwpFlow	0..1	Bandwidth Profile Flow parameters for all ingress EI Frames mapped to the OVC End Point or EVC End Point. Reference MEF 26.2 Section 16.10 Ingress Bandwidth Profile per OVC End Point Service Attribute. Reference MEF 10.4 Section 10.8 EVC EP Ingress Bandwidth Profile Service Attribute. The absence of this attribute corresponds to a Service Attribute of None.
ingressBandwidthProfilePerCosName	BandwidthProfilePerClassOfServiceName	0..*	For each CoS Name listed, Bandwidth Profile Flow parameters for all ingress EI Frames mapped to that CoS Name at the EVC End Point or OVC End Point. Reference MEF 26.2 Section 16.12 Ingress Bandwidth Profile per Class of Service Name Service and MEF 10.4 Section 10.9 EVC EP Class of Service Name Ingress Bandwidth Profile Service Attribute.
sourceAddressMacLimit	SourceMacAddressLimit	0..1	Specifies a limit on the number of different Source MAC address for which ingress EI Frames at this EVC End Point or OVC End Point will be delivered. The absence of this attribute corresponds to a Service Attribute value of None. Reference MEF 10.4 Section 10.12 EVC EP Source MAC Address Limit Service Attribute and MEF 26.2 Section 16.15 OVC End Point Source MAC Address Limit Service Attribute.

Table 35-CarrierEthernetServiceEndPoint Attributes

8 Operator Ethernet Services Model

The following section provides the Operator Ethernet Services model with objects, attributes and relationships. Each of the OVC main classes are sub-classed from a parent class that holds common attributes that are used by similar classes in the EVC model. The main OVC classes are CarrierEthernetEnniService, CarrierEthernetEnni, CarrierEthernetVuni, CarrierEthernetOperatorUni, CarrierEthernetOvcEndPoint and CarrierEthernetOvc. The superclasses are CarrierEthernetExternalInterface, CarrierEthernetServiceEndPoint, CarrierEthernetService and CarrierEthernetUni.

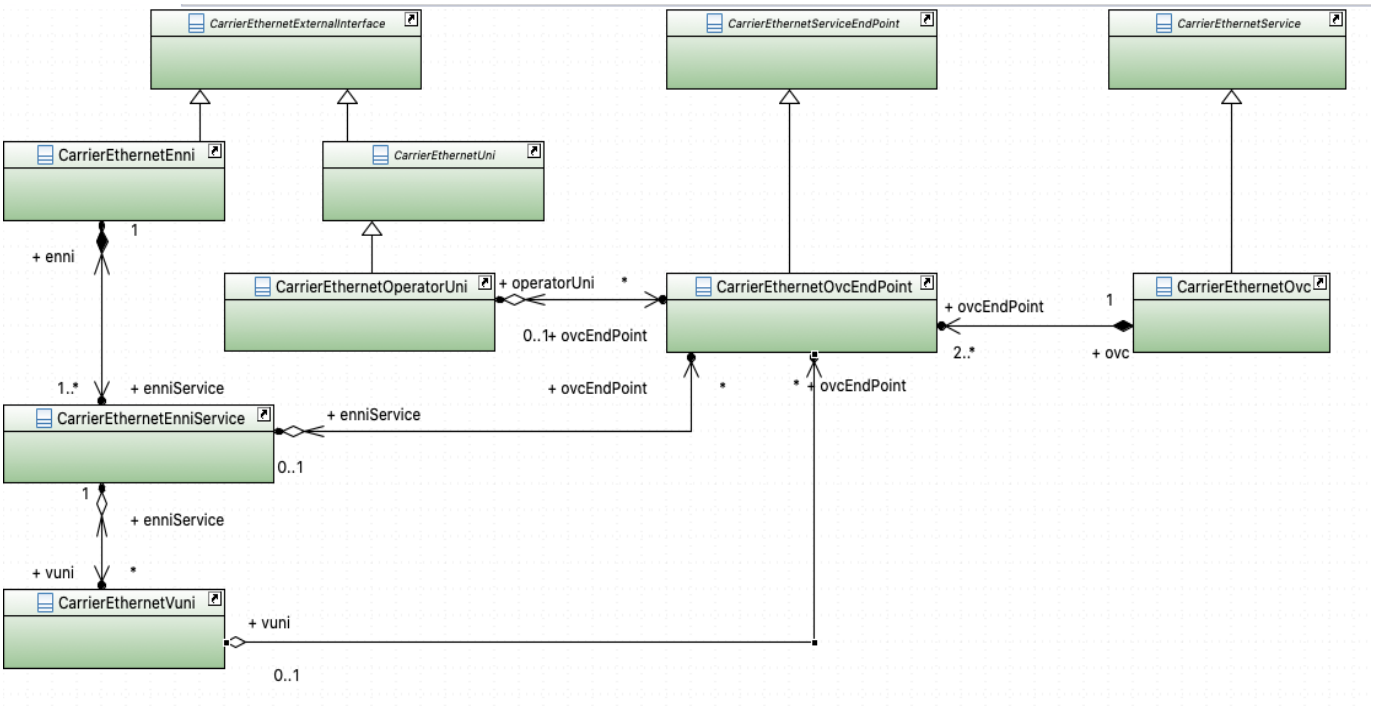

Figure 5-Operator Ethernet Services Model

8.1 CarrierEthernetEnni

The ENNI is a reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains. The class represents the ENNI attributes that are agreed between the operators on either side of the ENNI, in addition to certain other Service Provider/Operators as described in MEF 26.2 [3]. The CarrierEthernetEnni object will likely be used mostly for querying as part of an inventory request. It is likely that the instantiation and activation of the CarrierEthernetEnni will be done by both parties during a network activation phase and not as part of service activation.

Attribute Name	Type	Mult.	Description
peeringIdentifier	Identifier45	1	An identifier for the ENNI intended for operations purposes by the interconnecting Operators at the ENNI. Reference MEF 26.2 Section 9.1 ENNI Peering Identifier Common Attribute.

Attribute Name	Type	Mult.	Description
numberOfLinks	PositiveInteger	1	The number of physical links in the ENNI. Reference MEF 26.2 Section 9.4 ENNI Number of Links Common Attribute.
physicalLayer	PhysicalLayer	1..*	The physical layer of each of the links supporting the ENNI. Reference MEF 26.1 Section 9.2 ENNI Physical Layer Common Attribute.
taggedL2cpFrameProcessing	TaggedL2cpProcessing	1	Specifies the processing behavior for tagged Layer 2 Control Protocols. Reference MEF 26.2 Section 10.2 ENNI Tagged L2CP Frame Processing Multilateral Attribute.
enniService	CarrierEthernetEnniService	1..*	Attribute pointing to CarrierEthernetEnniService.

Table 36-CarrierEthernetEnni Attributes

8.2 CarrierEthernetEnniService

This class represents the ENNI Service Attributes for an ENNI used by a particular SP/SO. For each instance of an ENNI, there can be multiple sets of ENNI Service Attributes. The value for each ENNI Service Attribute in a set for an Operator CEN is specific to a SP/SO that is using the ENNI. Reference MEF 26.2 Section 13 ENNI Service Attributes.

Attribute Name	Type	Mult.	Description
operatorEnniIdentifier	Identifier45	1	An identifier for the ENNI intended for management purposes. Reference MEF 26.2 Section 13.1 Operator ENNI Identifier Service Attribute.
sVlanIdControl	SVlanIdControl	1	The degree to which a SP/SO can use S-VLAN IDs to map to OVC End Points. Reference MEF 26.2 Section 13.2 S-VLAN ID Control Service Attribute.
maximumNumberOfOvcs	PositiveInteger	1	The maximum number of OVCs that the Operator CEN can support at the ENNI. Reference MEF 26.2 Section 13.3 Maximum Number of OVCs Service Attribute.
maximumNumbeOfOvcEndPointsPerOvc	PositiveInteger	1	The maximum number of OVC End Points that the Operator CEN can support at the ENNI for an OVC. Reference MEF 26.2 Section 13.4 Maximum Number of OVC End Points per OVC Service Attribute.
tokenShare	EnabledDisabled	1	An indication of the support of mapping more than one Bandwidth Profile Flow to an Envelope at the ENNI. Reference MEF 26.2 Section 13.5 ENNI Token Share Service Attribute.
envelopes	Envelope	0..*	The Envelopes and corresponding Envelope Coupling Flag value to which Bandwidth Profile Flows can be mapped. Reference MEF 26.2 Section 13.6 ENNI Envelopes Service Attribute.

Attribute Name	Type	Mult.	Description
ovcEndPoint	CarrierEthernetOvcEndPoint	0..*	Pointer to CarrierEthernetOvcEndPoint(s).
vuni	CarrierEthernetVuni	0..*	Pointer to CarrierEthernetVirtualUni(s).

Table 37-CarrierEthernetEnniService Attributes

8.3 CarrierEthernetOvcEndPoint

This class represents an OVC End Point which is a logical entity at a given External Interface that is associated with a distinct set of frames passing over that External Interface. Reference MEF 26.2 Section 16 OVC End Point Service Attributes.

Attribute Name	Type	Mult.	Description
identifier	Identifier45	1	An identifier for the OVC End Point intended for operating purposes. Reference MEF 26.2 Section 16.1 OVC End Point Identifier Service Attribute.
role	OvcEndPointRole	1	Indicates how EI Frames mapped to the OVC End Point can be forwarded. Reference MEF 26.2 Section 16.4 OVC End Point Role Service Attribute.
endPointMap	OvcEndPointMap	1	The information that determines which EI Frames are mapped to the OVC End Point. Reference MEF 26.2 Section 16.5 OVC End Point Map Service Attribute.
egressMap	OvcEpEgressMap	0..*	The specification of the content of the S-Tag and/or C-Tag PCP value and DEI value for egress EI Frames. Reference MEF 26.2 Section 16.8 OVC End Point Egress Map Service Attribute.
egressEquivalenceClassIdentifier	EecMap	1	The mechanism that allows an Egress Equivalence Class Name to be determined for an egress EI Frame. Reference MEF 26.2 Section 16.9 OVC End Point Egress Equivalence Class Identifier Service Attribute.
egressBandwidthProfilePerEndPoint	BwpFlow	0..1	Bandwidth Profile Flow parameters for all egress EI Frames mapped to the OVC End Point Reference MEF 26.2 Section 16.11 Egress Bandwidth Profile per OVC End Point Service Attribute.
egressBandwidthProfilePerEec	BandwidthProfilePerEquivalenceClassName	0..*	For each EEC Name listed, Bandwidth Profile Flow parameters, for all egress EI Frames mapped to that EEC Name at the OVC End Point. Reference MEF 26.2 Section 16.13 Egress Bandwidth Profile per Egress Equivalence Class Name Service Attribute.
aggregationLinkDepth	AggLinkDepth	0..1	The number of ENNI links that can carry ENNI Frames for each S-VLAN ID mapped to the OVC End Point. Reference MEF 26.2 Section 16.14 OVC End Point Aggregation Link Depth Service Attribute.

Attribute Name	Type	Mult.	Description
maintenanceIntermediatePoint	EnabledDisabled	1	The indication of the instantiation of a MIP. Reference MEF 26.2 Section 16.16 OVC End Point MIP Service Attribute.
maintenanceEndPointList	MepLevelAndDirection	0..*	The MEPs enable for the OVC End Point. Reference MEF 26.2 Section 16.17 OVC End Point Maintenance End Point List Service Attribute.
operatorUni	CarrierEthernetOperatorUni	0..1	Pointer to CarrierEthernetOperatorUni.
enniService	CarrierEthernetEnniService	0..1	Pointer to CarrierEthernetEnniService.

Table 38-CarrierEthernetOvcEndPoint Attributes

8.4 CarrierEthernetOperatorUni

This class represents the Operator UNI Service Attributes that are agreed on by the SP/SO and the Operator for each UNI.

Attribute Name	Type	Mult.	Description
identifier	Identifier45	1	An identifier for the UNI intended for management purposes. Reference MEF 26.2 Section 14.1 Operator UNI Identifier Service Attribute.
synchronousMode	SyncModePerLink	1..*	The specification of which physical links can be used as a frequency synchronization reference. Reference MEF 26.2 Section 14.3 Operator UNI Synchronous Mode Service Attribute.
physicalLayer	PhysicalLayer	1..*	The physical layer of each of the links supporting the Operator UNI. Reference MEF 26.2 Section 14.2 Operator UNI Physical Layer Service Attribute.
numberOfLinks	PositiveInteger	1	The number of physical links at the UNI. Reference MEF 26.2 Section 14.4 Operator UNI Number of Links Service Attribute.
defaultCeVlanId	VlanId	1	The CE-VLAN ID value for untagged and priority tagged Service Frames. Reference MEF 26.2 Section 14.9 Operator UNI Default CE-VLAN ID Service Attribute.
ingressBandwidthProfile	BwpFlow	0..1	A Bandwidth Profile Flow for all ingress Frames at the UNI. Reference MEF 26.2 Section 14.12 Operator UNI Ingress Bandwidth Profile per UNI Service Attribute. The absence of this attribute corresponds to a Service Attribute value of Disabled.
egressBandwidthProfile	BwpFlow	0..1	A Bandwidth Profile Flow for all egress Frames at the UNI. Reference MEF 26.2 Section 14.13 Operator UNI Egress Bandwidth Profile per UNI Service Attribute. The absence of this attribute corresponds to a Service Attribute value of Disabled.

Attribute Name	Type	Mult.	Description
elmi	EnabledDisabled	1	The indication of support of E-LMI. Reference MEf 26.2 Section 14.17 Operator UNI E-LMI Service Attribute.
l2cpAddressSet	L2cpAddressSet	1	L2CP Address Set applied to UNI. Reference MEF 26.2 Section 14.20 Operator UNI L2CP Address Set Service Attribute.
ovcEndPoint	CarrierEthernetOvcEndPoint	0..*	Pointer to CarrierEthernetOvcEndPoint.

Table 39-CarrierEthernetOperatorUni Attributes

8.5 CarrierEthernetVuni

This class represents a Virtual UNI (VUNI) instantiated at an ENNI. Reference MEF 26.2 Section 15 Virtual UNI (VUNI), Feeder OVC, and Remote UNI (RUNI).

Attribute Name	Type	Mult.	Description
identifier	Identifier45	1	An identifier for the instance of the VUNI intended for operations purposes. Reference MEF 26.2 Section 15.1.1 VUNI Identifier Service Attribute.
sVlanId	VlanId	1	A value that allows mapping ENNI Frames to OVC End Points in the VUNI. Reference MEF 26.2 Section 15.1.2 VUNI S-VLAN ID Service Attribute.
defaultEnniCeVlanId	VlanId	1	The ENNI CE-VLAN ID value for ENNI Frames with no C-Tag or a C-Tag whose VLAN ID value is 0. MEF 26.2 Section 15.1.3 VUNI Default ENNI CE-VLAN ID Service Attribute.
maximumNumberOfOvcEndPoints	PositiveInteger	1	The maximum number of OVC End Points that can be in the VUNI. Reference MEF 26.2 Section 15.1.4 VUNI Maximum Number of OVC End Points Service Attribute.
maximumNumberOfEnniCeVlanIdsPerOvcEndPoint	PositiveInteger	1	The maximum number of ENNI CE-VLAN ID values that can be mapped to an OVC End Point that is in the VUNI. Reference MEF 26.2 Section 15.1.5 VUNI Maximum Number of ENNI CE-VLAN IDs per OVC End Point Service Attribute.
ingressBandwidthProfile	BwpFlow	0..1	A Bandwidth Profile Flow for all ingress Frames mapped to the VUNI. Reference MEF 26.2 Section 15.1.6 VUNI Ingress Bandwidth Profile Service Attribute.
egressBandwidthProfile	BwpFlow	0..1	A Bandwidth Profile Flow for all egress Frames mapped to the VUNI. Reference MEF 26.2 Section 15.1.7 VUNI Egress Bandwidth Profile Service Attribute.
l2cpAddressSet	L2cpAddressSet	1	L2CP Address Set applied to VUNI. Reference MEF 26.2 Section 15.1.8 VUNI L2CP Address Set Service Attribute.

Attribute Name	Type	Mult.	Description
l2cpPeering	L2cpPeering	0..*	L2CP Peering applied to VUNI. Reference MEF 26.2 Section 15.1.9 VUNI L2CP Peering Service Attribute.
mepList	MepLevelAndDirection	0..*	The indication of the instantiation of a MEP. A list with each item specifying the MEG Level. Reference MEF 26.2 Section 15.1.10 VUNI Maintenance End Point List Service Attribute.
ovcEndPoint	CarrierEthernetOvcEndPoint	0..*	Reference to CarrierEthernetOvcEndPoint.

Table 40-CarrierEthernetVuni Attributes

8.6 CarrierEthernetOvc

This class represents an Operator Virtual Connection (OVC). Reference MEF 26.2 Section 8.8 Operator Virtual Connection.

Attribute Name	Type	Mult.	Description
identifier	Identifier45	1	An identifier for the OVC intended for management purposes. Reference MEF 26.2 Section 12.1 OVC Identifier Service Attribute.
maximumNumberOfUniOvcEndPoints	NaturalNumber	1	The bound on the number of OVC End Points at different UNIs that can be associated by the OVC. Reference MEF 26.2 Section 12.4 Maximum Number of UNI OVC End Points Service Attribute.
maximumNumberOfEnniOvcEndPoints	PositiveInteger	1	The bound on the number of OVC End Points at ENNIs that be associated by the OVC. Reference MEF 26.2 Section 12.5 Maximum Number of ENNI OVC End Points Service Attribute.
ceVlanIdPreservation	VlanIdPreservation	1	Indicates the relationship between the presence and value of the C-tag VLAN ID in Ingress EI Frames and the presence and value of the C-tag VLAN ID in corresponding Egress EI Frames. Reference MEF 26.2 Section 12.7 OVC CE-VLAN ID Preservation Service Attribute.
sVlanPcpPreservation	EnabledDisabled	1	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. Reference MEF 26.2 Section 12.10 OVC S-VLAN PCP Preservation Service Attribute.
sVlanDeiPreservation	EnabledDisabled	1	A relationship between the S-VLAN DEI value of a frame at one ENNI and the S-VLAN DEI value of the corresponding frame at another ENNI. Reference MEF 26.2 Section 12.10 OVC S-VLAN PCP Preservation Service Attribute.

Attribute Name	Type	Mult.	Description
l2cpAddressSet	L2cpAddressSet	1	The subset of the Bridge Reserved Addresses that are Peered or Discarded. Reference MEF 26.2 Section 12.16 OVC L2CP Address Set Service Attribute.
ovcEndPoint	CarrierEthernetOvcEndPoint	2..*	Association attribute to CarrierEthernetOvcEndPoint.

Table 41-CarrierEthernetOvc Attributes

9 Operator Ethernet Services

The following section details the association of the Operator Ethernet services. The Operator Ethernet services are defined in MEF 51.1. The set of Operator services detailed are Access E-Line, Access E-LAN, Transit E-Line and Transit E-LAN.

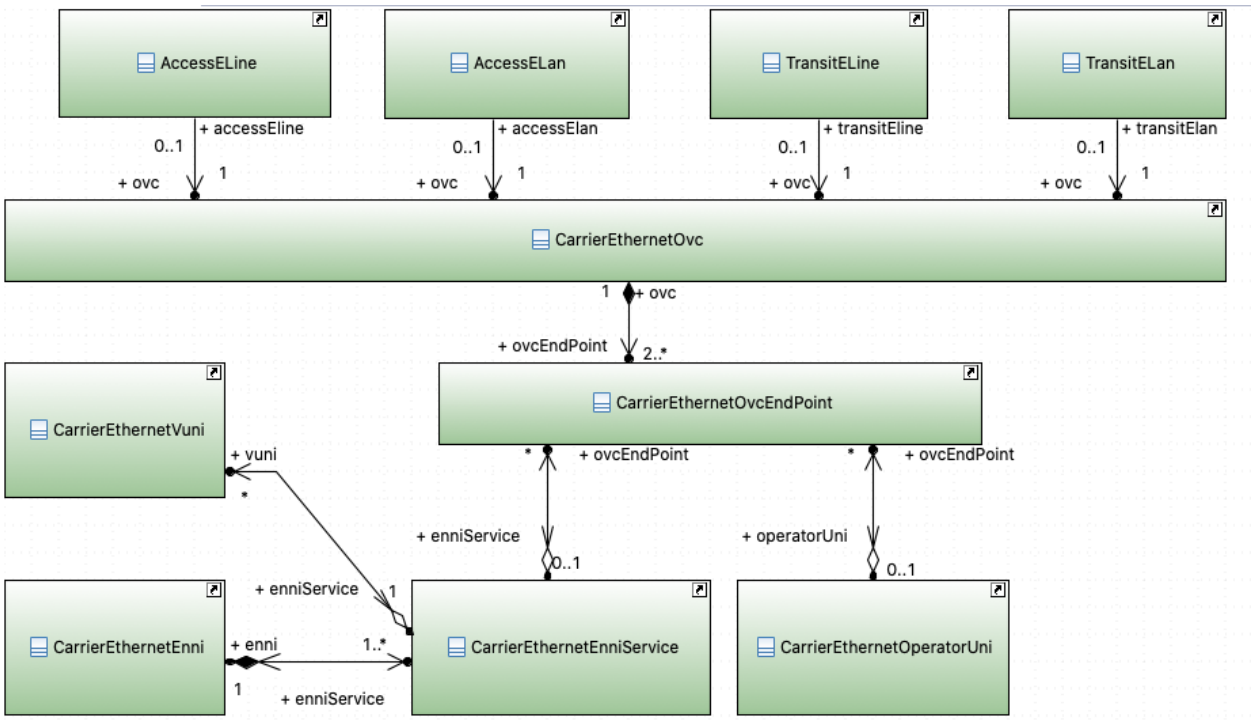

Figure 6-Operator Services Model

9.1 Access E-Line Service

The Access E-Line Service provides a Point-to-Point OVC connecting one UNI with one ENNI. At the UNI, one or more CE-VLAN IDs can map to a given OVC End Point. At the ENNI, an S-VLAN ID maps to the OVC End Point. Reference MEF 51.1 Section 9.1 Access E-Line Service Definition.

9.2 Access E-LAN Service

The Access E-LAN Service provides a Multipoint-to-Multipoint OVC connecting one or more UNIs with one or more ENNIs. Reference MEF 51.1 Section 9.2 Access E-LAN Service Definition.

9.3 Transit E-Line Service

The Transit E-Line Service provides a single Point-to-Point OVC associating two OVC End Points, each of which is at an ENNI (could be two different ENNIs or the same ENNI, e.g., where hairpin switching is used). Transit E-Line Service includes preservation of CE-VLAN ID, CE-VLAN PCP and CE-VLAN DEI and allows for one or more Class of Service Names. It also includes support for SOAM. Reference MEF 51.1 Section 10.1 Transit E-Line Service Definition.

9.4 Transit E-LAN Service

The Transit E-LAN Service provides a Multipoint-to-Multipoint OVC that associates OVC End Points at one or more ENNIs. It has the capability to map a single S-VLAN ID per OVC End Point at each ENNI, or multiple S-VLAN IDs per OVC End Point at each ENNI. Transit E-LAN Service includes preservation of CE-VLAN ID, CE-VLAN PCP and CE-VLAN DEI, and allows for one or more Class of Service Names. It also includes SOAM support. Reference MEF 51.1 Section 10.2 Transit E-LAN Service Definition.

10 Subscriber Ethernet Services Model

The following section provides a more detailed UML model for the Subscriber Ethernet Services model and its associated attributes and object relationships. The three main objects for the Carrier Ethernet Model are Subscriber UNI, EVC End Point and EVC. The superclasses are CarrierEtherExternalInterface, CarrierEthernetServiceEndPoint, CarrierEthernetService and CarrierEthernetUni.

Each of the EVC main classes are sub-classed from a parent class that holds common attributes that are used by similar classes in the OVC model.

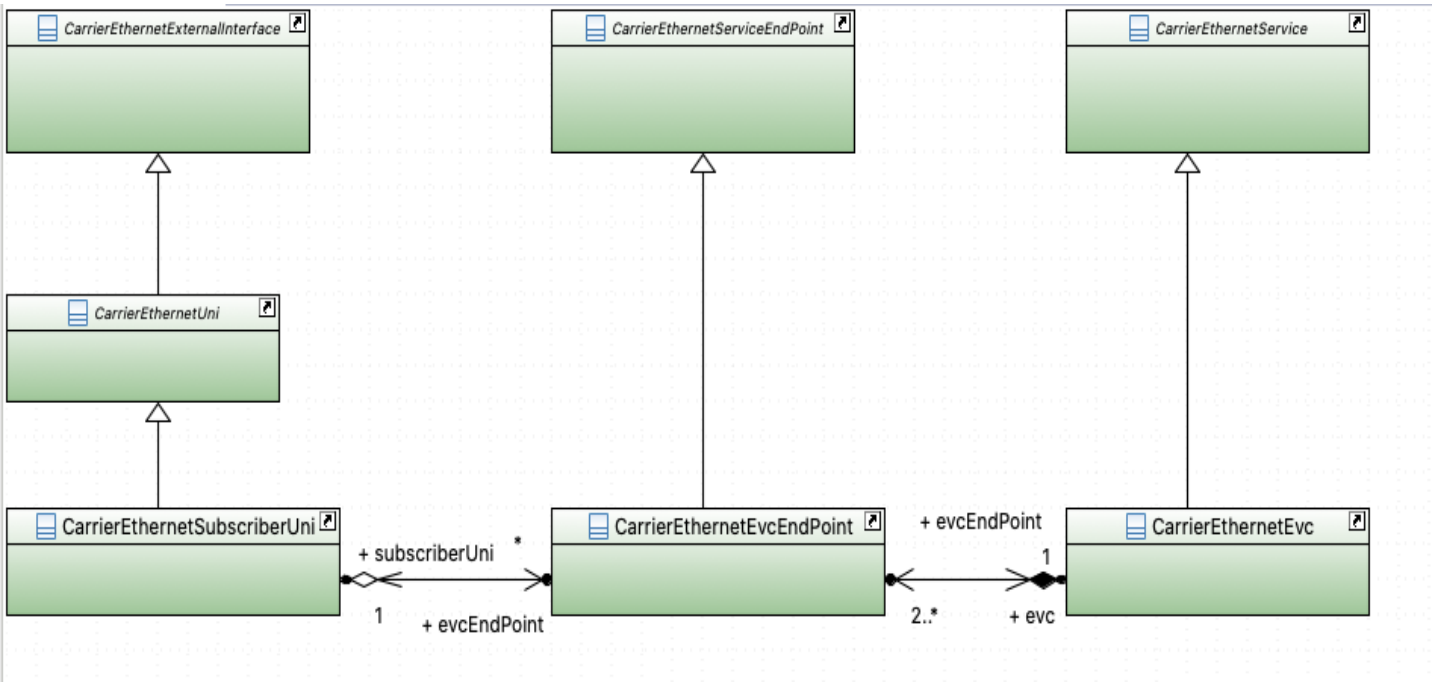

Figure 7-Subscriber Ethernet Service Model

10.1 CarrierEthernetSubscriberUni

This class represents the Ethernet User Network Interface demarcation point between the responsibility of the Service Provider and the responsibility of the Subscriber. Reference MEF 10.4 Section 9. Subscriber UNI Service Attributes.

Attribute Name	Type	Mult.	Description
identifier	Identifier45	1	String that is used to allow the Subscriber and Service Provider to uniquely identify the UNI for operations purposes. Reference MEF 10.4 Section 9.1 Subscriber UNI ID Service Attribute.
instantiation	Instantiation	1	The value is either Physical or Virtual. Reference MEF 10.4 Section 9.2 Subscriber UNI Instantiation Service Attribute.
virtualFrameMap	VirtualFrameMap	0..1	A map for virtual frame mapping. The absence of this attribute corresponds to a Service Attribute value of Not Applicable. Reference MEF 10.4 Section 9.3 Subscriber UNI Virtual Frame Map Service Attribute.
listOfPhyLinks	SubscriberUniPhysicalLinks	0..*	A list of 4-tuples of the form <id,pl,fs,pt>, with one list item for each physical link. The value of id is an identifier for the physical link. The value of pl specifies a physical layer. fs indicates if synchronous Ethernet is used on the physical link corresponding to the 4-tuple and has the value either Enable or Disabled. The value pt indicates if the Precision Time Protocol is used on the physical link corresponding to the 4-tuple and has the value either Enabled or Disabled. The absence of this attribute corresponds to a Service Attribute value of Not Applicable. Reference MEF 10.4 Section 9.4 Subscriber UNI List of Physical Links Service Attribute.
CarrierEthernetEvcEndPoint	CarrierEthernetEvcEndPoint	0..*	Subscriber UNI association to CarrierEthernetEvcEndPoint.

Table 42-CarrierEthernetSubscriberUni Attributes

10.2 CarrierEthernetEvcEndPoint

A CarrierEthernetEvcEndPoint is a construct at a UNI that selects a subset of the Service Frames that pass over the UNI. A CarrierEthernetEvcEndPoint represents the logical attachment of an Evc to a UNI. Reference MEF 10.4 Section 10 EVC EP Service Attributes.

Attribute Name	Type	Mult.	Description
identifier	Identifier45	1	A string that is used to allow the Subscriber and Service Provider to uniquely identify the CarrierEthernetEvcEndPoint for operations purposes.Reference MEF 10.4 Section 10.1 EVC EP ID Service Attribute.

Attribute Name	Type	Mult.	Description
role	EvcEndPointRole	1	Indicates how Service Frames mapped to the EVC End Point can be forwarded. Reference MEF 10.4 Section 10.3 EVC EP Role Service Attribute.
evcEndPointMap	VlanIdListOrUnTag	1	The value of this attribute is one of List, All or UT/PT. The information that determines which Service Frames are mapped to the EVC End Point. Reference MEF 10.4 Section 10.4 EVC EP Map Service Attribute.
egressMap	EvcEpEgressMap	0..*	Attribute is a map of the form <Corresponding Ingress Service Frame Class of Service Name, Corresponding Ingress Service Frame Color> to either <Egress Service Frame C-Tag PCP value, Egress Service Frame C-Tag DEI value> or Discard. Reference MEF 10.4 Section 10.7 EVC EP Egress Map Service Attribute.
egressBandwidthProflePerEndPoint	EgressBwpFlow	0..1	Attribute used to limit the rate of all Egress Service Frames mapped to an EVC EP at a UNI. Reference MEF 10.4 Section 10.10 EVC EP Egress Bandwidth Profile Service Attribute.
egressBandwidthProfilePerCosName	ClassOfServiceEgressBandwidthProfile	0..*	Used to limit the rate of all Egress Service Frames with a given Class of Service Name, as determined at the ingress UNI for each frame per the EVC EP Ingress Class of Service Map Service Attribute. Reference MEF 10.4 Section 10.11 EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute.
subscriberMegMip	MegLevel	0..1	Integer in the range 0-7 that indicates the MEG Level of a Subscriber MEG MIP. Reference MEF 10.4 Section 10.13 EVC EP Subscriber MEG MIP Service Attribute. The absence of this attribute corresponds to a Service Attribute value of None.
subscriberUni	CarrierEthernetSubscriberUni	1	Reference to CarrierEthernetSubscriberUni.

Table 43-CarrierEthernetEvcEndPoint Attributes

10.3 CarrierEthernetEvc

An EVC is an association of two or more EVC End Points (EVC EPs). Reference MEF 10.4 Section 7.8 Ethernet Virtual Connection, EVC End Point and EVC EP Map Service Attribute.

Attribute Name	Type	Mult.	Description
identifier	Identifier45	1	Used to identify an EVC within the SP Network. Reference MEF 10.4 Section 8.1 EVC ID Service Attribute.
CarrierEthernetEvcEndPoint	CarrierEthernetEvcEndPoint	2..*	Pointer to CarrierEthernetEvcEndPoint(s).

Table 44-CarrierEthernetEvc Attributes

11 Subscriber Ethernet Services

The following section details the association of the Subscriber Ethernet Services. The Subscriber Ethernet Services are defined in MEF 6.3. The set of Subscriber Ethernet Services are Ethernet Private Line, Ethernet Virtual Private Line, Ethernet Private LAN, Ethernet Virtual Private LAN, Ethernet Private Tree and Ethernet Virtual Private Tree services.

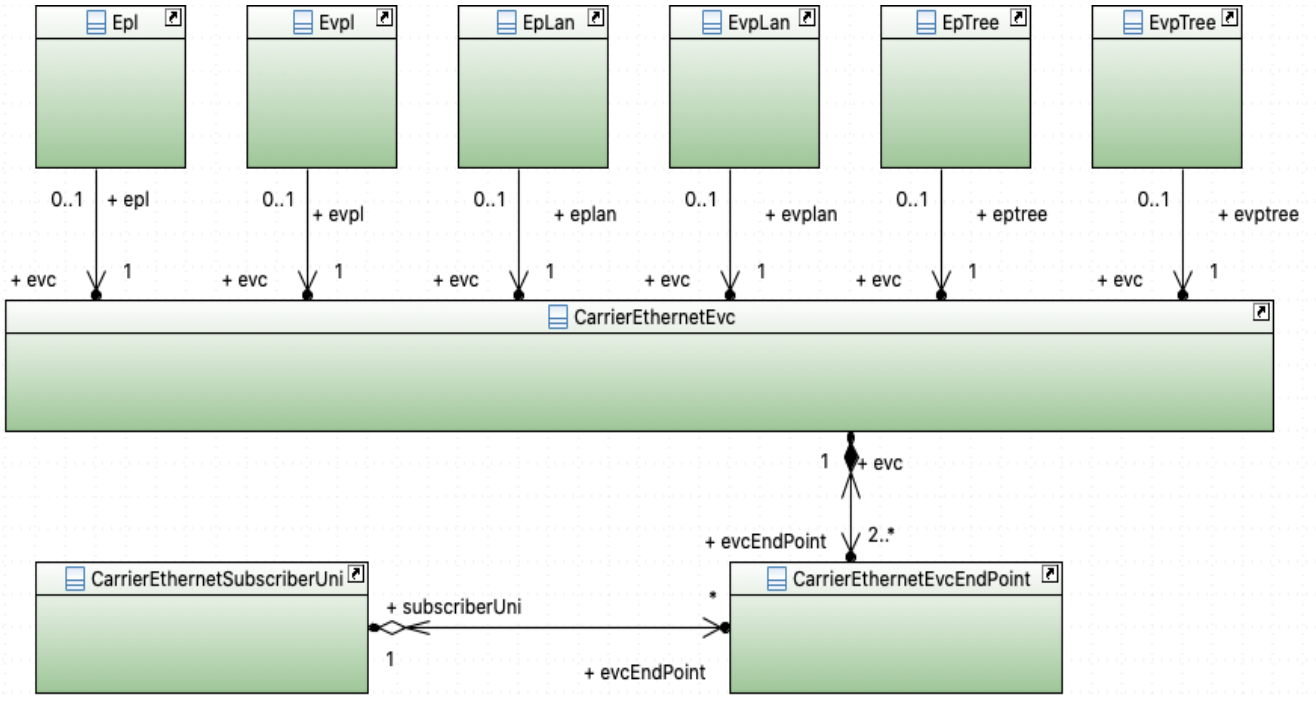

Figure 8-Subscriber Ethernet Service Model

11.1 Ethernet Private Line (EPL) Service

An Ethernet Private Line (EPL) service is a Port-based Service of E-Line Service Type. EPL services are intended to be highly transparent, in the sense that Service Frames received at the ingress UNI are delivered at the egress UNI with as few modifications as possible. Reference MEF 6.3 Section 9.1 Ethernet Private Line Service.

11.2 Ethernet Virtual Private Line (EVPL) Service

An Ethernet Virtual Private Line (EVPL) service is a VLAN-based Service of E-Line Service Type. An EVPL can be used to create services similar to the Ethernet Private Line (EPL) with some notable exceptions. An EVPL maps Service Frames at a UNI to an EVC EP based on the EVC EP Map Service Attribute value. An additional difference compared to an EPL is that an EVPL will always filter some additional L2CP Service Frames with certain destination address as specified in MEF 45.1. Reference MEF 6.3 Section 9.2 Ethernet Virtual Private Line Service.

11.3 Ethernet Private LAN (EP-LAN) Service

Ethernet Private LAN (EP-LAN) service is a Port-based Service of E-LAN Service Type. An EP-LAN service enables Subscribers with multiple sites to interconnect them so that all sites

appear to be on the same Local Area Network (LAN) and have the same performance and access to resources such as servers and storage. Reference MEF 6.3 Section 9.3 Ethernet Private LAN Service.

11.4 Ethernet Virtual Private LAN (EVP-LAN) Service

An Ethernet Virtual Private LAN (EVP-LAN) service is a VLAN-based Service of E-LAN Service Type. Some Subscribers desire a service of E-LAN Service Type to connect their UNIs in a network, while at the same time accessing other services from one or more of those UNIs. Reference MEF 6.3 Section 9.4 Ethernet Virtual Private LAN Service.

11.5 Ethernet Private Tree (EP-Tree) Service

An Ethernet Private Tree (EP-Tree) service is defined as a Port-based Service of E-Tree Service Type. An EP-Tree service enables Subscribers with multiple sites to interconnect them in a way that does not resemble a LAN. The sites can be connected with a centralized site (or few such sites) which is designated as a Root and all the remaining sites designated as Leaf. An EP-Tree service is a highly transparent service that connects multiple UNIs. Reference MEF 6.3 Section 9.5 Ethernet Private Tree Service.

11.6 Ethernet Virtual Private Tree (EVP-Tree) Service

An Ethernet Virtual Private Tree (EVP-Tree) Service is defined as a VLAN-based Service of E-Tree Service Type. Some Subscribers desire access to certain applications or content services from well-defined access points within their own (or an external) network. In this case it is necessary to interconnect the participating UNIs in a Rooted-Multipoint connection to the well-defined access (or root) points. Reference MEF 6.3 Section 9.6 Ethernet Virtual Private Tree Service.

12 Carrier Ethernet Service Level Specification (SLS)

The following section provides the details of the Carrier Ethernet Service Level Specification (SLS). Both the OVC and EVC services use the SLS model with association between Ordered Pairs or OVC(EVC) End Points. Reference MEF 10.4 Section 8.8 EVC Service Level Specification Service Attribute and MEF 26.2 Section 12.13 OVC Service Level Specification Service Attribute.

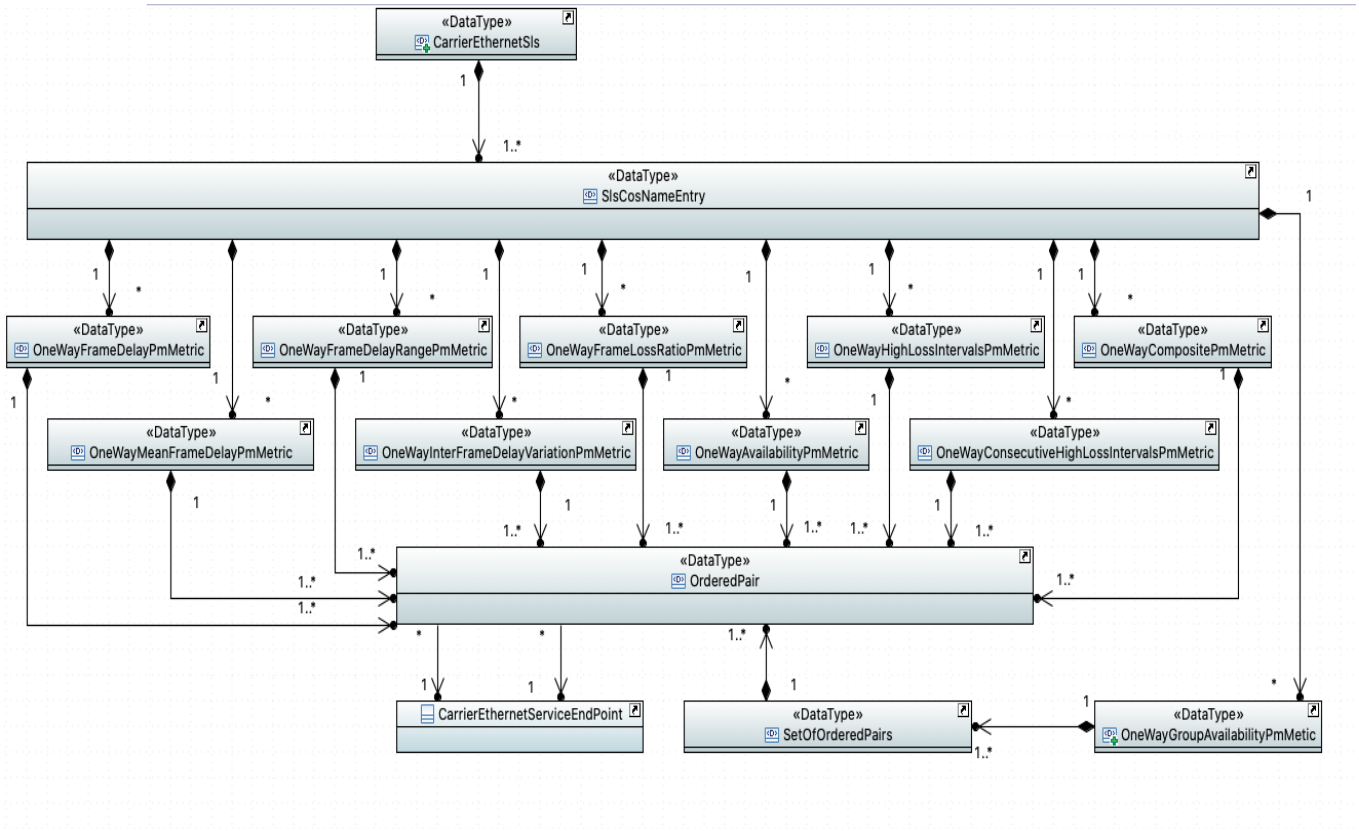

Figure 9-Carrier Ethernet SLS

12.1 CarrierEthernetSls

Data type that represents Carrier Ethernet Service Level Specification that provides a list of Performance Metrics where each item in the list includes the parameters and performance objective for the given Performance Metric. It is associated with EVC or OVC and a list of SlsCosNameEntry(s). Reference MEF 10.4 Section 8.8 EVC Service Specification Service Attribute and MEF 26.2 Section 12.13 OVC Service Level Specification Service Attribute.

Attribute Name	Type	Mult.	Description
timeInterval	TimeIntervalT	1	This attribute sets the time interval over which to evaluate the performance for the SLS.
startTime	TimeAndDate	1	This attribute represents the date and time for the start of the SLS. It is the beginning of the first Time Interval, T.

slsCosNameEntry	SlsCosNameEntry	1..*	Pointer to SlsCosNameEntry.

Table 45-CarrierEthernetSls Attributes

12.2 SlsCosNameEntry

The SlsCosNameEntry data type represents the CoS Name entry consisting of a list of 4-tuples of the form <CoS Name, Δt, C, n> where CoS Name is Class of Service Name, Δt is a small time interval, C is a threshold and n to identify consecutive Δt for high loss interval. The SlsCosNameEntry data type is associated with EVC or OVC and SlsObjectiveAndParameters.

Attribute Name	Type	Mult.	Description
cosName	String	1	This attribute denotes the Class of Service Name.
deltaT	PositiveInteger	1	This attribute denotes the deltat, a time interval in seconds, much smaller that T (SLS time period), e.g., 10 seconds.
thresholdC	Real	1	This attribute denotes the threshold for FLR used to determine whether a given time interval delta t has high loss.
consecutiveIntervalN	PositiveInteger	1	This attribute denotes n, used to identify how many consecutive deltat intervals must have high loss to trigger a change in Availability.
oneWayFrameDelayPmMetric	OneWayFrameDelayPmMetric	0..*	Pointer to One-way Frame Delay Performance Management Metric.
oneWayInterFrameDelayVariationPmMetric	OneWayInterFrameDelayVariationPmMetric	0..*	Pointer to One-way Inter-Frame Delay Variation Performance Management Metric.
oneWayMeanFrameDelayPmMetric	OneWayMeanFrameDelayPmMetric	0..*	Pointer to One-way Mean Frame Delay Performance Management Metric.
oneWayFrameDelayRangePmMetric	OneWayFrameDelayRangePmMetric	0..*	Pointer to One-way Frame Delay Range Performance Management Metric.
oneWayFrameLossRatioPmMetric	OneWayFrameLossRatioPmMetric	0..*	Pointer to One-way Frame Loss Ratio Performance Management Metric.
oneWayAvailabilityPmMetric	OneWayAvailabilityPmMetric	0..*	Pointer to One-way Availability Performance Management Metric.
oneWayHighLossIntervalPmMetric	OneWayHighLossIntervalsPmMetric	0..*	Pointer to One-way High Loss Interval Performance Management Metric.
oneWayConsecutiveHighLossIntervalPmMetric	OneWayConsecutiveHighLossIntervalsPmMetric	0..*	Pointer to One-way Consecutive High Loss Interval Performance Management Metric.
oneWayCompositePmMetric	OneWayCompositePmMetric	0..*	Pointer to One-way Composite Performance Management Metric.
oneWayGroupAvailabilityPmMetric	OneWayGroupAvailabilityPmMetic	0..*	Pointer to One-way Group Availability Performance Management Metric.

Table 46-SlsCosNameEntry Attributes

12.3 OneWayFrameDelayPmMetric

Data type representing One-way Frame Delay Performance Metric. Reference MEF 10.4 Section 8.8.2 One-way Frame Delay Performance Metric and MEF 26.2 Section 12.13.2 One-way Frame Delay Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFdPercentile	Percentage	1	A percentage in (0,100] for Frame Delay metric.
oneWayFdObjective	Time	1	Performance Objective in time units > 0 for Frame Delay metric.

Table 47-OneWayFrameDelayPmMetric Attributes

12.4 OneWayMeanFrameDelayPmMetric

Data type representing One-way Mean Frame Delay Performance Metric. Reference MEF 10.4 Section 8.8.3 One-way Mean Frame Delay Performance Metric and MEF 26.2 Section 12.13.3 One-way Mean Frame Delay Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayMfdObjective	Time	1	Performance Objective in time units.

Table 48-OneWayMeanFrameDelayPmMetric Attributes

12.5 OneWayFrameDelayRangePmMetric

Data type representing One-way Frame Delay Range Performance Metric. Reference MEF 10.4 Section 8.8.4 One-way Frame Delay Range Performance Metric and MEF 26.2 Section 12.13.4 One-way Frame Delay Range Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFdrPercentile	Percentage	1	A percentage in (0,100].
oneWayFdrObjective	Time	1	Performance Objective in time units > 0.

Table 49-OneWayFrameDelayRangePmMetric Attributes

12.6 OneWayInterFrameDelayVariationPmMetric

Data type representing One-way Inter-Frame Delay Performance Metric. Reference MEF 10.4 Section 8.8.5 One-way Inter-Frame Delay Performance Metric and MEF 26.2 Section 12.13.5 One-way Inter-Frame Delay Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.

timeDuration	Time	1	A time duration in time units.
oneWayIfdvPercentile	Percentage	1	A percentage in (0,100].
oneWayIfdvObjective	Time	1	Performance Objective in time units > 0.

Table 50-OneWayInterFrameDelayVariationPmMetric Attributes

12.7 OneWayFrameLossRatioPmMetric

Data type representing One-way Frame Loss Ratio Performance Metric. Reference MEF 10.4 Section 8.8.6 One-way Frame Loss Ratio Performance Metric and MEF 26.2 Section 12.13.6 One-way Frame Loss Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFlrObjective	Percentage	1	Performance Objective expressed as a percentage.

Table 51-OneWayFrameLossRatioPmMetric Attributes

12.8 OneWayAvailabilityPmMetric

Data type representing One-way Availability Performance Metric. Reference MEF 10.4 Section 8.8.7 One-way Availability Performance Metric and MEF 26.2 Section 12.13.7 One-way Availability Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayAvailabilityObjective	Percentage	1	One-way Availability Performance Objective expressed as a percentage.

Table 52-OneWayAvailabilityPmMetric Attributes

12.9 OneWayHighLossIntervalsPmMetric

Data type representing One-way High Loss Intervals Performance Metric. Reference MEF 10.4 Section 8.8.8 One-way High Loss Performance Metric and MEF 26.2 Section 12.13.8 One-way High Loss Intervals Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayHighLossIntervalsObjective	Integer	1	Performance Objective expressed as a non-negative integer.

Table 53-OneWayHighLossIntervalsPmMetric Attributes

12.10 OneWayConsecutiveHighLossIntervalsPmMetric

Data type representing One-way Consecutive High Loss Intervals Performance Metric. Reference MEF 10.4 Section 8.8.9 One-way Consecutive High Loss Intervals Performance

Metric and MEF 26.2 Section 12.13.9 One-way Consecutive High Loss Intervals Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
consecutiveNumberP	Integer	1	The number of high loss intervals that constitute a consecutive high loss interval.
oneWayChliObjective	Integer	1	Performance Objective expressed as a non-negative integer.

Table 54-OneWayConsecutiveHighLossIntervalsPmMetric Attributes

12.11 OneWayCompositePmMetric

Data type representing One-way Composite Performance Metric. Reference MEF 10.4 Section 8.8.10 One-way Composite Performance Metric.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
compositePerformanceIndicatorThreshold	EFloat	1	Composite Performance Indicator threshold which if exceeded suggests an unacceptable time interval.
compositeFrameLoss	Integer	1	Composite indicator for One-way Frame Loss equal to 0 or 1.
compositeFrameDelay	Integer	1	Composite indicator for One-way Frame Delay equal to 0 or 1.
compositeFrameDelayVariation	Integer	1	Composite indicator for One-way Frame Delay Variation equal to 0 or 1.
oneWayFdThreshold	Time	1	Composite One-way Frame Delay threshold in time units.
oneWayIfdvThreshold	Time	1	One-way Frame Delay Variation threshold in time units.
cpmObjective	Percentage	1	Composite Performance Objective as a percentage.

Table 55-OneWayCompositePmMetric Attributes

12.12 OneWayGroupAvailabilityPmMetic

Data type representing One-way Group Availability Performance Metric. Reference MEF 10.4 Section 8.8.11 One-way Group Availability Performance Metric and MEF 26.2 Section 12.13.10 One-way Group Availability Performance Metric.

Attribute Name	Type	Mult.	Description
setOfOrderedPairList	SetOfOrderedPairs	1..*	Non-empty subsets of ordered EP pairs.
oneWayGroupAvObjective	Percentage	1	Performance Objective expressed as percentage.

minimumNumberOfSets AvailableK	PostiveInteger	1	Specified number of sets of ordered EVC End Point Pair available during characterized percentage of time of measurement.

Table 56-OneWayGroupAvailabilityPmMetric Attributes

12.13 OrderedPair

The OrderedPair data type is an ordered pair of EVC/OVC End Points for a specific performance metric for one-way direction. It is associated with one-way performance metrics and a pair of CarrierEthernetServiceEndPoints.

Attribute Name	Type	Mult.	Description
toCarrierEthernetService EndPoint	CarrierEthernetService EndPoint	1	Pointer to the to CarrierEthernetServiceEndPoint in Ordered Pair.
fromCarrierEthernetServi ceEndPoint	CarrierEthernetService EndPoint	1	Pointer to the from CarrierEthernetServiceEndPoint in Ordered Pair.

Table 57-OrderedPairs Attributes

12.14 SetOfOrderedPairs

Data type representing a set of Ordered Pairs.

Attribute Name	Type	Mult.	Description
orderedPairList	OrderedPair	1..*	Attribute denotes a set of Ordered Pairs.

Table 58-SetOfOrderedPairs Attributes

13 Ethernet Data Type Definitions

The following section details the associated set of data types that are used by the Carrier Ethernet model.

13.1 BandwidthProfilePerClassOfServiceName

List of pairs of the form <x,y> where x is Class of Service Name that is in the value of the EVC or OVC List of Class of Service Names Service Attribute for the EVC or OVC that associates the EVC or OVC End Point and y is BwpFlow. Reference MEF 10.4 Section 10.9 EVC EP Class of Service Name Ingres Bandwidth Profile Service Attribute and MEF 26.2 Section 16.12 Ingress Bandwidth Profile per Class of Service Name Service Attribute.

Attribute Name	Type	Mult.	Description
classOfServiceName	String	1	Class of Service Name.
bwpFlow	BwpFlow	1	Pointer to BwpFlow.

Table 59-BandwidthProfilePerClassOfServiceName Data Type Attributes

13.2 BandwidthProfilePerEquivalenceClassName

List of pairs of the form <x,y> where x is an Egress Equivalence Class Name and y has the value of BwpFlow. Reference MEF 26.2 Section 16.13 Egress Bandwidth Profile per Egress Equivalence Class Name Service Attribute.

Attribute Name	Type	Mult.	Description
egressEquivalenceClassName	String	1	Egress Equivalence Class of Name.
bwpFlow	BwpFlow	1	Pointer to BwpFlow.

Table 60-BandwidthProfilePerEquivalenceClassName Data Type Attributes

13.3 ClassOfServiceEgressBandwidthProfile

List of pairs of the form <x,y> where x is an Class of Service Name contained in the EVC List of Class of Service Names and y is <CIR, CIRmax, ER>. Reference MEF 10.4 Section 10.11 EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute.

Attribute Name	Type	Mult.	Description
classOfServiceName	String	1	Class of Service Name.
egressBwpFlow	EgressBwpFlow	1	Pointer to EgressBwpFlow.

Table 61-ClassOfServiceEgressBandwidthProfile Data Type Attributes

13.4 EgressBwpFlow

Bandwidth Profile for egress interfaces that support the set of cir, cirMax, rank and envelope.

Attribute Name	Type	Mult.	Description
cir	NaturalNumber	1	Attribute represents Committed Information Rate. When added to unused committed bandwidth provided from higher-ranked Bandwidth Profile Flows (depending on the value of CF for the higher-ranked Bandwidth Profile Flows), limits the average rate in bits per second at which Service Frames for this Bandwidth Profile Flow can be declared Green.
cirMax	NaturalNumber	1	Attribute represents Maximum Committed Information Rate. Limits the average rate in bits per second at which Service Frames for this Bandwidth Profile Flow can be declared Green (regardless of unused committed bandwidth from higher-ranked Bandwidth Profile Flows).
rank	PositiveInteger	1	This attribute denotes the rank of the bandwidth profile flow in the envelope.
envelope	Envelope	1	Pointer to Envelope.

Table 62-EgressBwpFlow Data Type Attributes

13.5 FrameDisposition

Data type representing service frame disposition for unicast, multicast and broadcast frame types.

Attribute Name	Type	Mult.	Description
unicast	FrameDelivery	1	Unicast frame disposition.
multicast	FrameDelivery	1	Multicast frame disposition.
broadcast	FrameDelivery	1	Broadcast frame disposition.

Table 63-FrameDisposition Data Type Attributes

13.6 OvcEndPointMap

The information that determines which EI Frames are mapped to the OVC End Point. Reference MEF 26.2 Section 16.5 OVC End Point Map Service Attribute. The OvcEndPointMap associates exactly one of the four OvcEndPoint Map types.

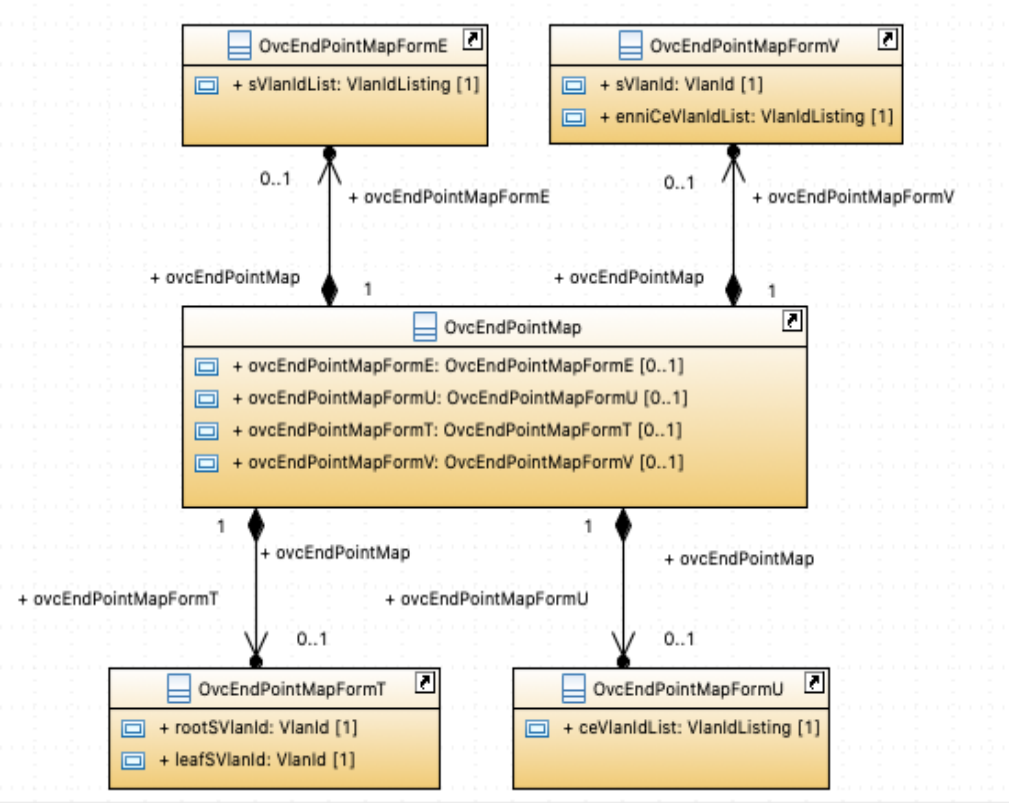

Figure 10-OvcEndPointMap and related Data Types

Attribute Name	Type	Mult.	Description
ovcEndPointMapFormE	OvcEndPointMapFormE	0..1	Pointer to OVC End Point Map Form E.
ovcEndPointMapFormU	OvcEndPointMapFormU	0..1	Pointer to OVC End Point Map Form U.
ovcEndPointMapFormT	OvcEndPointMapFormT	0..1	Pointer to OVC End Point Map Form T.
ovcEndPointMapFormV	OvcEndPointMapFormV	0..1	Pointer to OVC End Point Map Form V.

Table 64-OvcEndPointMap Data Type Attributes

13.6.1 OvcEndPointMapFormE

The value of an End Point Map of Form E (E for ENNI) consists of a list of one or more S-VLAN ID values. An S-Tagged ENNI Frame whose S-VLAN ID values matches an entry in the list maps to the OVC End Point.

Attribute Name	Type	Mult.	Description
sVlanIdList	VlanIdListing	1	List of one or more S-VLAN ID values. Reference MEF 26.2 Section 16.5.1 OVC End Point Map Form E.

Table 65-OvcEndPointMapFormE Data Type Attributes

13.6.2 OvcEndPointMapFormT

The value of an OVC End Point Map of Form T (T for Trunk) consists of a pair of S-VLAN ID values <r,l>. r is called the Root S-VLAN ID value and l is called the Leaf S-VLAN ID value. An S-Tagged ENNI Frame whose S-VLAN ID value matches one of the two S-VLAN ID values in the OVC End Point Map Form T maps to the OVC End Point. Note that Form T differs from Form E because it distinguishes the role of each S-VLAN ID value.

Attribute Name	Type	Mult.	Description
rootSVlanId	VlanId	1	Root S-VLAN ID value. Reference MEF 26.2 Section 16.5.2 OVC End Point Map Form T.
leafSVlanId	VlanId	1	Leaf S-VLAN ID value. Reference MEF 26.2 Section 16.5.2 OVC End Point Map Form T.

Table 66-OvcEndPointMapFormT Data Type Attributes

13.6.3 OvcEndPointMapFormU

The value of the OVC End Point Map of Form U (U for UNI) is a list of one or more CE-VLAN ID values. A Service Frame is mapped to the OVC End Point if the CE-VLAN ID value of the Service Frame is in the list.

Attribute Name	Type	Mult.	Description
ceVlanIdList	VlanIdListing	1	List of one or more CE-VLAN ID values. Reference MEF 26.2 Section 16.5.4 OVC End Point Map Form U.

Table 67-OvcEndPointMapFormU Data Type Attributes

13.6.4 OvcEndPointMapFormV

The value of an OVC End Point Map of Form V (V for VUNI) consists of one S-VLAN ID value and a list of one or more ENNI CE-VLAN ID values. An S-Tagged ENNI Frame whose S-VLAN ID value matches the S-VLAN ID value in the map and whose ENNI CE-VLAN ID value matches one of the ENNI CE-VLAN ID values in the map, maps to the OVC End Point.

Attribute Name	Type	Mult.	Description
enniCeVlanIdList	VlanIdListing	1	List of one or more ENNI CE-VLAN ID values. Reference MEF 26.2 Section OVC End Point Map Form V.
sVlanId	VlanId	1	S-VLAN ID value. Reference MEF 26.2 Section 16.5.3 OVC End Point Map Form V.

Table 68-OvcEndPointMapFormV Data Type Attributes

13.7 SubscriberUniPhysicalLinks

The value of the Subscriber UNI List of Physical Links Service Attribute is a list of 4-tuples (which may be empty if Virtual UNI is used) of the form <id,pl,fs,pt>, with one list item for each physical link. The The value of id is an identifier for the physical link. The value of pl specifies a physical layer. fs indicates if synchronous Ethernet is used on the physical link corresponding to the 4-tuple and has the value either Enabled or Disabled. The value of pt indicates if the Precision Time Protocol is used on the physical link corresponding to the 4-tuple and has the value either Enabled or Disabled. Reference MEF 10.4 Section 9.4 Subscriber UNI List of Physical Links Service Attribute.

Attribute Name	Type	Mult.	Description
id	Identifier45	1	Identifier of the physical link.
physicalLink	PhysicalLayer	1	Physical layer type.
synchronousEthernet	EnabledDisabled	1	Synchronous Ethernet capable.
precisionTiming	EnabledDisabled	1	Using Precision Timing.

Table 69-SubscriberUniPhysicalLinks Data Type Attributes

13.8 Time

A data type used to represent time in various units.

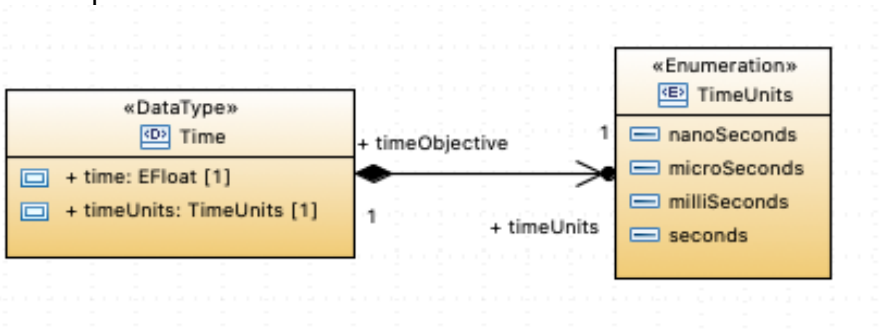

Figure 11-Time Data Type

Attribute Name	Type	Mult.	Description
time	EFloat	1	Time as a float value.
timeUnits	TimeUnits	1	Time units as a set of enumerations.

Table 70-Time Data Type Attributes

13.9 VirtualFrameMap

The details of the Virtual Map (Frame) are currently beyond the scope of MEF 10.4. However, there are two requirements. The Virtual Map is a map from the set of Virtual Frames that cross the UNI to a sequence of pairs of the form <s,t> where s is a standard Ethernet frame and t is the arrival time at the UNI for all bits in s. Reference MEF 10.4 Section 9.2 [R56] and [R57]. The Virtual Map is modelled as an abstract class which can be sub-classed for specific cases of a particular type of Virtual Frame.

14 OVC and EVC Enumerations Definitions

The following section details the set of Enumerations used in support of the MSM Carrier Ethernet model.

14.1 DscpValue

Enumeration used to indicate the set of DSCP values as well as groups of values such as list such as NO_IP_PACKET and ALL_VALUES.

Contains Enumeration Literals:

- NO_IP_PACKET:
  - EI Frame does not contain an IP Packet.
- ALL_VALUES:
  - All DSCP values 0-63, and EI Frames that do not contain an IP Packet.
- 0-63
  - Available DSCP values.

14.2 EnabledDisabled

Enumeration used to indicate state as ENABLED or DISABLED.

Contains Enumeration Literals:

- ENABLED:
  - Enumeration representing an ENABLED state.
- DISABLED:
  - Enumeration representing a DISABLED state.

14.3 Instantiation

Enumeration representing the instantiation of the UNI.

Contains Enumeration Literals:

- PHYSICAL:
  - Enumeration representing a Physical type.
- VIRTUAL:
  - Enumeration representing a Virtual type.

14.4 LinkAggregation

Data type representing Link Aggregation types as used in MEF 10.4 and MEF 26.2.

Contains Enumeration Literals:

- NONE:
  - No Link Aggregation is used.
- 2_LINK_ACTIVE_STANDBY:
  - The SP Network or Operator Network uses Link Aggregation as in either Clause 5.6.1 of IEEE Std 802.1AX- 2008 [2] or Clause 6.7.1 of IEEE Std 802.1AX-2014

with one Link Aggregation Group (LAG) across the links supporting the EI such that all EI Frames are carried on only one of the two links when both links are operational.

- ALL_ACTIVE:
  - The SP Network uses Link Aggregation as specified in Clause 5.3 of IEEE Std 802.1AX-2014, including the use of the version 2 LACPDUs as specified in Clause 5.3.1h of IEEE Std 802.1AZ-2014, with one Link Aggregation Group (LAG) across the links.
- OTHER:
  - The Operator/Subscriber/Service Provider agree on another resiliency mechanism.

14.5 MegLevel

Enumeration representing Maintenance Entity Group Level.
Contains Enumeration Literals:

- 0:
- 1:
- 2:
- 3:
- 4:
- 5:
- 6:
- 7:

14.6 OvcEndPointExternalInterfaceType

Enumeration for an OVC End Point Type.
Contains Enumeration Literals:

- UNI:
  - Enumeration representing a UNI.
- ENNI:
  - Enumeration representing a ENNI.

14.7 SVlanIdControl

When the value is Full, the Operator can support only a single SP/SO at the ENNI.
Contains Enumeration Literals:

- FULL:
  - Enumeration indicating value of FULL.
- PARTIAL:
  - Enumeration indication value of PARTIAL.

14.8 TimeUnits

Enumeration representing time units.
Contains Enumeration Literals:

- nanoSeconds:
- microSeconds:

- milliSeconds:
- seconds:

15 References

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