



**Working Draft**

**MEF W101 v0.3**

# **LSO Carrier Ethernet Service Schemas and Developer Guide**

**October 2024**

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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.

*Editor Note 1: This list will be finalized before Letter Ballot. Any member that comments in at least one CfC is eligible to be included by opting in before the Letter Ballot is initiated. Note it is the MEF member that is listed here (typically a company or organization), not their individual representatives.*

## 2 Abstract

This MEF Standard consisting of this Developer Guide and its associated software artifacts (JSON/YAML Schemas) defines and describes the service-specific payload for the LSO Legato API for a set of Service Functions – specifically, Service Order and Service Inventory, for Subscriber Ethernet and Operator Ethernet Services. The document starts with an overview of LSO Legato and Subscriber and Operator Ethernet Services. It then provides a basic information model for the MEF Ethernet Service Attributes. The final sections describe the Data Model focused on the JSON/YAML Schemas associated with this specification.

This document can be thought of as a developer's guide for the Subscriber and Operator Ethernet Services Data Model and the schemas provided that embody the Data Model. MEF Services are described by a set of Service Attributes. Each Service Attribute describes an aspect of the service that is agreed between the provider and the user of the service. The document that describes the Service Attributes for Subscriber Ethernet Services is MEF 10.4 [6] and Operator Ethernet Services is MEF 26.2 [8]. The corresponding Information Model representing these resources and attributes is MEF 7.4 [5].

This Standard normatively incorporates the following files by reference as if they were part of this document, from GitHub repository [https://github.com/MEF-GIT/MEF-LSO/tree/develop\\_ce/schema/serviceSchema/ce](https://github.com/MEF-GIT/MEF-LSO/tree/develop_ce/schema/serviceSchema/ce).

### 3 Terminology and Abbreviations

This section defines the terms used in this document. In many cases, the normative definitions of 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. If the reference includes an asterisk (\*), the definition has been adapted from the original.

Term	Definition	Reference
Business Applications	The Service Provider functionality supporting Business Management Layer functionality (e.g., product catalog, order management, billing, relationship management, etc.)	MEF 55.1 [10]
BUS	See Business Applications	MEF 55.1 [10]
CEN	Carrier Ethernet Network	MEF 12.2 [7]
Carrier Ethernet Network	A network from a Service Provider or network Operator supporting the MEF service and architecture models.	MEF 12.2 [7]
Data Model	A representation of concepts of interest to an environment in a form that is dependent on data repository, data definition language, query language, implementation language, and/or protocol (typically, but not necessarily, all five).	IETF RFC 3444 [3]
ENNI	External Network Network Interface	MEF 26.2 [8]
External Network Network Interface	A reference point representing the boundary between two Operator Carrier Ethernet Networks that are operated as separate administrative domains.	MEF 26.2 [8]
Ethernet Service	A connectivity service that carries Ethernet Frames irrespective of the underlying technology and that is specified using Service Attributes as defined in an MEF Specification.	MEF 10.4 [6]
Information Model	A representation of concepts of interest to an environment in a form that is independent of data repository, data definition language, query language, implementation language, and protocol.	IETF RFC 3444 [3]

Term	Definition	Reference
Order	One or more Service Order Items formulated into a fulfillment request made by a Client to a Server.	This document (derived from MEF 57.2)
Service Provider	In the context of this document, a Service Provider is an Ethernet Service Provider. In this document, we use Service Provider to include Super Operator as specified in MEF 26.2 (also referred to as SP/SO).	This Document
Subscriber Ethernet Service	In the context of this document, an Ethernet Service conforming to one of the six Subscriber Ethernet Services defined in MEF 6.3.	This Document

**Table 1-Terminology and Abbreviations**



## 4 Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 (RFC 2119 [2], RFC 8174 [4]) when, and only when, they appear in all capitals, as shown here. All key words must be in bold text.

Items that are **REQUIRED** (contain the words **MUST** or **MUST NOT**) are labeled as **[Rx]** for required. Items that are **RECOMMENDED** (contain the words **SHOULD** or **SHOULD NOT**) are labeled as **[Dx]** for desirable.

Items that are **OPTIONAL** (contain the words **MAY** or **OPTIONAL**) are labeled as **[Ox]** for optional.

## 5 Numerical Prefixes

This document uses the prefix notation to indicate multiplier values as shown in Table 2-Numerical Prefix Conventions.

Decimal		Binary	
Symbol	Value	Symbol	Value
k	$10^3$	Ki	$2^{10}$
M	$10^6$	Mi	$2^{20}$
G	$10^9$	Gi	$2^{30}$
T	$10^{12}$	Ti	$2^{40}$
P	$10^{15}$	Pi	$2^{50}$
E	$10^{18}$	Ei	$2^{60}$
Z	$10^{21}$	Zi	$2^{70}$
Y	$10^{24}$	Yi	$2^{80}$

**Table 2-Numerical Prefix Conventions**

## 6 Introduction

LSO Legato provides a programmatic interface for establishing automated exchange of information (i.e., Service Order, Service Inventory) between a Business Application and Service Orchestration Function. These APIs are hierarchically structure. The outer-most structure includes information relating to the access method (e.g., REST), next is information relating to the function being requested (e.g., Service Order or Inventory, etc.) and the inner-most structure contains information relating to the specific service, for example Carrier Ethernet Service.

The specific types of Ethernet Services are Subscriber and Operator Ethernet Services. Subscriber Ethernet Services are requested between a Customer and a Service Provider or a Service Provider and a Partner. Operator Ethernet Services are requested between a Service Provider (SP) and a Partner. The Service Attributes for Subscriber and Operator Ethernet Services are defined in MEF 10.4 [6] and MEF 26.2 [8] respectively. The corresponding Information Model that is used as a reference for JSON/YAML Subscriber and Operator Ethernet Services schemas is MEF 7.4 [5].

This specification is accompanied by a Data Model for Subscriber and Operator IP Services instantiated as a set of YAML schemas that can be used within the Legato API to perform Service Order, and request an Inventory for the Subscriber and Operator IP Services consisting of:

The Data Model for Subscriber Ethernet Services includes:

- EVC: An EVC is an association of two or more EVC End Points (EVC EPs).
- EVC End Point: An EVC End Point is a construct at a UNI that selects a subset of the Service Frames that pass over the UNI. An EVC End Point represents the logical attachment of an EVC to a UNI.
- Subscriber UNI: A construct that represents the Ethernet User Network Interface demarcation point between the responsibility of the Service Provider and the responsibility of the Subscriber.

The Data Model for Operator Ethernet Services includes:

- OVC: The Operator Virtual Connection is the building block for constructing an EVC spanning multiple Operator CENs. An OVC is an association of OVC End Points.
- OVC End Point: A logical entity at a given External Interface that is associated with a distinct set of frames passing over that External Interface. An OVC End Point represents the logical attachment of an OVC to an External Interface (a UNI or ENNI).
- Operator UNI: UNI used in Operator Ethernet Service solution where attributes are agreed to by the Service Provider/Super Operator and the Operator.
- Virtual UNI: An instantiation in one Operator CEN of functions that perform a portion of the Service Attributes observable at a UNI supported by a different Operator CEN.

- ENNI: A reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains.
- ENNI Service: A construct that 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 document contains the following sections:

An overview of LSO Legato (Section 6)

An overview of IP Services Model (Section 7)

An overview of Subscriber Ethernet Services (Section 8)

An overview of Operator Ethernet Services (Section 9)

Subscriber and Operator Service Superclasses (Section 10)

Data Model Design Principles and Assumptions (Section 11)

Data Modes for Carrier Ethernet Services (Section 12)

Relationship between the Entities (Section 13)

Subscriber Ethernet Service Data Model (Section 14)

Operator Ethernet Service Data Model (Section 15)

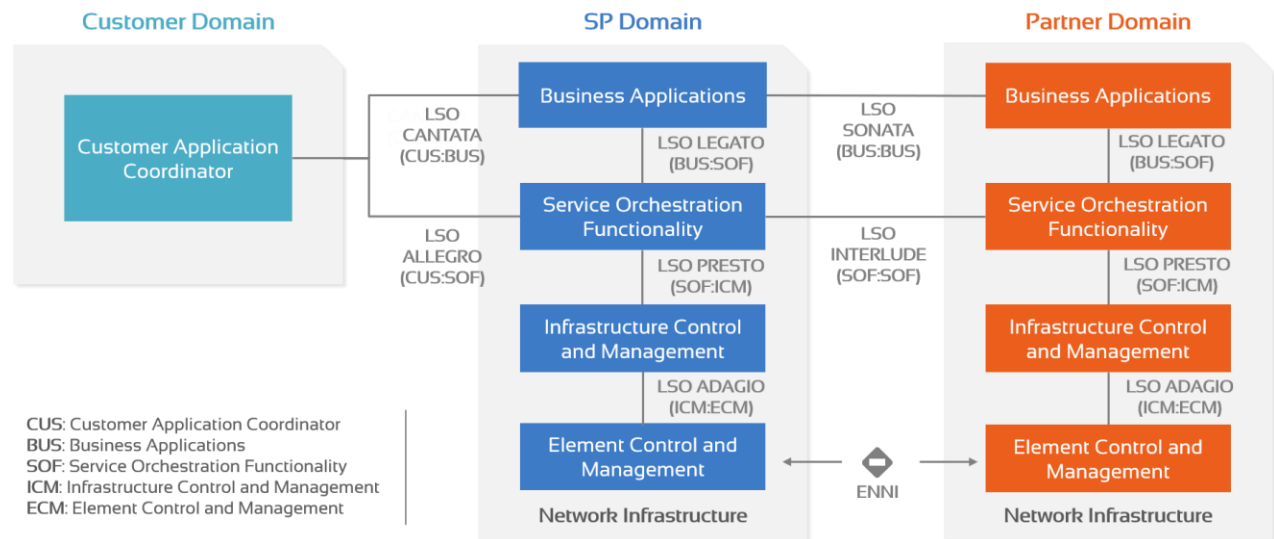
Common Classes and Types (Section 16)

Carrier Ethernet Bandwidth Profile and Bandwidth Profile Envelope (Section 17)

Carrier Ethernet SLS (Section 18)

## 7 Overview of LSO Legato

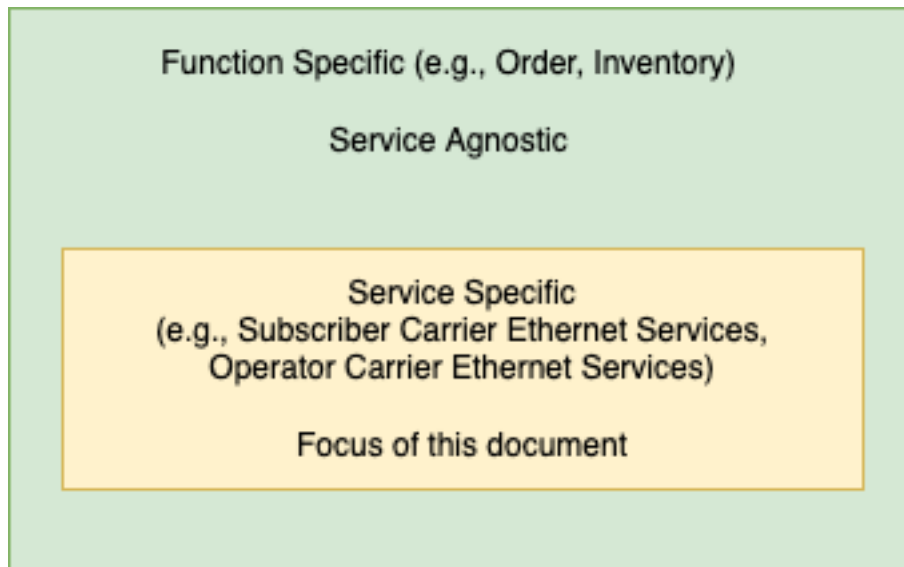
MEF 55.1 [10] describes the Reference Architecture for Lifecycle Service Orchestration (LSO) of MEF-defined connectivity services. MEF 55.1 [10] defines seven LSO Reference Points that are abstract interconnection points between different domains - either within the service provider domain (intra-domain) or between service provider and other business entities (inter-domain). One of these LSO Reference Points is LSO Legato which defines the abstract boundary point between a Service Provider's or Partner's Business Application (BA) and Service Orchestration Functionality (SOF) for providing connectivity services provisioning.



**Figure 1-LSO Reference Diagram**

The access to automated service provisioning functionality is provided using the Service Provisioning API at LSO Legato. LSO Legato provides a suite of APIs for ordering, inventory, etc. which are standardized by MEF as LSO Legato APIs, and which are made available by MEF in a series of releases of the LSO Legato SDK.

The LSO Legato APIs comprise two parts: one is the service-independent functionality, or Basic API Structure, and the second is the service-specific payload, or Information Payload, as shown in diagram below.



**Figure 2-LSO Legato API Structure**

This document defines the service-specific payload, shown as YAML/JSON Data Model in the figure above, specifically for a MEF 3.0 Subscriber and Operator Ethernet Services as defined in MEF 10.4 [6] and MEF 26.2 [8] respectively. Both Subscriber Ethernet and Operator Ethernet Information Models are defined in MEF 7.4 [5]. The envelope resources of the API and association to specific payload resources will be discussed in detail later in this document.

## 8 Overview of Ethernet Services Model

The Carrier Ethernet Services model has nine main classes, CarrierEthernetSvc, CarrierEthernetSvcEndPoint, CarrierEthernetSubscriberUni, CarrierEthernetOvc, CarrierEthernetOvcEndPoint, CarrierEthernetOperatorUni, CarrierEthernetEnni, CarrierEthernetEnniService and CarrierEthernetVuni. An Ethernet Service is defined as either a Subscriber Ethernet Service or an Operator Ethernet Service.

A Subscriber Ethernet Service is an Ethernet Service that is provided by a Service Provider to two or more UNIs. In some Ethernet Services the Subscriber will have locations that are not all served by a single CEN Operator. Specifically, to support all Subscriber's UNIs one or more CEN Operators are required. This is where an Operator Ethernet Service is used.

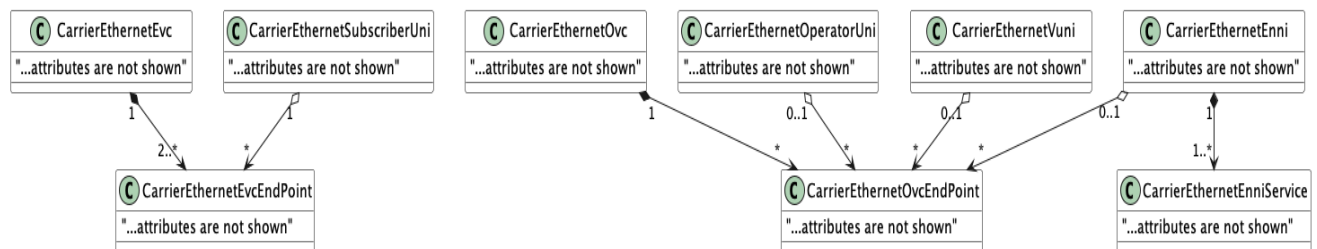


Figure 3- Ethernet Service Model Overview

## 9 Overview of Subscriber Ethernet Services

This specification describes a data model for MEF-defined Subscriber Ethernet Services. A Subscriber Ethernet Service is an Ethernet Service provided to an end user (the Subscriber) by a Service Provider. There is no restriction on the type of organization that can act as a Subscriber; for example, a Subscriber can be an enterprise, a mobile operator, an IT system integrator, a government department, etc. At its most basic, a Subscriber Ethernet Service provides connectivity for Ethernet frames between different parts of the Subscriber's network (usually at different physical locations) or between the Subscriber's network and an external network. The subsequent sub-sections provide background on the set of objects that are associated with a Subscriber Ethernet Service.

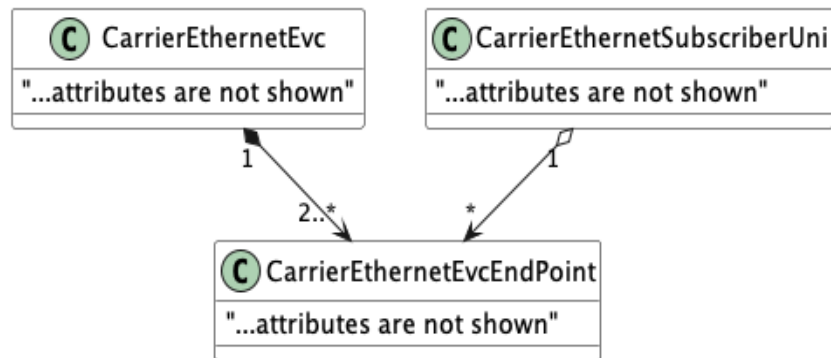


Figure 4-Subscriber Ethernet Service Model

### 9.1 Carrier Ethernet Subscriber UNI

A User Network Interface (UNI) is the demarcation point between the responsibility of the Service Provider (SP) and the responsibility of the Subscriber. A Subscriber is connected to the SP at one or more UNIs.

### 9.2 Carrier Ethernet EVC and Ethernet Virtual Connection End Points

A fundamental aspect of Subscriber Ethernet Services is the Ethernet Virtual Connection (EVC) is an association of two or more EVC End Points (EVC Eps). An EVC EP is a construct at a UNI that selects a subset of the Service Frames that pass over the UNI. The subset of Service Frames is specified via the value of the EVC EP Map Service Attributes.



## 10 Overview of Operator Ethernet Services

This specification describes a data model for MEF-defined Carrier Ethernet Operator Services. When a Service Provider provides an end-to-end Subscriber IP Service to a Subscriber, they might not be able to implement the entire service using their own network - for instance, one of the Subscriber UNIs might not be in a geographic region where the Service Provider does not operate. In this case, the Service Provider must partner with another Operator who can reach that UNI. The Operator provides Carrier Ethernet connectivity service between the UNI and a point where they can interconnect with the SP's network as described in [8].

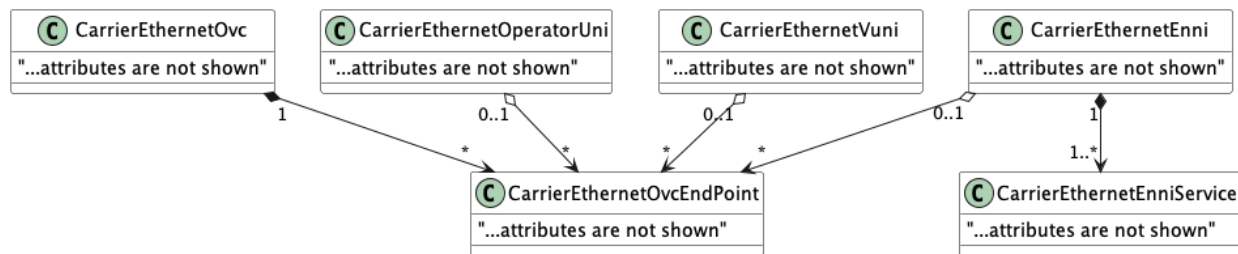


Figure 5-Operator Ethernet Service Model

### 10.1 Carrier Ethernet Operator UNI

A Carrier Ethernet Operator UNI the supporting interface between a customer and SP/SO when the SP/SO is serving Carrier Ethernet Operator Services. The Carrier Ethernet Operator UNI is different from the Carrier Ethernet Subscriber UNI. They are different because the value of each Operator UNI Service Attribute is agreed by the SP/SO and the Operator while the value of each Subscriber UNI Service Attribute is agreed to by the Subscriber and Service Provider.

### 10.2 Carrier Ethernet OVC and OVC End Points

The Operator Virtual Connection (OVC) is the building block for constructing an EVC spanning multiple Operator CENs. In the same way that an EVC defines an association of UNIs, an OVC is and association of OVC End Points. An OVC End Point is a logical entity at a given External Interface that is associated with a distinct set of frames passing over that External Interface. An OVC End Point represents the logical attachment of an OVC to an External Interface (a UNI or ENNI) [8].

### 10.3 Carrier Ethernet ENNI and ENNI Service

An External Network Network Interface (ENNI) is the demarcation point between the responsibility of one Operator and another - in other words, it is the interface where two Operators interconnect. For each instance of an ENNI, there are 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 per [8]. Each such value is agreed to by the SP/SO and the Operator.

## 10.4 Carrier Ethernet VUNI

A Virtual UNI (VUNI) is the instantiation in one Operator CEN of functions that perform a portion of the Service Attributes observable at a UNI supported a different Operator CEN. Each VUNI is paired with a UNI, called a Remote UNI (RUNI) that is supported by an Operator CEN other than the Operator CEN containing the VUNI [8].

## 11 Data Model Design Principles and Assumptions

A Service Attribute for a Service can have a value that is a simple datatype such as an integer or string (or list of simple datatypes) or a value that is an object with multiple properties or a composition of objects. Within this document each simple value (integer, string, Boolean, etc.) is referred to as a Service-Specific Attribute. A Service-Specific Attribute could be a Service Attribute (in the case where the Service Attribute itself has a simple type) or it could be a parameter within a Service Attribute (if the Service Attribute is a structured object or a composition of such objects). The classification for each Service-Specific Attribute may be different across Service Function, Service Action, and Service Offering.

The Carrier Ethernet Service data model supports both INSTALL and CHANGE actions for Service Order for EVC, OVC, Subscriber UNI, Operator UNI, EVC End Point, OVC End Point, and ENNI. The Carrier Ethernet Service data model supports the RETRIEVE action for Inventory for all Service Order components.

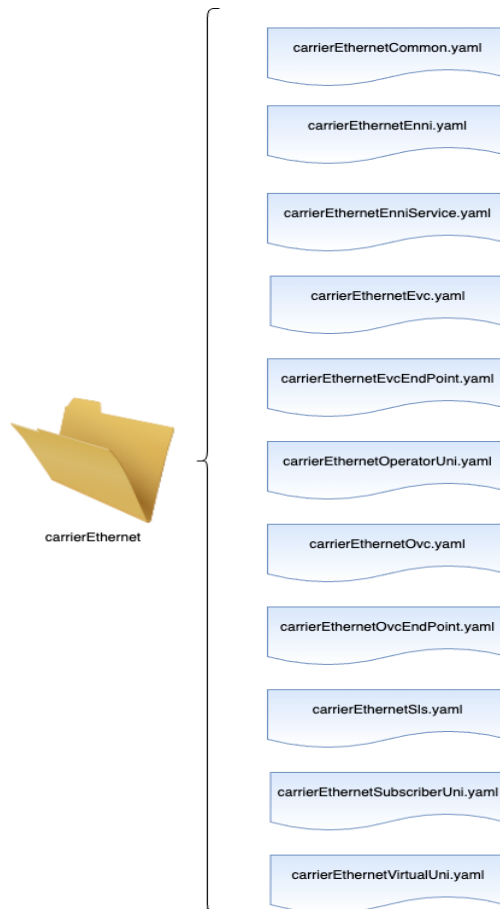
The location and physical layer of a UNI Access Link Trunk or ENNI Link cannot be changed once it is ordered; instead, this is handled as an installation (UNI Access Link Trunk or ENNI Link at new location) and disconnect (UNI Access Link Trunk or ENNI Link at previous location), as there is often a requirement for a smooth transition with minimum downtime.

## 12 Data Models for Carrier Ethernet Services

The data models for the Carrier Ethernet Service configuration are expressed as a set of JSON schemas based on JSON schema draft 7 and encoded in YAML. These schemas accompany this document. This section explains the organization and structure of these schemas.

### 12.1 Organization and Structure of the Schemas

The schemas are organized into a file structure as shown in Figure 6.



**Figure 6-Schema Files Organization**

Both Subscriber and Operator Carrier Ethernet Service schemas are provided in the same directory. There is one file that provides common resources that are shared with Subscriber and Operator service:

- carrierEthernet/carrierEthernetCommon.yaml – provides classes shared among all Carrier Ethernet services.

These common classes are referenced in the relevant service component schema files. For example, the `CarrierEthernetService.frameDisposition` attribute specified in `carrierEthernetCommon.yaml` file refers to common `FrameDisposition` definition:

```
frameDisposition:
```

```
$ref: "#/definitions/FrameDisposition"
```

### 12.1.1 Naming Conventions

In the schemas, class and type names are UpperCamelCase and Service Attribute/property names are lowerCamelCase.

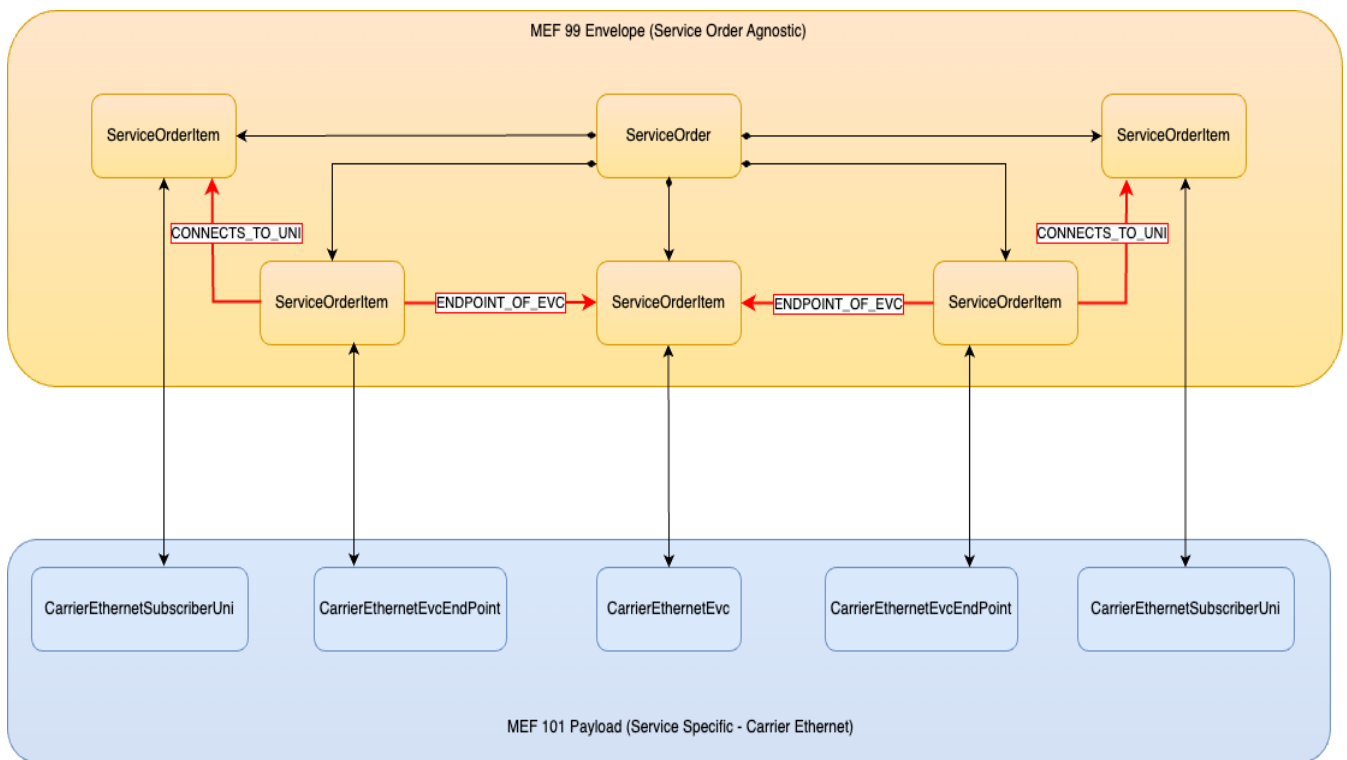
## 13 Relationships Between Entities

This section describes the constraints and relationships between the primary Service Order Items for both Subscriber (EVC, UNI and EVC End Points) and Operator Ethernet Services (OVC, UNI, ENNI and OVC End Points).

The Subscriber Ethernet Service is associated with two or more UNIs each associated with an EVC End Point and End Points associated with EVC. The Operator Ethernet Service is one UNI and one ENNI associated with an OVC End Point and End Points associated with OVC.

### 13.1 Subscriber Ethernet Services Relationships Between Entities

A MEF Service Order for Subscriber Ethernet Service has one or more Service Order Items which are components of the Service-agnostic envelope part of the MEF 99 API[11]. Each Service Order Item is associated to the Service-specific payload components (CarrierEthernetEvc, CarrierEthernetEvcEndPoint and CarrierEthernetSubscriberUni). The relationships between the envelope and payload components are shown in Figure 7.



**Figure 7-Subscriber Ethernet Service Order API Associations**

#	Source Service	Relationship Type	Cardinality	Target Service
1	CarrierEthernetEvcEndPoint	ENDPOINT_OF_EVC ROOT_ENDPOINT_OF_EVC LEAF_ENDPOINT_OF_EVC	1	CarrierEthernetEvc



2	CarrierEthernetSvcEndPoint	CONNECTS_TO_UNI	1	CarrierEthernetSubscriberUni
---	----------------------------	-----------------	---	------------------------------

**Table 3-Service Relationship Roles Subscriber Carrier Ethernet**

- [R1]** For a service listed in Source Service column in Table 3, the Relationship Type field of the Service Order Item Relationship types **MUST** contain one the corresponding values shown in the Relationship Type column.
- [R2]** For Order, the relationships to Carrier Ethernet Subscriber UNIs **MUST** be specified for every INSTALL of, or CHANGE to an EVC.
- [R3]** For Order, the relationships to Carrier Ethernet Subscriber UNIs **MUST** be specified for every INSTALL of, or CHANGE to an EVC End Point.
- [R4]** For an EVC service, the relationship to a UNI **MUST** reference a CarrierEthernetSubscriberUni Order Item.
- [R5]** For a CHANGE to an EVC Service, the relationship to the Subscriber UNI **MUST NOT** be changed from the value present in the Service Inventory.

[R5] indicates that once an EVC and EVC End Point are associated with a Subscriber UNI, it cannot be associated with a different Subscriber UNI.

A UNI and an EVC End Point may be included in the same Service Order as the EVC. The UNI is associated with a specific INSTALL\_LOCATION, which is required at INSTALL and CHANGE. Once a UNI is associated with a specific location, the INSTALL\_LOCATION cannot be changed and as, the same INSTALL\_LOCATION value must be specified for every CHANGE.

The install location is captured in the service-agnostic part of the Service Order API. The value in the Place Relationship Role column in the table below is used in the *role* field of the *RelatedPlaceRefOrValue* type.

Service	Place Relationship Role	Cardinality	CHANGE
CarrierEthernetSubscriberUni	INSTALL_LOCATION	1	Must be same value as Service Inventory.

**Table 4-Place Relationship Role**

- [R6]** For a CarrierEthernetSubscriberUni, the Role field (role) of the Related Place (RelatedPlaceRefOrValue) type, **MUST** contain one of the values shown in Place Relationship Role in Table 4.
- [R7]** For Order, the Related Place (*RelatedPlaceRefOrValue*) **MUST** be specified for every INSTALL of, or CHANGE to, a CarrierEthernetSubscriberUni.
- [R8]** For a CHANGE to a CarrierEthernetSubscriberUni the Related Place **MUST NOT** be changed from the value present in the Service Inventory.

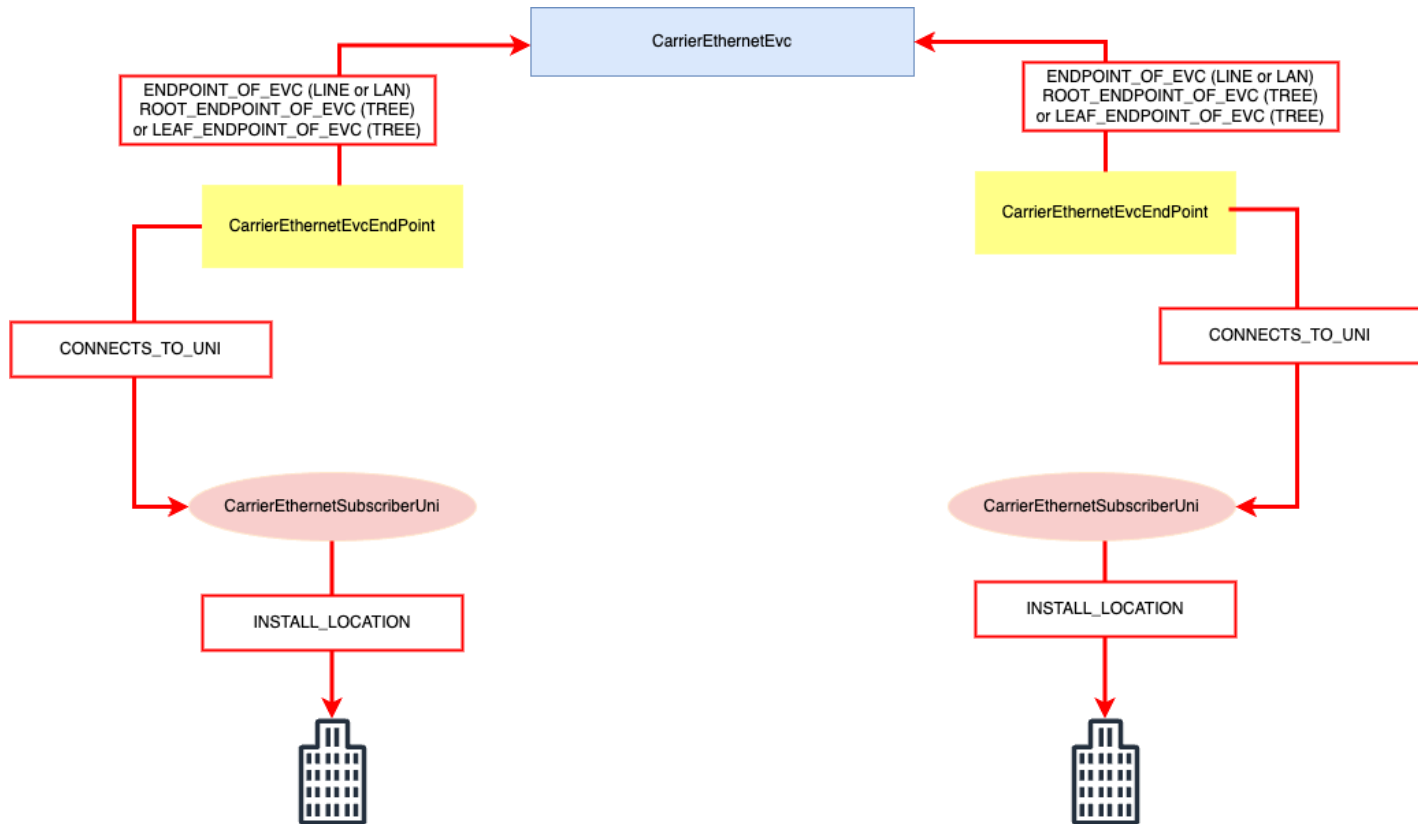


Figure 8-Subscriber Carrier Ethernet Services Entities and Relationships

### 13.2 Operator Ethernet Services Relationships Between Entities

A MEF Service Order for an Operator Ethernet Service has one or more Service Order Items which are components of the Service-agnostic envelope part of the MEF 99 API[11]. Each Service Order Item is associated to the Service-specific payload components (CarrierEthernetSvc, CarrierEthernetSvcEndPoint, CarrierEthernetOperatorUni, CarrierEthernetEnni and CarrierEthernetEnniService). The relationships between the envelope and payload components are shown in Figure 9.



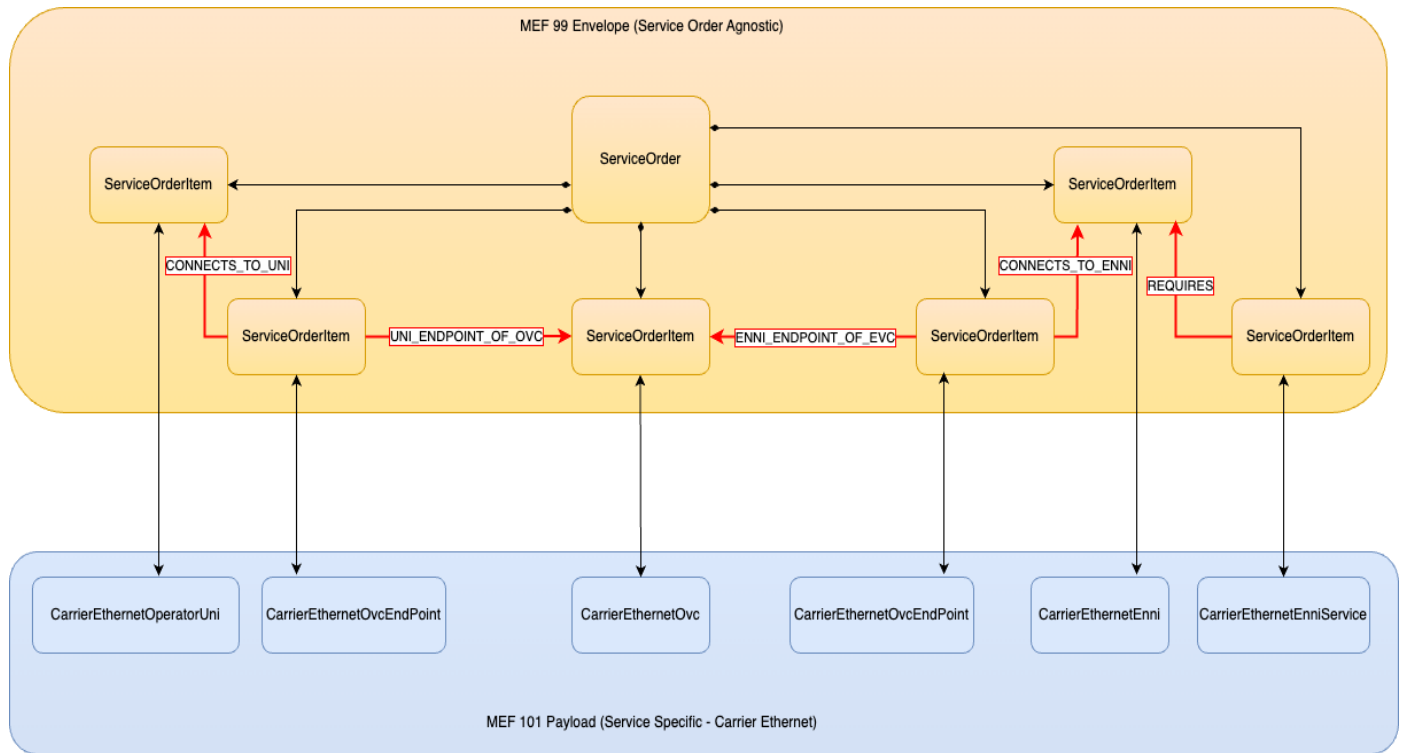


Figure 9-Operator Carrier Ethernet Service Order API Associations

#	Source Service	Relationship Type	Cardinality	Target Service
1	CarrierEthernetOvcEndPoint	UNI_ENDPOINT_OF_OVC	1	CarrierEthernetOvc
2	CarrierEthernetOvcEndPoint	ENNI_ENDPOINT_OF_OVC	1	CarrierEthernetOvc
3	CarrierEthernetOvcEndPoint	CONNECTS_TO_UNI	1	CarrierEthernetOperatorUni
4	CarrierEthernetOvcEndPoint	CONNECTS_TO_ENNI	1	CarrierEthernetEnni
5	CarrierEthernetEnni	REQUIRES	1..*	CarrierEthernetEnniService

Table 5-Service Relationship Roles Operator Carrier Ethernet

**[R9]** For a service listed in Source Service column in Table 3, the Relationship Type field of the Service Order Item Relationship types **MUST** contain one the corresponding values shown in the Relationship Type column.

**[R10]** For Order, the relationships to Carrier Ethernet Operator UNIs **MUST** be specified for every INSTALL of, or CHANGE to an OVC.

**[R11]** For Order, the ENNI **MUST** specify an ENNI Service specific to relationship between SP/SO.

**[R12]** For Order, the relationships to Carrier Ethernet ENNI **MUST** be specified for every INSTALL of, or CHANGE to an OVC.

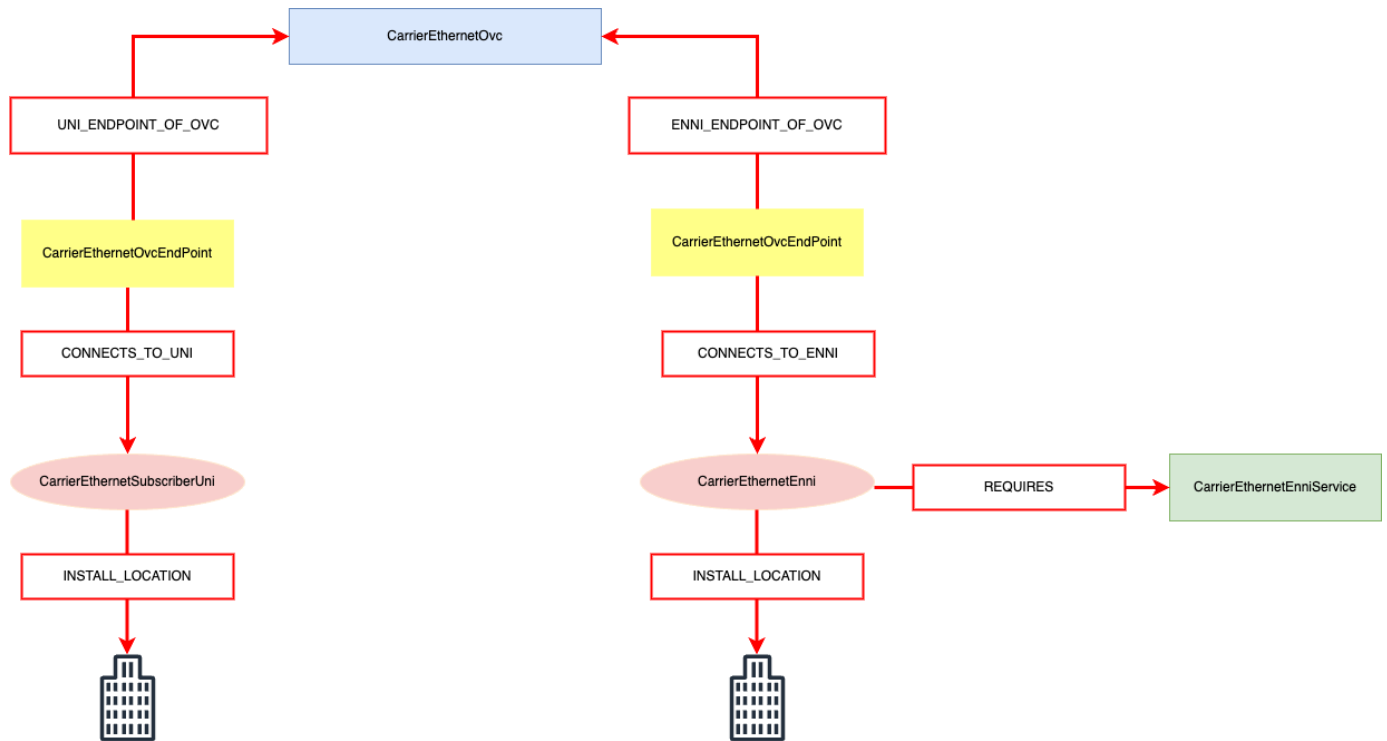
- [R13] For Order, the relationships to Carrier Ethernet Operator UNIs **MUST** be specified for every INSTALL of, or CHANGE to an OVC End Point.
- [R14] For Order, the relationships to Carrier Ethernet ENNI **MUST** be specified for every INSTALL of, or CHANGE to an OVC End Point.
- [R15] For an OVC service, the relationship to an Operator UNI **MUST** reference a CarrierEthernetOperatorUni Order Item.
- [R16] For an OVC service, the relationship to an ENNI **MUST** reference a CarrierEthernetEnni Order Item.
- [R17] For a CHANGE to an OVC Service, the relationship to the Operator UNI **MUST NOT** be changed from the value present in the Service Inventory.
- [R18] For a CHANGE to an OVC Service, the relationship to the ENNI **MUST NOT** be changed from the value present in the Service Inventory.
- [R17] indicates that once an OVC and OVC End Point are associated with an Operator UNI, it cannot be associated with a different Operator UNI.
- [R18] indicates that once an OVC and OVC End Point are associated with an ENNI, it cannot be associated with a different ENNI.
- An Operator UNI and an OVC End Point may be included in the same Service Order as the OVC. The Operator UNI is associated with a specific INSTALL\_LOCATION, which is required at INSTALL and CHANGE. Once a Operator UNI is associated with a specific location, the INSTALL\_LOCATION cannot be changed and as, the same INSTALL\_LOCATION value must be specified for every CHANGE.
- The install location is captured in the service-agnostic part of the Service Order API. The value in the Place Relationship Role column in the table below is used in the *role* field of the *RelatedPlaceRefOrValue* type.

Service	Place Relationship Role	Cardinality	CHANGE
CarrierEthernetOperatorUni	INSTALL_LOCATION	1	Must be same value as Service Inventory.
CarrierEthernetEnni	INSTALL_LOCATION	1	Must be same value as Service Inventory.

Table 6-Place Relationship Role

- [R19] For a CarrierEthernetOperatorUni, the Role field (role) of the Related Place (RelatedPlaceRefOrValue) type, **MUST** contain one of the values shown in Place Relationship Role in Table 6.
- [R20] For Order, the Related Place (*RelatedPlaceRefOrValue*) **MUST** be specified for every INSTALL of, or CHANGE to, a CarrierEthernetOperatorUni.

- [R21]** For a CHANGE to a CarrierEthernetOperatorUni the Related Place **MUST NOT** be changed from the value present in the Service Inventory.
- [R22]** For Order, the Related Place (*RelatedPlaceRefOrValue*) **MUST** be specified for every INSTALL of, or CHANGE to, a CarrierEthernetEnni.
- [R23]** For a CHANGE to a CarrierEthernetOperatorEnni the Related Place **MUST NOT** be changed from the value present in the Service Inventory.



**Figure 10-Operator Carrier Ethernet Entities and Relationships**

## 14 Subscriber Carrier Ethernet Services Data Model

A Subscriber Carrier Ethernet Service is a Carrier Ethernet Service provided to an end user (the Subscriber) by a Service Provider. There is no restriction on the type of organization that can act as a Subscriber; for example, a Subscriber can be an enterprise, a mobile operator, an IT system integrator, a government department, etc. At its most basic, a Subscriber Carrier Ethernet Service provides connectivity for Carrier Ethernet frames between different parts of the Subscriber's network (usually at different physical locations). The set of potential services supported include E-Line (Point-to-Point EVC), E-LAN (Multipoint-to-Multipoint) and E-Tree (Rooted-Multipoint EVC).

The Resources and corresponding Attributes are listed in groups:

- Subscriber Carrier Ethernet Services Resource:

- CarrierEthernetSubscriberUni

- CarrierEthernetEvcEndPoint

- CarrierEthernetEvc

### 14.1 CarrierEthernetSubscriberUni

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 [6]. The model below illustrates the payload component association to envelope components.

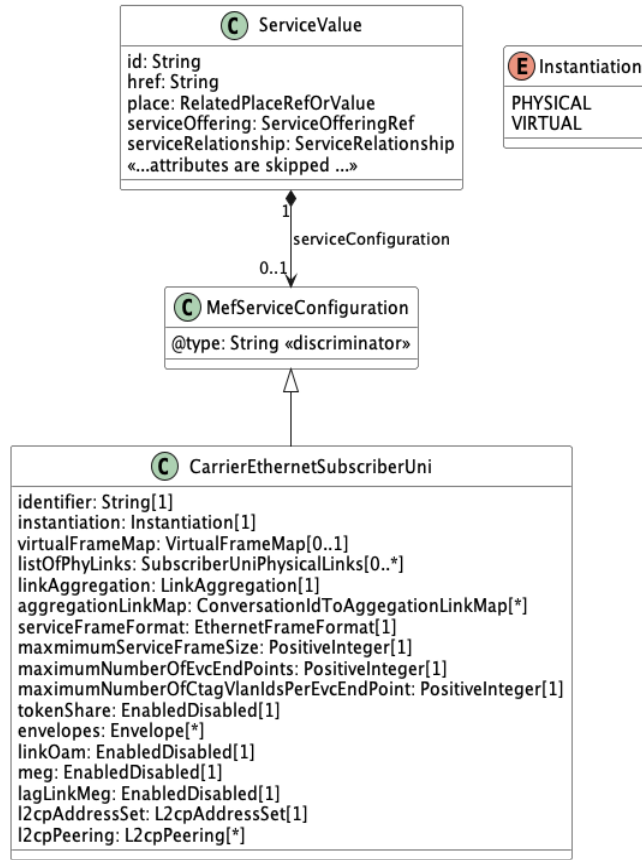


Figure 11-CarrierEthernetSubscriberUni Model

Schema File Name: carrierEthernet/carrierEthernetSubscriberUni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-subscriber-uni:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
identifier	String <i>Min length=1</i> <i>Max length=45</i> <i>Pattern=pattern:</i> <i>"[\\x20-\\x7F]+"</i>	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	Maximum number of IPv4 routes supported by the service. Reference MEF 61.1 Section 10.5 IPVC Maximum Number of IPv4 Routes Service Attribute. Absence of this attribute

Schema File Name: carrierEthernet/carrierEthernetSubscriberUni.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-subscriber-uni:v0.0.2:all			
			corresponds to a value of "Unlimited".
listOfPhysicalLinks	SubscriberUniPhysicalLinks	0..*	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 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.
linkAggregation	LinkAggregation	1	The value of the Subscriber UNI Link Aggregation Service Attribute is one of <i>2-Link Active/Standby, All Active, Other, or Not Applicable</i> . The value of this Service Attribute is dependent on the value of the Subscriber UNI Instantiation Service Attribute (Section 9.2) and the value of the Subscriber UNI List of Physical Links Service Attribute (Section 9.4). Reference MEF 10.4 Section 9.5 Subscriber UNI Link Aggregation Service Attribute.
aggregationLinkMap	ConversationIdToAggregationLinkMap	0..*	The value of the Subscriber UNI Port Conversation ID to Aggregation Link Map Service Attribute is either a Port Conversation ID to Aggregation Link Map as defined in IEEE Std 802.1AX –2014 [3] or <i>Not Applicable</i> . Reference MEF 10.4

<b>Schema File Name: carrierEthernet/carrierEthernetSubscriberUni.yaml</b> <b>\$id: urn:mef:iso:spec:service:carrier-ethernet-subscriber-uni:v0.0.2:all</b>			
			Section 9.6 Subscriber UNI Port Conversation ID to Aggregation Link Map Service Attribute.
serviceFrameFormat	EthernetFrameFormat	1	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.
maximumServiceFrameSize	Integer	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. Reference MEF 26.2 Section 14.8 Operator UNI Maximum Service Frame Size Service Attribute. Reference MEF 26.2 Section 10.3 ENNI Maximum Frame Size Multilateral Attribute.
maximumNumberOfEvcEndPoints	Integer	1	An integer greater than or equal to 1 that limits the number of EVC End Points that can be located at the UNI. Reference MEF 10.4 Section 9.9 Subscriber UNI Maximum Number of EVC EPs Service Attribute. The maximum number of OVC End Points that the Operator CEN can support at the UNI. Reference MEF 26.2 Section 14.10 Operator UNI Maximum Number of OVC End Points Service Attribute.
maximumNumberOfCtagVlanIdsPerEvcEndPoint	Integer	1	An integer greater than or equal to 1 that limits the number of C-Tag VLAN IDs that can map to each EVC End Point. Reference MEF 10.4 Section 9.10 Subscriber UNI Maximum Number of C-Tag VLAN IDs per EVC EP Service Attribute. The maximum number of CE-VLAN ID values that can be mapped to an OVC End Point by the Operator CEN at the UNI.

Schema File Name: carrierEthernet/carrierEthernetSubscriberUni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-subscriber-uni:v0.0.2:all			
			Reference MEF 26.2 Section 14.11 Operator UNI Maximum Number of CE-VLAN IDs per OVC End Point Service Attribute.
tokenShare	EnabledDisabled	1	Indicates whether Bandwidth Profile Envelopes containing more than one Bandwidth Profile Flow are supported by the Service Provider at the UNI. Reference MEF 10.4 Section 9.11 Subscriber 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 Sub-scriber UNI Envelopes Service Attribute and MEF 26.2 Section 14.19 Operator UNI Envelopes Service Attribute.
linkOam	EnabledDisabled	1	The value of the Subscriber UNI Link OAM Service Attribute is either <i>Enabled</i> or <i>Disabled</i> . The Subscriber UNI Link OAM Service Attribute controls when and how Link OAM per IEEE Std 802.3-2015 [5] is run on the physical links in the UNI.
meg	EnabledDisabled	1	The Subscriber UNI MEG Service Attribute indicates if the Service Provider has instantiated a MEG End Point at the UNI Maintenance Entity Group (MEG) Level. The value of the Subscriber UNI MEG Service Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 10.4 Section 9.14 Subscriber UNI MEG Service Attribute.
lagLinkMeg	EnabledDisabled	1	The value of the Subscriber UNI LAG Link MEG Service Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 10.4 Section 9.15 Subscriber UNI LAG Link MEG Service Attribute.



Schema File Name: carrierEthernet/carrierEthernetSubscriberUni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-subscriber-uni:v0.0.2:all			
l2cpAddressSet	L2cpAddressSet	1	The Subscriber UNI L2CP Address Set Service Attribute is defined in MEF 45.1.
l2cpPeering	L2cpPeering	0..*	The Subscriber UNI L2CP Peering Service Attribute is defined in MEF 45.1.

Table 7-CarrierEthernetSubscriberUni Service Attributes

### 14.1.1 SubscriberUniPhysicalLinks

This is a 6-tuple that specifies UNI specific link attributes (in addition to the general physical link attributes). The components of the 6-tuple are: (1) Physical layer, (2) whether Synchronous Ethernet is enabled or disabled, (3) whether PTP is used on the link, (4) UNI connector type, (6) the UNI connector gender, and (6) whether auto-negotiation is used on the link.

Schema File Name: carrierEthernet/carrierEthernetSubscriber.yaml			
Attribute Name	Type	Multiplicity	Description
physicalLink	CarrierEthernetPhysicalLink	1	Identifier of link.
synchronousEthernet	EnabledDisabled	1	Synchronous Ethernet enabled or disabled.
precisionTiming	EnabledDisabled	1	Precision timing enabled or disabled.
uniConnectorType	String Enum: <ul style="list-style-type: none"><li>• SC</li><li>• LC</li><li>• RJ45</li><li>• OTHER</li></ul>	1	This indicates the type of connector that is presented to the Subscriber.
uniConnectorGender	String Enum: <ul style="list-style-type: none"><li>• SOCKET</li><li>• PLUG</li></ul>	1	This indicates whether the Subscriber is presented with a SOCKET (common) or a PLUG (less common).
autoNegotiation	EnabledDisabled	1	IEEE Std 802.3-2018 Clause 28 and 37 - Indicates whether 802.3 autonegotiation is enabled on the UNI link.

Table 8-SubscriberUniPhysicalLinks Service Attributes

## 14.2 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 [6].

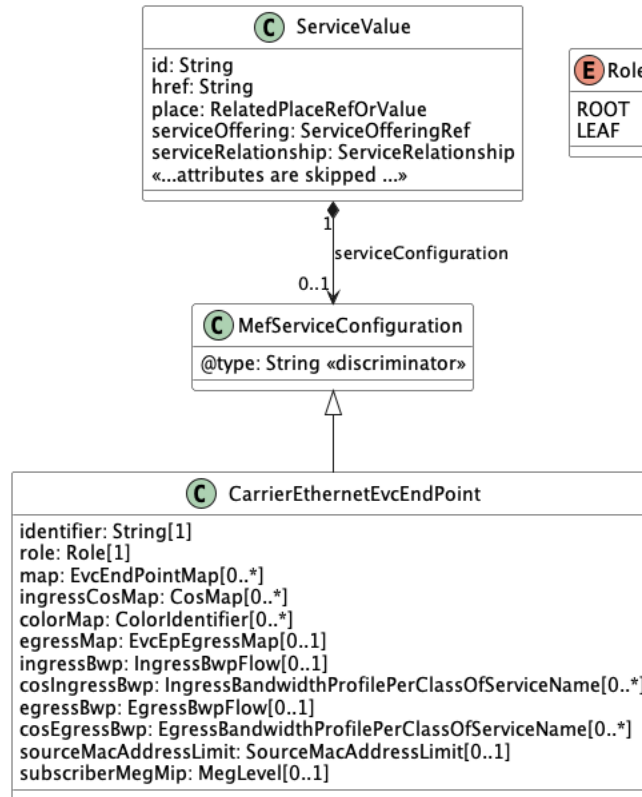


Figure 12-CarrierEthernetEvcEndPoint Model

Schema File Name: carrierEthernet/carrierEthernetEvcEndPoint.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-vc-end-point:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
identifier	String Min length=1 Max length=45 Pattern=pattern: "/[x20-\x7F]+"	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.
role	String Enum: <ul style="list-style-type: none"> <li>ROOT</li> <li>LEAF</li> </ul>	1	This enumeration is indicating how external interface frames mapped to the EVC End Point can be forwarded. Reference

Schema File Name: carrierEthernet/carrierEthernetEvcEndPoint.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-evc-end-point:v0.0.2:all			
			MEF 10.4 Section 10.3 EVC EP Role Service Attribute.
map	EvcEndPointMap	0..*	MEF 10.4 sec. 10.4 - This is specifications for which ServiceFrames are mapped to the EVC End Point. The allowed values in MEF 10.4 are ALL, LIST, and UT/PT. Since Private services must be ALL, the map isn't needed for those services, and therefore the type does not include ALL. If the type is LIST, there must be a list of VLAN IDs specified.
ingressCosMap	CosMap	0..*	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.
colorMap	ColorIdentifier	0..*	Represents the Color Identifier. The Color Identifier is a pair of the form <F,M>.  Reference MEF 10.4 Section 10.6 EVC EP Color Map Service Attribute.
egressMap	EvcEpEgressMap	0..1	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.
ingressBwp	IngressBwpFlow	0..1	Attribute used to limit the rate of Ingress Service Frames

Schema File Name: carrierEthernet/carrierEthernetEvcEndPoint.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-evc-end-point:v0.0.2:all			
			mapped to an EVC End Point at a UNI. Reference MEF 10.4 Section 10.8 EVC EP Ingress Bandwidth Profile Service Attribute.
cosIngressBwp	IngressBandwidthProfilePerClassOfServiceName	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.
egressBwp	EgressBwpFlow	0..1	The EVC EP Egress Bandwidth Profile Service Attribute is used to limit the rate of all Egress Service Frames mapped to an EVC EP at a UNI (Section 7.10.2). The value of the EVC EP Egress Bandwidth Profile Service Attribute is either <i>None</i> or the 3-tuple <CIR, CIRmax,ER>. Reference MEF 10.4 Section 10.10 EVC EP Egress Bandwidth Profile Service Attribute.
cosEgressBwp	EgressBandwidthProfilePerClassOfServiceName	0..*	The EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute is 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.
sourceMacAddressLimit	SourceMacAddressLimit	0..1	The value of the EVC EP Source MAC Address Limit Service Attribute is either <i>None</i> or the pair <N,τ> where <i>N</i> is an integer 1 and <i>τ</i> is a time duration.

Schema File Name: carrierEthernet/carrierEthernetEvcEndPoint.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-evc-end-point:v0.0.2:all			
			Reference MEF 10.4 Section 10.12 EVC EP Source MAC Address Limit Service Attribute.
subscriberMegMip	MegLevel	0..1	The value of the EVC EP Subscriber MEG MIP Service Attribute is either <i>None</i> or an integer in the range 0 – 7 that indicates the MEG Level of a Subscriber MEG MIP. Reference MEF 10.13 EVC EP Subscriber MEG MIP Service Attribute.

Table 9-CarrierEthernetEvcEndPoint Service Attributes

*NOTE: that EVC EP UNI attributes is not provided given the relationship to UNI is provided in the envelope part of API (i.e., MEF 99).*

## 14.2.1 EvcEndPointMap

MEF 10.4 sec. 10.4 - This is specifications for which Service Frames are mapped to the EVC End Point. The allowed values in MEF 10.4 are ALL, LIST, and UT/PT. Since Private services must be ALL, the map isn't needed for those services, and therefore the type does not include ALL. If the type is LIST, there must be a list of VLAN IDs specified.

Schema File Name: carrierEthernet/carrierEthernetEvcEndPoint.yaml			
Attribute Name	Type	Multiplicity	Description
vlanType	String Enum: <ul style="list-style-type: none"><li>LIST</li><li>UT/PT</li><li>ALL</li></ul>	1	An indication of the type of EVC End Point Map. If the value is UT/PT, then no additional information is required. If the value is LIST, then a list of C-VLAN ID values must be specified. If the value is ALL, then all Service Frames at the UNI where the EVC CP is located MUST be mapped to EVC EP.
vlanId	Integer	0..*	A list of VLAN IDs if the value of vlanType is "LIST" *** Validation Notes: This element must be specified if and only if EndPointMapEvc.vlanType= "LIST"

Table 10-EvcEndPointMap Service Attributes

## 14.2.2 EvcEpEgressMap

This map is a table with one entry for each CosName, that includes the CoSName, a PCP value for green frames, a PCP value for yellow frames, a DEI value for green frames and a DEI value for yellow frames. Any of the values can be DISCARD. This table is used at the UNI for EVCs.

Schema File Name: carrierEthernet/carrierEthernetEvcEndPoint.yaml			
Attribute Name	Type	Multiplicity	Description
evcEgressMapEntries	EvcEgressMapEntry	0..*	This is a table of EVC Egress Map entries. An empty list indicates a value of None. Per R140 in MEF 10.4, the value of the EVC EP Egress Map Service Attribute MUST NOT be None unless one of the conditions noted in the requirement is met.

**Table 11-EvcEpEgressMap Service Attributes**

## 14.2.3 EvcEgressMapEntry

A row in the EVC Egress Map. Contains a CoSName, PCPGreen, PCPYellow, DEIGreen, DEIYellow.

Schema File Name: carrierEthernet/carrierEthernetEvcEndPoint.yaml			
Attribute Name	Type	Multiplicity	Description
cosName	String	1	Class of Service Name.
pcpGreen	PcpOrDiscard	1	A PCP value (0-7) or DISCARD to use for Green Frames.
pcpYellow	PcpOrDiscard	1	A PCP value (0-7) or DISCARD to use for Yellow Frames.
deiGreen	DeiOrDiscard	1	A DEI value to use for Green frames. Validation Notes: This is optional ONLY if pcpGreen is set to DISCARD.
deiYellow	DeiOrDiscard	1	A DEI value to use for Green frames. Validation Notes: This is optional ONLY if pcpYellow is set to DISCARD.

**Table 12-EvcEpEgressMap Service Attributes**

## 14.3 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 [6].

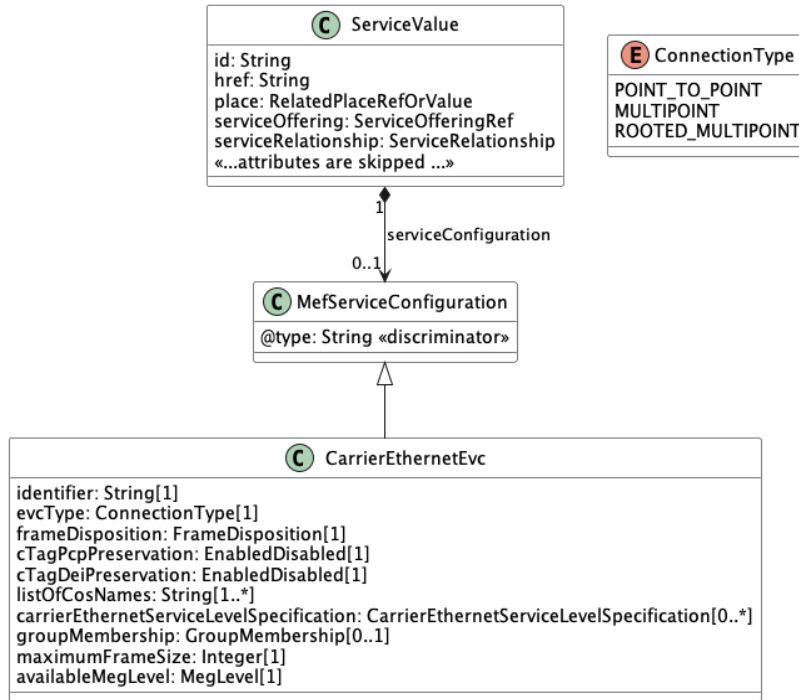


Figure 13-CarrierEthernetEvc Model

Schema File Name: carrierEthernet/carrierEthernetEvc.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-etc:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
identifier	String Min length=1 Max length=45 Pattern=pattern: "[\x20-\x7F]+"	1	Use to identify an EVC within the SP network. Reference MEF 10.4 Section 8.1 EVC ID Service Attribute.
etcType	ConnectionType	1	The value of the EVC Type Service Attribute is one of <i>Point-to-Point</i> , <i>Multipoint-to-Multipoint</i> , or <i>Rooted-Multipoint</i> . Reference MEF 10.4 Section 8.3 EVC Type Service Attribute.
frameDisposition	FrameDisposition	1	The EVC Data Service Frame Disposition Service Attribute indicates whether different types of Service Frame are to be delivered by the EVC. Reference MEF 10.4 Section 8.4 EVC Data Service Frame Disposition Service Attribute.
cTagPcpPreservation	EnabledDisabled	1	The EVC C-Tag PCP Preservation Service Attribute can be used to preserve the value of the PCP field in C-Tagged Service Frames

Schema File Name: carrierEthernet/carrierEthernetEvc.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-etc:v0.0.2:all			
			across an EVC. The value of the EVC C-Tag PCP Preservation Service Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 10.4 Section 8.5 EVC C-Tag PCP Preservation Service Attribute.
cTagDeiPreservation	EnabledDisabled	1	The EVC C-Tag DEI Preservation Service Attribute can be used to preserve the value of the DEI field in C-Tagged Service Frames across an EVC. The value of the EVC C-Tag DEI Preservation Service Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 10.4 Section 8.6 EVC C-Tag DEI Preservation Service Attribute.
listOfCosNames	String	1..*	List of Class of Service Names. Reference MEF 10.4 Section 8.7 EVC List of Class of Service Names Service Attribute.
carrierEthernetServiceLevelSpecification	CarrierEthernetServiceLevelSpecification	0..*	The EVC Service Level Specification Service Attribute (SLS) is the technical details of the service level, in terms of Performance Objectives, agreed between the Service Provider and the Subscriber 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.
groupMembership	GroupMembership	0..1	The EVC Group Membership Service Attribute is used to specify an instance of the Multiple EVC Service Level Specification Service Attribute, if any, in which the EVC is used. Reference MEF 10.4 Section 10.9 EVC Group Membership Service Attribute.
maximumFrameSize	Integer	1	Maximum size of EI frames that can be carried over the EVC or



Schema File Name: carrierEthernet/carrierEthernetEvc.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-etc:v0.0.2:all			
			OVC. Reference MEF 10.4 Section 8.10 EVC Maximum Service Frame Size Service Attribute.
availableMegLevel	MegLevel	1	The value of the EVC Available MEG Level Service Attribute is an integer from 0 to 7 or <i>None</i> . Reference MEF 10.4 Section 8.11 EVC Available MEG Level Service Attribute.

Table 13-CarrierEthernetEvc Service Attributes

*NOTE: that EVC List of EVC EPs attributes is not provided given the relationship to EVC EP is provided in the envelope part of API (i.e., MEF 99).*

## 15 Operator Carrier Ethernet Services Data Model

An Operator Carrier Ethernet Service is a Carrier Ethernet Service provided to an end user (the Subscriber) by a Service Provider.

The Resources and corresponding Attributes are listed in groups:

- Subscriber Carrier Ethernet Services Resource:

- CarrierEthernetOperatorUni

- CarrierEthernetEnni

- CarrierEthernetEnniService

- CarrierEthernetVirtualUni

- CarrierEthernetOvcEndPoint

- CarrierEthernetOvc

### 15.1 CarrierEthernetOperatorUni

This class represents the Operator UNI Service Attributes that are agreed on by the SP/SO and the Operator for each UNI. Reference MEF 26.2 Section 14 Operator UNI Service Attributes [8].

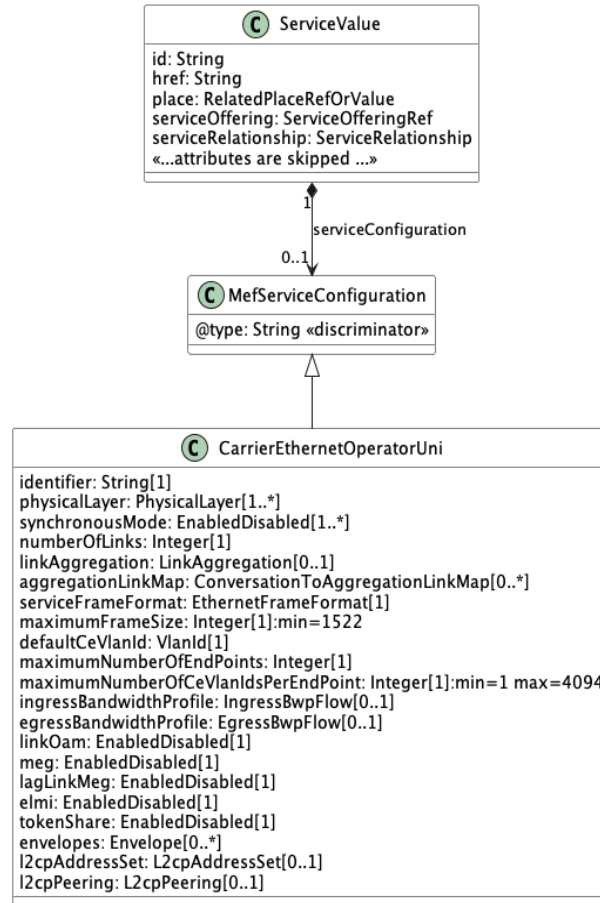


Figure 14-CarrierEthernetOperatorUni Model

Schema File Name: carrierEthernet/carrierEthernetOperatorUni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-operator-uni:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
Identifier	String <i>Min length=1</i> <i>Max length=45</i> <i>Pattern=pattern:</i> <i>"[\x20-\x7F]+"</i>	1	An identifier for the UNI intended for management purposes. Reference MEF 26.2 Section 14.1 Operator UNI Identifier Service Attribute.
physicalLayer	CarrierEthernetPhysicalLink	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.
synchronousMode	EnabledDisabled	1..*	The value of the Operator UNI Synchronous Mode Service Attribute is a list with one item for each of the physical links implementing the UNI. Each item in the list takes on one of

Schema File Name: carrierEthernet/carrierEthernetOperatorUni.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-operator-uni:v0.0.2:all			
			two values: <i>Enabled</i> or <i>Disabled</i> . Reference MEF 26.2 Section 14.3 Operator UNI Synchronous Mode Service Attribute.
numberOfLinks	Integer	1	The number of physical links at the UNI. Reference MEF 26.2 Section 14.4 Operator UNI Number of Links Service Attribute.
linkAggregation	LinkAggregation	0..1	The Operator UNI Link Aggregation Service Attribute value is one of <i>None</i> , <i>2-Link Active/Standby</i> , <i>All Active</i> , or <i>Other</i> . The value of this Service Attribute is dependent on the value of the Operator UNI Number of Links Service Attribute. Reference MEF 26.2 Section 14.5 Operator UNI Link Aggregation Service Attribute.
aggregationLinkMap	ConversationIdToAggregationLinkMap	0..*	This is a Port Conversation ID to Aggregation Link Map as defined in IEEE Std 802.1AX – 2014. Reference MEF 26.2 Section 14.6 Operator UNI Port Conversation ID to Aggregation Link Map Service Attribute.
serviceFrameFormat	EthernetFrameFormat	1	The Operator UNI Service Frame Format Service Attribute has the value <i>Ethernet MAC Frame conforming to Clause 3 of IEEE 802.3-2012</i> . Reference MEF 26.2 Section 14.7 Operator UNI Service Frame Format Service Attribute.
maximumFrameSize	Integer <i>Min = 1522</i>	1	The value for the Operator UNI Maximum Service Frame Size is a strictly positive integer in bytes. Reference MEF 26.2 Section 14.8 Operator UNI Maximum Service Frame Size Service Attribute.
defaultCeVlanId	VlanId	1	The value of the Operator UNI Default CE-VLAN ID is an integer that is the CE-VLAN ID value assigned to Untagged Service

Schema File Name: carrierEthernet/carrierEthernetOperatorUni.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-operator-uni:v0.0.2:all			
			Frames and Priority Tagged Service Frames. Reference Section 14.9 Operator UNI Default CD-VLAN ID Service Attribute.
maximumNumberOfEndPoints	Integer	1	The maximum number of OVC End Points that the Operator CEN can support at the UNI. Reference MEF 26.2 Section 14.10 Operator UNI Maximum Number of OVC End Points Service Attribute.
maximumNumberOfCeVlanIdsPerEndPoint	Integer <i>Minimum=1 Maximum=4094</i>	1	The maximum number of CE-VLAN ID values that can be mapped to an OVC End Point by the Operator CEN at the UNI. Reference MEF 26.2 Section 14.11 Operator UNI Maximum Number of CE-VLAN IDs per OVC End Point Service Attribute.
ingressBandwidthProfile	IngressBwpFlow	0..1	The value of the Operator UNI Ingress Bandwidth Profile per UNI Service Attribute is <i>Parameters</i> or <i>Disabled</i> . Reference MEF 26.2 Section 14.12 Operator UNI Ingress Bandwidth Profile per UNI Service Attribute.
egressBandwidthProfile	EgressBwpFlow	0..1	The value of the Operator UNI Egress Bandwidth Profile per UNI Service Attribute is <i>Parameters</i> or <i>Disabled</i> . An Operator UNI Egress Bandwidth Profile per UNI Service Attribute applies to all egress Service Frames at the UNI. Reference MEF 26.2 Section 14.13 Operator UNI Egress Bandwidth Profile per UNI Service Attribute.
linkOam	EnabledDisabled	1	The value is either Enable or Disabled. Reference MEF 26.2 Section 14.14 Operator Link OAM Service Attribute.
meg	EnabledDisabled	1	The value is either Enable or Disabled. Reference MEF 26.2

Schema File Name: carrierEthernet/carrierEthernetOperatorUni.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-operator-uni:v0.0.2:all			
			Section 14.15 Operator UNI MEG Service Attribute.
lagLinkMeg	EnabledDisabled	1	The value is either Enable or Disabled. Reference MEF 26.2 Section 14.16 Operator UNI LAG Link MEG Service Attribute.
elmi	EnabledDisabled	1	The value is either Enable or Disabled. Reference MEF 26.2 Section 14.17 Operator UNI E-LMI Service Attribute.
tokenShare	EnabledDisabled	1	The value is either Enable or Disabled. Reference 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 26.2 Section 14.19 Operator UNI Envelopes Service Attribute.
l2cpAddressSet	L2cpAddressSet	0..1	The Operator UNI L2CP Address Set Service Attribute is the L2CP Address Set Service Attribute defined in MEF 45 when applied to the UNI. Reference MEF 26.2 Section 14.20 Operator UNI L2CP Address Set Service Attribute.
l2cpPeering	L2cpPeering	0..*	The Operator UNI L2CP Peering Service Attribute is the L2CP Peering Service Attribute defined in MEF 45 when applied to the UNI. Reference MEF 26.2 Section 14.21 Operator UNI L2CP Peering Service Attribute.

Table 14-CarrierEthernetOperatorUni Service Attributes

## 15.2 CarrierEthernetEnni

The ENNI is a reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains. Reference MEF 26.2 Section 9 ENNI Common Attributes, Section 10 Operator Multilateral Attributes and Section 13 ENNI Service Attributes [8].

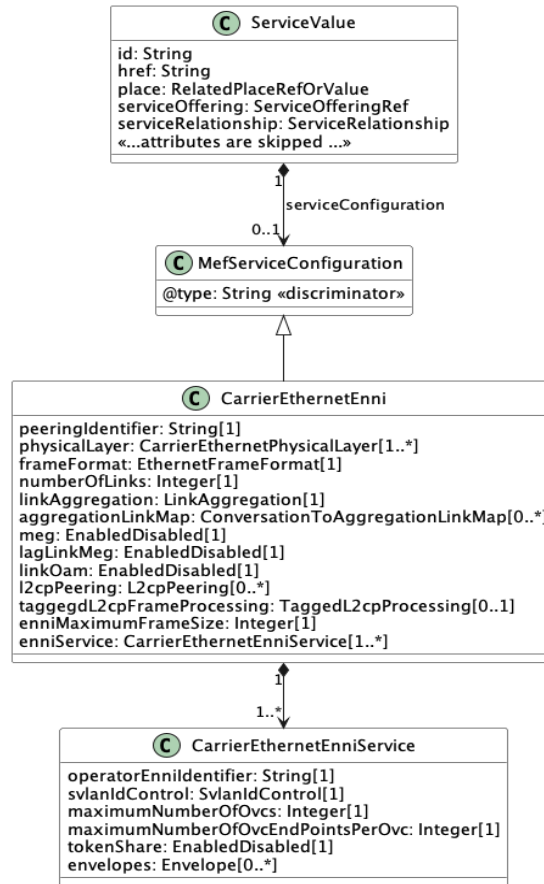


Figure 15-CarrierEthernetEnni Model

Schema File Name: carrierEthernet/carrierEthernetEnni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-enni:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
peeringIdentifier	String <i>Min length=1</i> <i>Max length=45</i> <i>Pattern=pattern:</i> <i>"[\\x20-\\x7F]+"</i>	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.
physicalLayer	CarrierEthernetPhysicalLayer	1..*	The physical layer of each of the links supporting the ENNI. Reference MEF 26.1 Section 9.2 ENNI Physical Layer Common Attribute.
frameFormat	EthernetFrameFormat	1	The ENNI Frame Format Common Attribute has the value <i>Ethernet MAC Frame conforming</i>

Schema File Name: carrierEthernet/carrierEthernetEnni.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-enni:v0.0.2:all			
			to Clause 3 of IEEE 802.3-2012. Reference MEF 26.2 Section 9.3 ENNI Frame Format Common Attribute.
numberOfLinks	Integer	1	The number of physical links in the ENNI. Reference MEF 26.2 Section 9.4 ENNI Number of Links Common Attribute.
linkAggregation	LinkAggregation	1	The value for the ENNI Number of Links Common Attribute is a strictly positive integer. This ENNI Common Attribute specifies the number of links that compose the ENNI. Reference MEF 26.2 Section 9.5 ENNI Link Aggregation Common Attribute.
aggregationLinkMap	ConversationIdToAggregationLinkMap	0..*	The ENNI Port Conversation ID to Aggregation Link Map Common Attribute is applicable only when the ENNI Link Aggregation Common Attribute has the value of <i>All Active</i> . Reference MEF 26.2 Section 9.6 ENNI Port Conversation ID to Aggregation Link Map Common Attribute.
meg	EnabledDisabled	1	The value of ENNI MEG Common Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 26.2 Section 9.7 ENNI MEG Common Attribute.
lagLinkMeg	EnabledDisabled	1	The value of the ENNI LAG Link MEG Common Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 26.2 Section 9.8 ENNI LAG Link MEG Common Attribute.
linkOam	EnabledDisabled	1	The value of the ENNI Link OAM Common Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 26.2 Section 9.9 ENNI Link OAM Common Attribute.
<b>Operator Multilateral Attributes</b>			
l2cpPeering	L2cpPeering	0..*	Specifies the Layer 2 Control Protocols that are peered at the



Schema File Name: carrierEthernet/carrierEthernetEnni.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-enni:v0.0.2:all			
			El, as described in MEF 45.1. Reference MEF 26.2 Section 10.1 ENNI L2CP Peering Multilateral Attribute.
taggedL2cpFrameProcessing	TaggedL2cpProcessing	0..1	The ENNI Tagged L2CP Processing Multilateral Attribute is defined in MEF 45. Reference MEF 26.2 Section 10.2 ENNI Tagged L2CP Frame Processing Multilateral Attribute.
enniMaximumFrameSize	Integer	1	Specifies the maximum size of El Frames that can be transmitted across El. Reference MEF 26.2 Section 10.3 ENNI Maximum Frame Size Multilateral Attribute.

Table 15-CarrierEthernetEnni Service Attributes

### 15.3 CarrierEthernetEnniService

The ENNI is a reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains. For each instance of an ENNI, there are 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 [8].

Schema File Name: carrierEthernet/carrierEthernetEnniService.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-enni-service:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
operatorEnniIdentifier	String <i>Min length=1</i> <i>Max length=45</i> <i>Pattern=pattern:</i> <i>"[\\x20-\\x7F]+"</i>	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 value of the S-VLAN ID Control Service Attribute is <i>Full</i> or <i>Partial</i> . Reference MEF 26.2 Section 13.2 S-VLAN ID Control Service Attribute.
maximumNumberOfOvcs	Integer	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.

Schema File Name: carrierEthernet/carrierEthernetEnniService.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-enni-service:v0.0.2:all			
maximumNumberOfOvcEndPointsPerOvc	Integer	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	The value of the ENNI Token Share Service Attribute is either Enabled or Disabled. Reference MEF 26.2 Section 13.5 ENNI Token Share Service Attribute.
envelopes	Envelope	0..*	The value of the ENNI Envelopes is a list of pairs of the form <x,y> where x is an Envelope ID and y is the Envelope Coupling Flag value. Reference MEF 26.2 Section 13.6 ENNI Envelopes Service Attribute.

Table 16-CarrierEthernetEnniService Attributes

## 15.4 CarrierEthernetVirtualUni

The ENNI is a reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains. Reference MEF 26.2 Section 15 Virtual UNI (VUNI), Feeder OVC and Remote UNI (RUNI) [8].

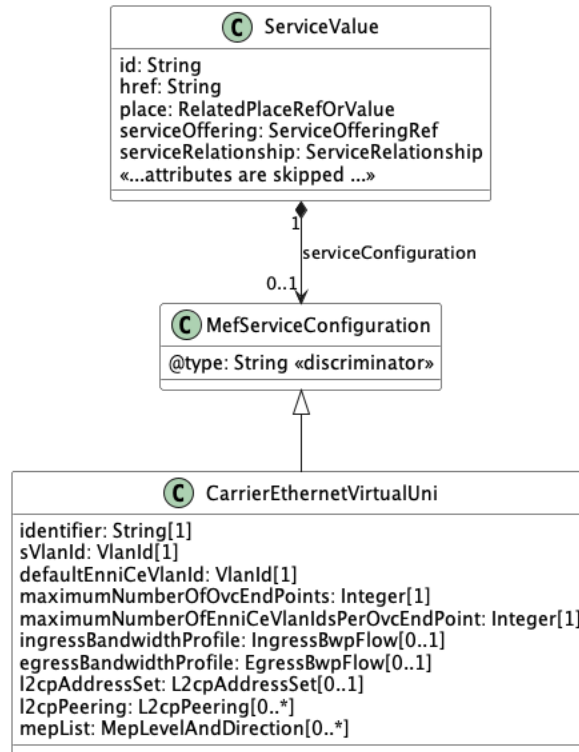


Figure 16-CarrierEthernetVirtualUni Model

Schema File Name: carrierEthernet/carrierEthernetEnni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-virtual-uni:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
identifier	String Min length=1 Max length=45 Pattern=pattern: "[\x20-\x7F]+"	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	The value of the VUNI S-VLAN ID Service Attribute is an integer in the range 1, 2,...,4094 that uniquely identifies the VUNI at the ENNI. Reference MEF 26.2 Section 15.1.2 VUNI S-VLAN ID Service Attribute.
defaultEnniCeVlanId	VlanId	1	The value of the VUNI Default ENNI CE-VLAN ID Service Attribute is an integer in the range 1,...,4094. The VUNI Default ENNI CE-VLAN ID Service Attribute is needed for the definition of the ENNI CE-VLAN ID for an ENNI Frame. Reference

Schema File Name: carrierEthernet/carrierEthernetEnni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-virtual-uni:v0.0.2:all			
			MEF 26.2 Section 15.1.3 VUNI Default ENNI CE-VLAN ID Service Attribute.
maximumNumberOfOvcEndPoints	Integer	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	Integer	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	IngressBwpFlow	0..1	The value of the VUNI Ingress Bandwidth Profile Service Attribute is either <i>Parameters</i> or <i>Disabled</i> . Reference MEF 26.2 Section 15.1.6 VUNI Ingress Bandwidth Profile Service Attribute.
egressBandwidthProfile	EgressBwpFlow	0..1	The value of the VUNI Egress Bandwidth Profile Service Attribute is either <i>Parameters</i> or <i>Disabled</i> . Reference MEF 26.2 Section 15.1.7 VUNI Egress Bandwidth Profile Service Attribute.
l2cpAddressSet	L2cpAddressSet	0..1	The VUNI L2CP Address Set Service Attribute is the L2CP Address Set Service Attribute defined in MEF 45 when applied to the VUNI. Reference MEF 26.2 Section 15.1.8 VUNI L2CP Address Set Service Attribute.
l2cpPeering	L2cpPeering	0..*	The VUNI L2CP Peering Service Attribute is the L2CP Peering Service Attribute defined in MEF 45 when applied to the VUNI. See MEF 45 for the possible values and requirements for this Service Attribute. Reference

Schema File Name: carrierEthernet/carrierEthernetEnni.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-virtual-uni:v0.0.2:all			
			MEF 26.2 Section 15.1.9 VUNI L2CP Peering Service Attribute.
mepList	MepLevelAndDirection	0..*	The value of the VUNI Maintenance End Point List Service Attribute is a list MEG Levels, one for each MEP that is instantiated. Reference MEF 26.2 Section 15.1.10 VUNI Maintenance End Point List Service Attribute.

Table 17-CarrierEthernetVirtualUni Service Attributes

## 15.5 CarrierEthernetOvcEndPoint

This class represents the Operator UNI Service Attributes that are agreed on by the SP/SO and the Operator for each UNI. Reference MEF 26.2 Section 16.1 OVC End Point Service Attributes [8].

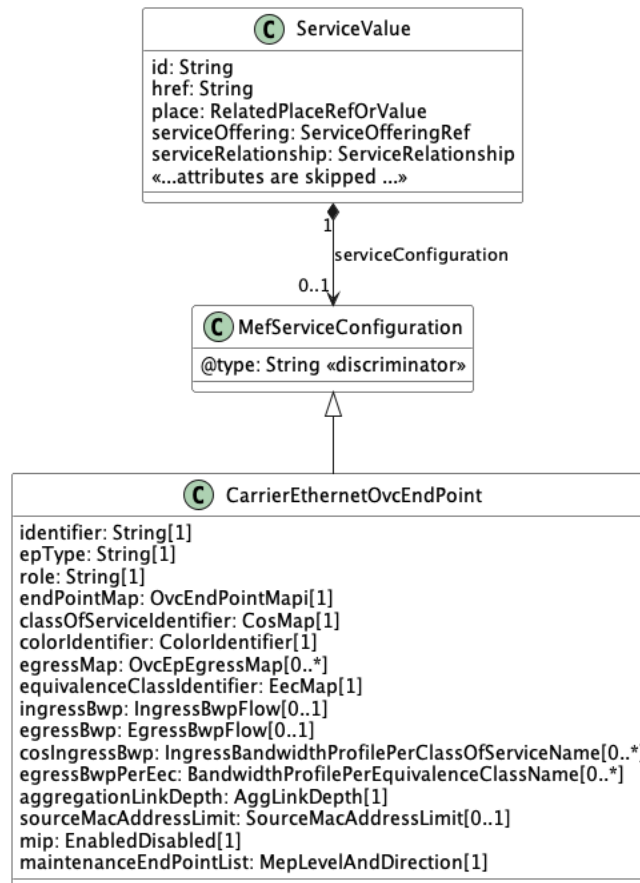


Figure 17-CarrierEthernetOvcEndPoint Model

Schema File Name: carrierEthernet/carrierEthernetOvcEndPoint.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-ovc-end-point:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
identifier	String Min length=1 Max length=45 Pattern=pattern: "[\x20-\x7F]+"	1	The value of the OVC End Point Identifier Service Attribute is a string that is used to allow the SP/SO and Operator to uniquely identify the OVC End Point for operations purposes. Reference MEF 16.1 OVC End Point Identifier Service Attribute.
epType	String Enum:  <ul style="list-style-type: none"> <li>UNI</li> <li>ENNI</li> </ul>	1	The value of the OVC End Point External Interface Type Service Attribute is either <i>UNI</i> or <i>ENNI</i> . Reference MEF 26.2 Section 16.2 OVC End Point External Interface Type Service Attribute.
role	String Enum:  <ul style="list-style-type: none"> <li>ROOT</li> <li>LEAF</li> <li>TRUNK</li> </ul>	1	String enumeration representing OVC End Point Role. Reference MEF 26.2 Section 16.4 OVC End Point Role Service Attribute.
endPointMap	OvcEndPointMap	1	The value of the OVC End Point Map Service Attribute specifies which EI Frames are mapped to the OVC End Point within an Operator CEN. Reference MEF 26.2 Section 16.5 OVC End Point Map Service Attribute.
classOfServiceIdentifier	CosMap	1	The value of the OVC End Point Class of Service Identifier Service Attribute is a triple of the form $\langle F, M, P \rangle$ where $F$ is a protocol field in the ingress EI Frame, $M$ is a map that maps each possible value of the field $F$ and the absence of the field $F$ to a Class of Service Name and $P$ is a map of Layer 2 Control Protocol types. Reference MEF 26.2 Section 16.6 OVC End Point Class of Service Identifier Service Attribute.
colorIdentifier	ColorIdentifier	1	The value of the OVC End Point Color Identifier Service Attribute is a pair of the form $\langle F, M \rangle$ where $F$ is a field in the ingress EI Frame and $M$ is a mapping

Schema File Name: carrierEthernet/carrierEthernetOvcEndPoint.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-ovc-end-point:v0.0.2:all			
			between each possible value of the field <i>F</i> and a Color. Reference MEF 26.2 Section 16.7 OVC End Point Color Identifier Service Attribute.
egressMap	OvcEpEgressMap	0..*	The value of the OVC End Point Egress Map Service Attribute is a set of mappings that determine the content of the S-Tag or C-Tag of an egress EI Frame. Reference MEF 26.2 Section 16.8 OVC End Point Egress Map Service Attribute.
egressEquivalenceClassIdentifier	EecMap	1	The value of the OVC End Point Egress Equivalence Class Identifier Service Attribute is a triple of the form $\langle F, M, P \rangle$ where <i>F</i> is a protocol field in the egress EI Frame, <i>M</i> is a map that maps each possible value of the field <i>F</i> and the absence of the field <i>F</i> to an Egress Equivalence Class Name and <i>P</i> is a map of L2CP type to Egress Equivalence Class Name. Reference MEF 26.2 Section 16.9 OVC End Point Egress Equivalence Class Identifier Service Attribute.
ingressBwp	IngressBwpFlow	0..1	The value of the Ingress Bandwidth Profile per OVC End Point is <i>Parameters</i> or <i>Disabled</i> . The Ingress Bandwidth Profile per OVC End Point Service Attribute describes ingress policing by the Operator CEN on all ingress EI Frames mapped to a given OVC End Point. Reference MEF 26.2 Section 16.10 Ingress Bandwidth Profile per OVC End Point Service Attribute.
egressBwp	EgressBwpFlow	0..1	The value of the Egress Bandwidth Profile per OVC End Point Service Attribute is <i>Parameters</i> or <i>Disabled</i> . The Egress Bandwidth Profile per OVC End Point Service Attribute describes the length and arrival

Schema File Name: carrierEthernet/carrierEthernetOvcEndPoint.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-ovc-end-point:v0.0.2:all			
			time characteristics of all egress EI Frames that are mapped to a given OVC End Point. Reference MEF 26.2 Section 16.11 Egress Bandwidth Profile per OVC End Point Service Attribute.
cosIngressBwp	IngressBandwidthProfilePerClassOfServiceName	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.
egressBwpPerEec	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	1	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. Reference MEF 26.2 Section 16.14 OVC End Point Aggregation Link Depth Service Attribute.
sourceMacAddressLimit	SourceMacAddressLimit	0..1	The value of the OVC End Point Source MAC Address Limit Service Attribute can be either the pair $\langle N, \tau \rangle$ where $N$ is a strictly positive integer and $\tau$ is a time interval or <i>Disabled</i> . Reference MEF 26.2 Section 16.15 OVC End Point Source MAC Address Limit Service Attribute.
mip	EnabledDisabled	1	The value of the OVC End Point MIP Service Attribute is either <i>Enabled</i> or <i>Disabled</i> . Reference



Schema File Name: carrierEthernet/carrierEthernetOvcEndPoint.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-ovc-end-point:v0.0.2:all			
			MEF 26.2 Section 16.16 OVC End Point MIP Service Attribute.
maintenanceEndPointList	MepLevelAndDirection	1	The value of the OVC End Point Maintenance End Point List Service Attribute is a list of pairs, one for each MEP that is instantiated. Each pair is of the form < <i>l</i> , <i>d</i> > where <i>l</i> equals the MEG Level, and <i>d</i> is the direction for the MEP, either <i>Up</i> or <i>Down</i> . Reference 16.17 OVC End Point Maintenance End Point List Service Attribute.

**Table 18-CarrierEthernetOvcEndPoint Service Attributes**

*NOTE: that OVC EP UNI nor ENNI attributes are not provided given the relationship to UNI or ENNI is provided in the envelope part of API (i.e., MEF 99).*

## 15.6 CarrierEthernetOvc

The Operator Virtual Connection (OVC) is the building block for constructing an EVC spanning multiple Operator CENs. Reference MEF 26.2 Section 8.8 Operator Virtual Connection.

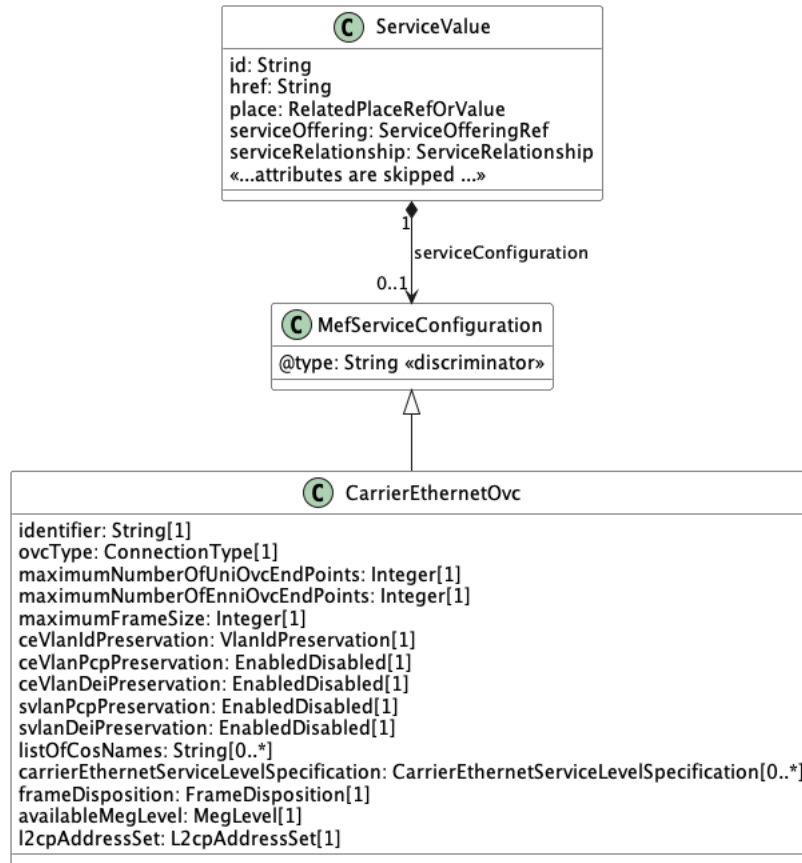


Figure 18-CarrierEthernetOvcModel

Schema File Name: carrierEthernet/carrierEthernetOvc.yaml			
\$id: urn:mef:iso:spec:service:carrier-ethernet-ovc:v0.0.2:all			
Attribute Name	Type	Multiplicity	Description
identifier	String Min length=1 Max length=45 Pattern=pattern: "[\x20-\x7F]+"	1	An identifier for the OVC intended for management purposes. Reference MEF 26.2 Section 12.1 OVC Identifier Service Attribute.
ovcType	ConnectionType	1	There are three values for the OVC Type Service Attribute: <i>Point-to-Point</i> , <i>Multipoint-to-Multipoint</i> , and <i>Rooted-Multipoint</i> . Reference MEF 26.2 Section 12.2 OVC Type Service Attribute.
maximumNumberOfUniOvcEndPoints	Integer Minimum: 0	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

Schema File Name: carrierEthernet/carrierEthernetOvc.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-ovc:v0.0.2:all			
			of UNI OVC End Points Service Attribute.
maximumNumberOfEnniOvcEndPoints	Integer Minimum: 1	1	The bound on the number of OVC End Points at ENNI that can be associated by the OVC. Reference MEF 26.2 Section 12.5 Maximum Number of ENNI OVC End Points Service Attribute.
maximumFrameSize	Integer	1	Maximum size of EI frames that can be carried over the EVC or OVC. Reference MEF 26.2 Section 12.6 OVC Maximum Frame Size Service Attribute.
ceVlanIdPreservation	VlanIdPreservation	1	Enumeration for VLAN ID Preservation. Reference MEF 26.2 Section 12.7 OVC CE-VLAN ID Preservation Service Attribute.
ceVlanPcpPreservation	EnabledDisabled	1	The value of OVC CE-VLAN PCP Preservation Service Attribute can be either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 26.2 Section 12.8 OVC CE-VLAN PCP Preservation Service Attribute.
ceVlanDeiPreservation	EnabledDisabled	1	The value of the OVC CE-VLAN DEI Preservation Service Attribute can be either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 26.2 Section 12.9 OVC CE-VLAN DEI Preservation Service Attribute.
svlanPcpPreservation	EnabledDisabled	1	The value of the OVC S-VLAN PCP Preservation Service Attribute can be either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 12.10 Section 12.10 OVC S-VLAN PCP Preservation Service Attribute.
svlanDeiPreservation	EnabledDisabled	1	The value of the OVC S-VLAN DEI Preservation Service Attribute can be either <i>Enabled</i> or <i>Disabled</i> . Reference MEF 26.2 Section 12.11 OVC S-VLAN DEI Preservation Service Attribute.

Schema File Name: carrierEthernet/carrierEthernetOvc.yaml \$id: urn:mef:iso:spec:service:carrier-ethernet-ovc:v0.0.2:all			
listOfCosNames	String	0..*	Used to specify all the Class of Service Names supported by an OVC. Reference MEF 26.2 Section 12.12 OVC List of Class of Service Names Service Attribute.
carrierEthernetServiceLevelSpecification	CarrierEthernetServiceLevelSpecification	0..1	The value of the OVC Service Level Specification Service Attribute. The OVC Service Level Specification Service Attribute (SLS) is the technical specification of the service level agreed to by the Operator and the SP/SO. Reference MEF 26.2 Section 12.13 OVC Service Level Specification Service Attribute.
frameDisposition	FrameDisposition	1	The value of the OVC Frame Delivery Service Attribute is a 3-tuple where each element equals one of <i>Discard</i> , <i>Deliver Unconditionally</i> , or <i>Deliver Conditionally</i> . Reference MEF 26.2 Section 12.14 OVC Frame Delivery Service Attribute.
availableMegLevel	MegLevel	0..1	The value of the OVC Available MEG Level Service Attribute is an integer from 0 to 7 or <i>None</i> . Reference MEF 26.2 Section 12.15 OVC Available MEG Level Service Attribute.
l2cpAddressSet	L2cpAddressSet	1	The OVC L2CP Address Set Service Attribute is the L2CP Address Set Service Attribute that is defined in Section 8.1 of MEF 45.1. Reference MEF 26.1 Section 12.16 OVC L2CP Address Set Service Attribute.

Table 19-CarrierEthernetOvc Service Attributes

**NOTE:** that OVC List of OVC EPs attributes is not provided given the relationship to OVC EP is provided in the envelope part of API (i.e., MEF 99).

## 16 Common Classes and Types

This section is structure like the previous section but focuses on common classes and types used by the Service Attributes. Most of these are structured to support a variety of Carrier Ethernet Services. This section details the data types and enumerations that are used by the Carrier Ethernet Service model.

### 16.1 CarrierEthernetPhysicalLink

A 2-tuple of the form {id, physicalLink}.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
Id	String Min Length=1 Max Length	1	An identifier for the physical link. This must be specified for all external interfaces.
physicalLink	String <ul style="list-style-type: none"> <li>10BASE2</li> <li>10BASE5</li> <li>10BASE_F</li> <li>10BASE_FB</li> <li>10BASE_FL</li> <li>10BASE_FP</li> <li>10BASE_T</li> <li>10BASE_TE</li> <li>10BROAD36</li> <li>10PASS_TS</li> <li>100BASE_BX10</li> <li>100BASE_FX</li> <li>100BASE_LX10</li> <li>100BASE_T</li> <li>100BASE_T2</li> <li>100BASE_T4</li> <li>100BASE_TX</li> <li>100BASE_X</li> <li>1000BASE_BX10</li> <li>1000BASE_CX</li> <li>1000BASE_KX</li> <li>1000BASE_LX</li> <li>1000BASE_LX10</li> <li>1000BASE_PX10</li> <li>1000BASE_PX20</li> <li>1000BASE_SX</li> <li>1000BASE_T</li> <li>1000BASE_X</li> <li>10GBASE_CX4</li> <li>10GBASE_E</li> <li>10GBASE_ER</li> <li>10GBASE_EW</li> <li>10GBASE_KR</li> <li>10GBASE_KX4</li> <li>10GBASE_L</li> <li>10GBASE_LR</li> <li>10GBASE_LRM</li> <li>10GBASE_LW</li> <li>10GBASE_LX4</li> <li>10GBASE_PR</li> </ul>	1	An Ethernet physical layer. This must be specified for all external interfaces.

	<ul style="list-style-type: none"> <li>• 10GBASE_PRX</li> <li>• 10GBASE_R</li> <li>• 10GBASE_S</li> <li>• 10GBASE_SR</li> <li>• 10GBASE_SW</li> <li>• 10GBASE_T</li> <li>• 10GBASE_W</li> <li>• 10GBASE_X</li> <li>• 100GBASE_R</li> <li>• 100GBASE_CR10</li> <li>• 100GBASE_ER4</li> <li>• 100GBASE_LR4</li> <li>• 100GBASE_SR10</li> <li>• 40GBASE_R</li> <li>• 40GBASE_CR4</li> <li>• 40GBASE_FR</li> <li>• 40GBASE_KR4</li> <li>• 40GBASE_LR4</li> <li>• 40GBASE_SR4</li> <li>• 1BASE5</li> <li>• 2BASE_TL</li> <li>• 1G_EPON</li> <li>• 10G_EPON</li> <li>• 10_1G_EPON</li> <li>• 10_10G_EPON</li> <li>• OTHER</li> <li>• NONE</li> </ul>		
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Table 20-CarrierEthernetPhysicalLink Attributes

## 16.2 ColorFromDei

This Class is referenced when the color comes from the C-tag DEI field (for EVCs and OVCs) or the S-tag DEI field for OVCs. MEF 10.4 (EVCs) and MEF 26.2 (OVCs) requires that DEI=0 means Green and DEI=1 means Yellow, so no map is needed.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
mapType	String Enum: DEI	1	Color map type.

Table 21-ColorFromDei Attributes

## 16.3 ColorFromDscp

This Class is referenced when the color comes from the DSCP field. It is a list of DSCP Entries where each entry has three components: (1) A list of DSCP values, (2) a color for IPv4 packets with one of those DSCP values, and (3) a color for IPv6 packets with one of those DSCP values. Any DSCP value that is not specified and any Frame that does not include an IP packet is Green.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
mapType	String Enum: DSCP	1	Color map type.

colorFromDscpMap	ColorFromDscpEntry	1..*	Frame Color.
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Table 22-ColorFromDscp Attributes

## 16.4 ColorFromDscpEntry

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
dscpList	Integer Min=0 Max=63	1..*	This is a list of DSCP value.
ipv4Color	FrameColor	1	Frame color for IPv4.
ipv6Color	FrameColor	1	Frame color for IPv6.

Table 23-ColorFromDscpEntry Attributes

## 16.5 ColorFromEp

The color of each Ingress Frame is determined solely from the EVC or OVC End Point. In other words, the EP declares all frames GREEN or all frame YELLOW.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
mapType	String Enum: ENDPOINT	1	Color map type.
epColor	FrameColor	1	Frame Color.

Table 24-ColorFromEp Attributes

## 16.6 ColorFromPcp

This Class is referenced when the color comes from the S-tag or C-tag PCP field. Each of the 8 possible PCP values maps to a color. If there is no tag, the frame is Green.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
mapType	String Enum: PCP	1	Color map type.
colorFromPcpMap	ColorFromPcpMapEntry	8..8	This is a list of 8 Color mappings, one for each PCP value.

Table 25-ColorFromPcp Attributes

## 16.7 ColorFromPcpMapEntry

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
pcpValue	PcpValue	1	PCP value.

pcpColor	FrameColor	1	Frame color.
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Table 26-ColorFromPcpMapEntry Attributes

## 16.8 ColorIdentifier

MEF 10.4 sec. 10.6 - The value of the EVC EP Color Map Service Attribute is a pair of the form  $\langle F, M \rangle$  where: F is one of the values ENDPOINT, DEI, PCP, or DSCP and M is a map that can be used to assign Color to each Ingress Service Frame. (The form of M depends on the value of F.). The EVC EP Color Map Service Attribute is the mechanism by which the Color for an Ingress Service Frame that is mapped to an EVC EP is indicated by the content in the Service Frame header.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
colorFromEp	ColorFromEp	0..1	The color of each Ingress Frame is determined solely from the EVC or OVC End Point. In other words, the EP declares all frames GREEN or all frame YELLOW.
colorFromDei	ColorFromDei	0..1	This Class is referenced when the color comes from the C-tag DEI field (for EVCs and OVCs) or the S-tag DEI field for OVCs. MEF 10.4 (EVCs) and MEF 26.2 (OVCs) requires that DEI=0 means Green and DEI=1 means Yellow, so no map is needed.
colorFromPcp	ColorFromPcp	0..1	This Class is referenced when the color comes from the S-tag or C-tag PCP field. Each of the 8 possible PCP values maps to a color. If there is no tag, the frame is Green.
colorFromDscp	ColorFromDscp	0..1	This Class is referenced when the color comes from the DSCP field. It is a list of DSCP Entries where each entry has three components: (1) A list of DSCP values, (2) a color for IPv4 packets with one of those DSCP values, and (3) a color for IPv6 packets with one of those DSCP values. Any DSCP value that is not specified and any Frame that does not include an IP packet is Green.



Table 27-ColorIdentifier Attributes

## 16.9 ColorMode

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

Contains Enumeration Literals:

- COLOR\_AWARE
- COLOR\_BLIND

## 16.10 ConnectionType

This is for EVC or OVC connection types, including point to point, multi-point and rooted multi-point. Reference MEF 26.2 Section 12.2 OVC Type Service Attribute and MEF 10.4 Section 8.3 EVC Type Service Attribute.

Contains Enumeration Literals:

- POINT\_TO\_POINT
- MULTIPOINT
- ROOTED\_MULTIPOINT

## 16.11 ConversationIdToAggregationLinkMap

This is a Port Conversation ID to Aggregation Link Map as defined in IEEE Std 802.1AX – 2014.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
conversationId	Integer	1..*	The conversation ID is a VLAN ID or 0 for untagged or priority tagged frames.
linkNumberIdList	Integer Min=1	1..*	The link number ID of the aggregation link.

Table 28-ConversationIdToAggregationLinkMap Attributes

## 16.12 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 Pcp-CosIdPac 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
cosName	String	1	This attribute denotes the Class of Service name that the CosIdentifier maps to.
l2cpProtocolList	L2cpProtocol	0..*	This attribute lists the L2CP protocols that map to the Class of Service name.
sepCosIdPac	SepCosIdPac	0..1	Pointer to SepCosIdPac.
pcpCosIdPac	PcpCosIdPac	0..1	Pointer to PcpCosIdPac.
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 29-CosIdentifier Attributes**

## 16.13 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	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 30-CosMap Attributes**

## 16.14 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.

Contains Enumeration Literals:

- PCP
  - Priority Code Point
- END\_POINT
  - End Point
- DSCP
  - Differentiated Services Code Point

## 16.15 DataSize

A value and a unit of measure that specifies a data size for example for a buffer or a burst size.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
dataSizeValue	Integer	1	The value in the data size. For example, if a burst size is 40 KBYTES, this element is 40.
dataSizeUnits	String Enum: <ul style="list-style-type: none"> <li>• BYTES</li> <li>• KBYTES</li> <li>• MBYTES</li> <li>• GBYTES</li> <li>• TBYTES</li> <li>• PBYTES</li> <li>• EBYTES</li> <li>• ZBYTES</li> <li>• YBYTES</li> </ul>	1	The unit of measure in the data size. For example, if a burst size is 40 KBYTES, this element is KBYTES. Note that the units indicate binary values, e.g., KBYTES is 1024 bytes.

**Table 31-DataSize Attributes**

## 16.16 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).

Contains Enumeration Literals:

- DISCARD
- 0
- 1

## 16.17 DscpCosIdPac

Represents the object class represents CoS Identifier that maps the IP DSCP values to the Class of Service Name(s). It can map a list of DSCP values to two different Class of Service Names, one for ingress EI Frames carrying an IPv4 packet and a different one for ingress EI Frames carrying and IPv6 packet. It also can map a list of DSCP values (both IPv4 and IPv6) to one Class of Service Name. 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
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.
ipVersion	IpVersion	1	Pointer to IpVersion.

**Table 32-DscpCosIdPac Attributes**

## 16.18 DscpEeIdPac

This represents the IP DSCP values that map to a given Egress Equivalence Class Name (specified in EeIdIdentifier), 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
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.
ipVersion	IpVersion	1	Pointer to IpVersion.

**Table 33-DscpEeIdPac Attributes**

## 16.19 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
- ALL\_VALUES
- "0" – "63"

## 16.20 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
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.
pcpEecIdPac	PcpEecIdPac	1	Pointer to PcpEecIdPac.
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.

Table 34-EecIdentifier Attributes

## 16.21 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml

Attribute Name	Type	Multiplicity	Description
eecMappingType	EecMappingType	1	Pointer to EecMappingType.
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 35-EecMap Attributes

## 16.22 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.

Contains Enumeration Literals:

- DSCP
- PCP

## 16.23 EgressBandwidthProfilePerClassOfServiceName

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 EgressBwpFlow. Reference MEF 10.4 Section 10.11 EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute and MEF 26.2 Section 16.13 Egress Bandwidth Profile per Class of Service Name Service Attribute.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
classOfServiceName	Strting	1	Class of Service Name.
egressBwpFlow	EgressBwpFlow	1	Pointer to EgressBwpFlow.

Table 36-EgressBandwidthProfilePerClassOfServiceName Attributes

## 16.24 EgressBwpFlow

The EgressBwpFlow object class represents the Bandwidth Profile Flow which includes the bandwidth profile parameters CIR, CIRmax, and ER.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
cir	Information Rate	1	Committed Information Rate.

cirMax	InformationRate	1	Committed Information Rate maximum.
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.
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.
envelopeld	String	1	This attribute identifies the Envelope that the Bandwidth Profile belongs to.
envelopeRank	Integer	1	This attribute denotes the rank of the bandwidth profile flow in the envelope.
tokenRequestOffset	Integer	1	Attribute represents Token Request Off-set. Adjusts the bandwidth consumed by each Service Frame in the Bandwidth Profile Flow relative to the length of the Service Frame.

Table 37-EgressBwpFlow Attributes

## 16.25 EnabledDisabled

Enumeration used to indicate state as ENABLED or DISABLED.

Contains Enumeration Literals:

- ENABLED
- DISABLED

## 16.26 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
envelopeld	String Max length = 45	1	This attribute is a string that identifies the Envelope.
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).

**Table 38-Envelope Attributes**

## 16.27 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.

Contains Enumeration Literals:

- ETHERNET

## 16.28 EvcGroupMembership

Specifies an instance of the Multiple EVC Service Level Specification Service Attribute.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
id	String	1	One of the values in an instance of Multiple EVC Service Level Specification Service Attribute.
cosName_G	String	1	Entry in the value of EVC List of Class of Service Names.
sg	String	0..*	Subset of ordered EVC EP pairs constructed from the value of the EVC List of EVC EPs Service Attribute.

**Table 39-EvcGroupMembership Attributes**



## 16.29 FrameColor

Frame color is either Green or Yellow.

Contains Enumeration Literals:

- GREEN
- YELLOW

## 16.30 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.

Contains Enumeration Literals:

- DISCARD
- CONDITIONALLY
- UNCONDITIONALLY

## 16.31 FrameDisposition

The EVC/OVC Service Frame Disposition indicates whether different types of Service Frames are to be delivered by the EVC/OVC. Reference MEF 10.4 Section 8.4 EVC Data Frame Service Frame Disposition Service Attribute and MEF 26.2 OVC Frame Disposition.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
unicast	FrameDelivery	1	Pointer to FrameDelivery.
multicast	FrameDelivery	1	Pointer to FrameDelivery.
broadcast	FrameDelivery	1	Pointer to FrameDelivery.

**Table 40-FrameDisposition Attributes**

## 16.32 InformationRate

A value and a unit of measure that specifies an Information Rate.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
irValue	Number Minimum: 0	1	The value in the information rate. For example if the

			information rate is 70 kbps this element is 70.
irUnits	String Enum:  <ul style="list-style-type: none"> <li>• BPS</li> <li>• KBPS</li> <li>• MBPS</li> <li>• GBPS</li> <li>• TBPS</li> <li>• PBPS</li> <li>• EBPS</li> <li>• ZBPS</li> <li>• YBPS</li> </ul>	1	The unit of measure for the Information Rate. For example, if the Information Rate is 70KBPS this element is KBPS. Note that the values are decimal values. 1 KBPS is 1000 bits per second and 1MBPS is 1,000,000 bits per second.

Table 41-InformationRate Attributes

### 16.33 IngressBandwidthProfilePerClassOfServiceName

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 IngressBwpFlow. 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
classOfServiceName	String	1	Class of Service Name.
ingressBwpFlow	BwpFlow	1	Pointer to IngressBwpFlow.

Table 42-IngressBandwidthProfilePerClassOfServiceName Attributes

### 16.34 IngressBwpFlow

The IngressBwpFlow 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 IngressBwpFlow 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
cir	Information Rate	1	Committed Information Rate.

cirMax	InformationRate	1	Committed Information Rate maximum.
cbs	DataSize	1	Constant Burst Size.
eir	InformationRate	1	Excess Information Rate.
eirMax	InformationRate	1	Excess Information Rate maximum.
ebs	DataSize	1	Excess Burst Size.
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.
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.
envelopeld	String	1	This attribute identifies the Envelope that the Bandwidth Profile belongs to.
envelopeRank	Integer	1	This attribute denotes the rank of the bandwidth profile flow in the envelope.

tokenRequestOffset	Integer	1	Attribute represents Token Request Off-set. Adjusts the bandwidth consumed by each Service Frame in the Bandwidth Profile Flow relative to the length of the Service Frame.
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Table 43-IngressBwpFlow Attributes

### 16.35 IpVersion

Enumeration used for IP versions.

Contains Enumeration Literals:

- IPv4
- IPv6

### 16.36 L2cpAddressSet

Enumeration listing the L2CP Address Set. Reference MEF 45.1 Section 8.1 L2CP Address Set Service Attribute. CTA - CEVLAN Tag Aware for VLAN-based services where the CE-VLAN ID is used to map a frame to a service. CTB - CVLAN Tag Blind for Port-based services where the CE-VLAN ID not used to map a frame to a service. CTB2 - CVLAN Tag Blind Option 2 for point-to-point Port-based services that support the EPL Option 2 L2CP processing.

Contains Enumeration Literals:

- CTA
- CTB
- CTB2

### 16.37 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
protocolId	L2cpProtocol	1	Protocol ID for which frames will be peered.
destinationAddress	String	1	MAC Destination address.

linkIdList	String	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.
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Table 44-L2cpPeering Attributes

## 16.38 L2cpProtocol

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

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
l2cpProtocolType	L2cpProtocolType	1	Pointer to L2cpProtocolType.
llcAddressOrEtherType	Integer Minimum:0	1	LLC address type or EtherType.
subType	Integer	1	SubType.

Table 45-L2cpProtocol Attributes

## 16.39 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:

- CTA
- CTB
- CTB2

## 16.40 LinkAggregation

Data type representing Link Aggregation types as used in MEF 10.4 and MEF 26.2. NONE-No Link Aggregation is used. 2\_LINK\_ACTIVE\_STANDBY-The SP 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 UNI/ENNI such that all Service 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 other resiliency mechanism.

Contains Enumeration Literals:

- NONE
- 2\_LINK\_ACTIVE\_SUMMARY
- ALL\_ACTIVE
- OTHER

#### 16.41 MegLevel

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.

Contains Enumeration Literals:

- "NONE"
- "0"
- "1"
- "2"
- "3"
- "4"
- "5"
- "6"
- "7"

#### 16.42 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
mepDirection	MepDirection	1	Pointer to MepDirection.
level	Integer Minimum:0 Maximum:7	1	MEP level.

**Table 46-MepLevelAndDirection Attributes**

#### 16.43 MepDirection

This is for MEP direction, either Down MEP or Up MEP. Reference MEF-Types.

Contains Enumeration Literals:

- UP
- DOWN

## 16.44 PcpCosIdPac

The PcpCosIdPac object class represents the PCP values that map to a given Class of Service Name (specified 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
pcpValueList	PcpOrUntagged	1..*	This attribute is a list of PCP values that map to the CoS Name.

Table 47-PcpCosIdPac Attributes

## 16.45 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
pcpValueList	PcpOrUntagged	1..*	This attributes a list of PCP values that map to Egress Equivalence Class Name.

Table 48-PcpEecIdPac Attributes

## 16.46 PcpOrDiscard

This enumeration lists the one of PCP values or DISCARD.

Contains Enumeration Literals:

- DISCARD
- 0
- 1
- 2
- 3

- 1000 • 4
- 1001 • 5
- 1002 • 6
- 1003 • 7

#### 1004 **16.47 PcpOrUntagged**

1005 This enumeration lists the one of PCP values or DISCARD.

1006 Contains Enumeration Literals:

- 1007 • DISCARD
- 1008 • 0
- 1009 • 1
- 1010 • 2
- 1011 • 3
- 1012 • 4
- 1013 • 5
- 1014 • 6
- 1015 • 7

#### 1016 **16.48 PcpValue**

1017 This enumeration lists the one of PCP values.

1018 Contains Enumeration Literals:

- 1019 • 0
- 1020 • 1
- 1021 • 2
- 1022 • 3
- 1023 • 4
- 1024 • 5
- 1025 • 6
- 1026 • 7

#### 1027 **16.49 SepCosIdPac**

1028 Represents the CoS Identifier that maps the EVC End Point or the OVC End Point to a Class of Service Name.

1029 NOTE: This object does not have attributes. Reference MEF 26.2 Section 16.6.2 OVC End Point Class of  
1030 Service Identifier Service Attribute for an OVC End Point in a VUNI or at a UNI and MEF 10.4 Section  
1031 10.5.1.1 EVC EP Ingress Class of Service Map Attribute Based on EVC EP.



## 16.50 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.

Schema File Name: carrierEthernet/carrierEthernetCommon.yaml			
Attribute Name	Type	Multiplicity	Description
limit	Integer	1	This attribute denotes the maximum acceptable source MAC addresses.
interval	Integer	1	This attribute denotes the time limit interval in milliseconds.

**Table 49-SourceMacAddressLimit Attributes**

## 16.51 TaggedL2cpProcessing

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

Contains Enumeration Literals:

- 802\_1\_COMPLIANT
- 802\_1\_NON\_COMPLIANT

## 16.52 VlanId

Data type with single attribute, vlanId which is defined as a PositiveInteger. Value 1 to 4094.

## 17 Carrier Ethernet Service Level Specification

The EVC Service Level Specification Service Attribute (SLS) is the technical details of the service level, in terms of Performance Objectives, agreed between the Service Provider and the Subscriber as part of the Service Level Agreement. A given SLS might contain 0, 1 or more Performance Objective for each Performance Metric [6].

The OVC Service Level Specification Service Attribute (SLS) is the technical specification of the service level agreed to by the Operator and the SP/SO. For any given SLS, a performance objective may or may not be specified [8].

The following performance metrics are supported as part of an SLS:

1. One-way Frame Delay Performance Metric
2. One-way Mean Frame Delay Performance Metric
3. One-way Frame Delay Range Performance Metric
4. One-way Inter-Frame Delay Variation Performance Metric
5. One-way Frame Loss Ratio Performance Metric
6. One-way Availability Performance Metric
7. One-way High Loss Intervals Performance Metric
8. One-way Consecutive High Loss Intervals Performance Metric
9. One-way Composite Performance Metric (only supported by EVC, not OVC)
10. One-way Group Availability Performance Metric

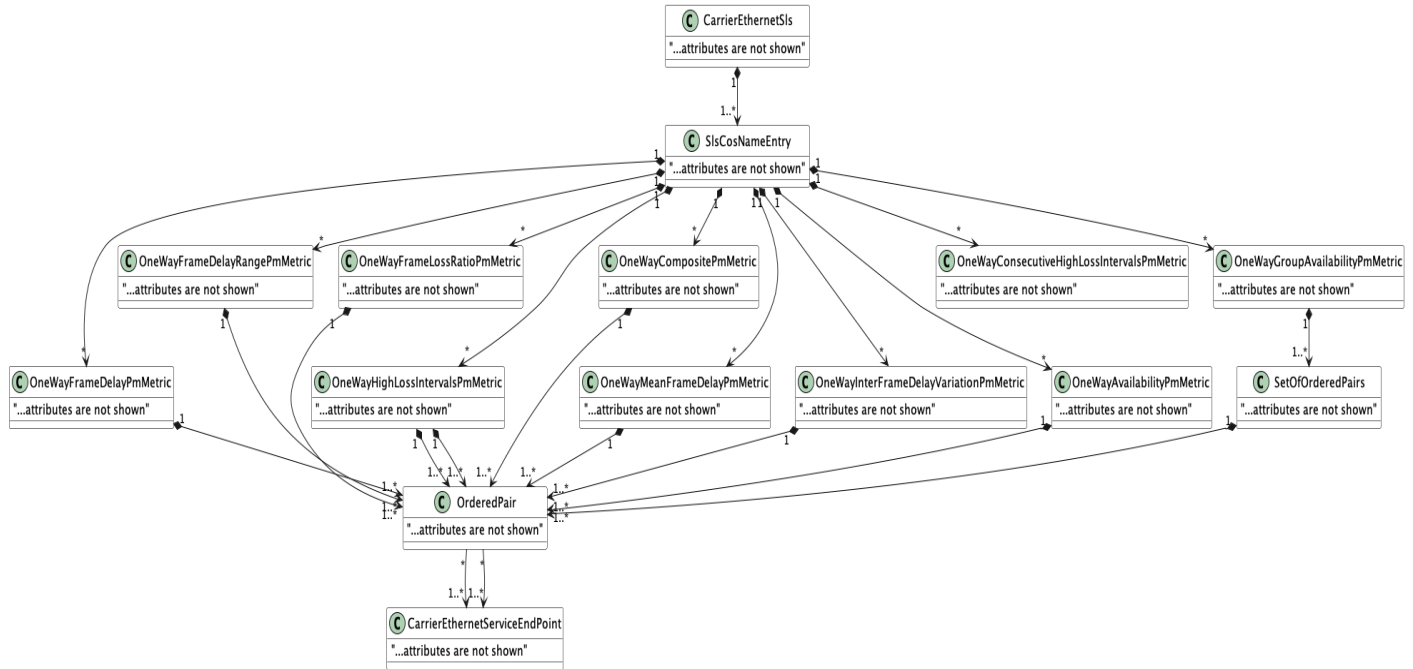


Figure 19-Service Level Specification Model

Figure 20 below provides an example of the value for the EVC Service Level Specification Attribute. Some observations:

- Performance Metrics and Objectives are specified for the *Gold* and *Silver* Class of Service Names for the EVC.
- A single value of  $t_s$  and a single value of  $T$  apply to all Class of Service Names.
- Different values of  $\Delta t$ ,  $C$ , and  $n$  apply to Gold and Silver.
- Two instances of the One-way Delay Performance Metric apply to *Gold*. There is a different set of order EVC EP pairs, a different percentile and a different objective for each instance. This could be due to EVC EP  $c$  being geographically distant from EVC EPs  $a$  and  $b$ .
- The One-way Frame Delay Range Performance Metric and One-way Availability Performance along with corresponding objectives apply to *Gold*.
- The One-way Availability Performance Metric applies to *Silver*.

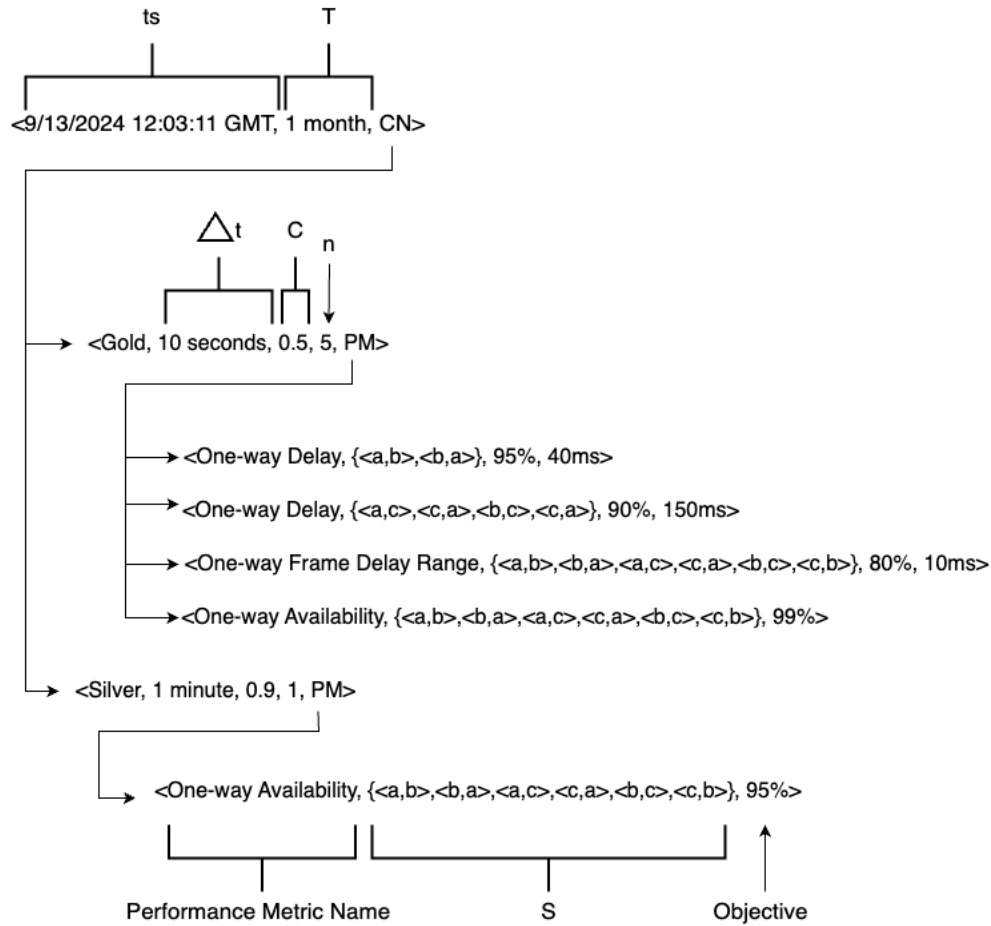


Figure 20-E/OVC Service Level Specification Service Attribute Value Example

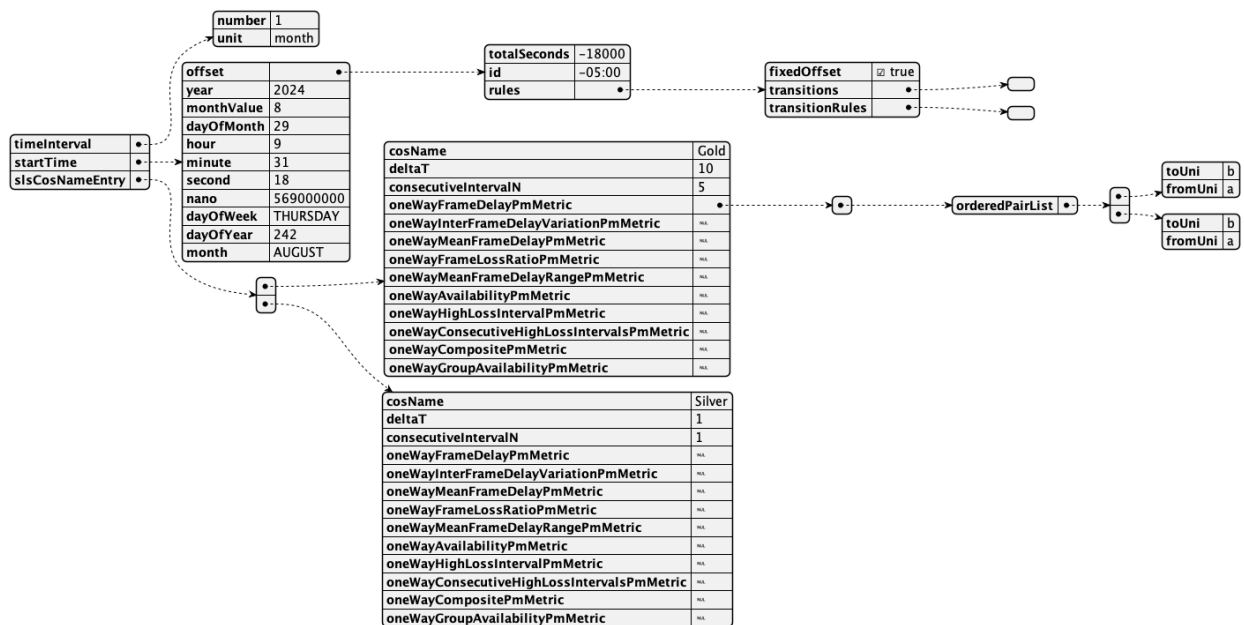


Figure 21-Carrier Ethernet SLS JSON Example

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
timeInterval	TimeIntervalT	1	Time interval.
startTime	Date-Time	1	Start time.
sIsCosNameEntry	SIsCosNameEntry	1	Pointer to SLS CoS Name Entry.

Table 50-CarrierEthernetServiceLevelSpecification Attributes

## 17.1 SIsCosNameEntry

The SIsCosNameEntry data type represents the CoS Name entry consisting of a list of 5-tuples of the form <CoS Name,  $\Delta t$ , C, n, PM> where CoS Name is Class of Service Name,  $\Delta t$  is a small time interval, C is a threshold and n to identify consecutive  $\Delta t$  for high loss interval and PM is a non-empty list where each element in the list consists of Performance Metrics. The SIsCosNameEntry data type is associated with EVC or OVC and SIsObjectiveAndParameters. 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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
cosName	TimeIntervalT	1	Class of Service name.
deltaT	Integer	1	This attribute denotes the delta-T, a time interval in seconds, smaller than T (SLS time period).
thresholdC	Number	1	Denotes the threshold for FLR, used to determine where a given time interval delta t has high loss.
consecutiveIntervalN	Integer	1	This attribute denotes n, used to identify how many consecutive delta-T intervals must have high loss to trigger a change in Availability.
oneWayFrameDelayPmMetric	OneWayFrameDelayPmMetric	0..*	Pointer to OneWayFrameDelay
oneWayInterFrameDelayVariationPmMetric	OneWayInterFrameDelayVariationPmMetric	0..*	Pointer to OneWayInterFrameDelayVariationPmMetric

oneWayMeanFrameDelayPmMetric	OneWayMeanFrameDelayPmMetric	0..*	Pointer to OneWayMeanFrameDelayPmMetric
oneWayFrameLossRatioPmMetric	OneWayFrameLossRatioPmMetric	0..*	Pointer to OneWayFrameLossRatioPmMetric
oneWayMeanFrameDelayRangePmMetric	OneWayMeanFrameDelayRangePmMetric	0..*	Pointer to OneWayMeanFrameDelayRangePmMetric
oneWayAvailabilityPmMetric	OneWayAvailabilityPmMetric	0..*	Pointer to OneWayAvailabilityPmMetric
oneWayHighLossIntervalPmMetric	OneWayHighLossIntervalPmMetric	0..*	Pointer to OneWayHighLossIntervalPmMetric
oneWayConsecutiveHighLossIntervalPmMetric	OneWayConsecutiveHighLossIntervalPmMetric	0..*	Pointer to OneWayConsecutiveHighLossIntervalPmMetric
oneWayCompositePmMetric	OneWayCompositePmMetric	0..*	Pointer to OneWayCompositePmMetric
oneWayGroupAvailabilityPmMetric	OneWayGroupAvailabilityPmMetric	0..*	Pointer to OneWayGroupAvailabilityPmMetric

Table 51-SlsCosNameEntry Attributes

## 17.2 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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFdPercentile	Percentage	1	Frame Delay percentile.
oneWayFdObjective	Time	1	Frame Delay objective.

Table 52-OneWayFrameDelayPmMetric Attributes

### 17.3 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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
timeDuration	Time	1	Time duration.
oneWayIfdvPercentile	Percentage	1	Inter-Frame Delay Variation percentile.
oneWayIfdvObjective	Time	1	Inter-frame Delay Variation objective.

**Table 53-OneWayInterFrameDelayVariationPmMetric Attributes**

### 17.4 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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayMfdObjective	Time	1	Mean Frame Delay objective.

**Table 54-OneWayMeanFrameDelayPmMetric Attributes**

### 17.5 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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description

orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFrameLossRatioObjective	Percentage	1	Frame Loss Ratio objective.

Table 55-OneWayFrameLossPmMetric Attributes

## 17.6 OneWayMeanFrameDelayRangePmMetric

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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFdrPercentile	Percentage	1	Frame Delay Range percentile.
oneWayFdrObjective	Time	1	Frame Delay Range objective.

Table 56-OneWayMeanFrameDelayRangePmMetric Attributes

## 17.7 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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayAvailabilityObjective	Percentage	1	Availability objective.

Table 57-OneWayAvailabilityPmMetric Attributes



## 17.8 OneWayHighLossIntervalPmMetric

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

Schema File Name: carrierEthernet/carrierEthermetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayHighLossIntervalsObjective	Integer	1	High Loss Intervals objective.

**Table 58-OneWayHighLossIntervalPmMetric Attributes**

## 17.9 OneWayConsecutiveHighLossIntervalPmMetric

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.

Schema File Name: carrierEthernet/carrierEthermetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairs	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 as a non-negative integer.

**Table 59-OneWayConsecutiveHighLossIntervalPmMetric Attributes**

## 17.10 OneWayCompositePmMetric

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

Schema File Name: carrierEthernet/carrierEthermetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description

orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
compositePerformanceIndicatorThreshold	Number	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	Frame Delay threshold.
oneWayIfdvThreshold	Time	1	Inter-Frame Delay Variation threshold.
cpmObjective	Percentage	1	Performance objective.

Table 60-OneWayCompositePmMetric Attributes

## 17.11 OneWayGroupAvailabilityPmMetric

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.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
setOfOrderedPairs	SetOfOrderedPairs	1..*	Set of Ordered Pairs.
minimumNumberOfSetsAvailableK	Integer	1	Specified number of sets of ordered EVC End Point Pair available during characterized percentage of time measurement.
oneWayGroupAvailabilityObjective	Percentage	1	Group Availability objective.

Table 61-OneWayGroupAvailabilityPmMetric Attributes

## 17.12 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 Carrier Service Ethernet End Points.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
toCarrierEthernetServiceEndPoint	String	1	This is the EVC End Point ID for an EVC End Point in the service or OVC End Point in the service.
fromCarrierEthernetServiceEndPoint	String	1	This is the EVC End Point ID for an EVC End Point in the service or OVC End Point in the service.

Table 62-OrderedPair Attributes

## 17.13 Percentage

A rate, number, or amount in each hundred.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml	
Minimum:0	
Maximum: 100	
Type: Number	

Table 63-Percentage Attributes

## 17.14 SetOfOrderedPair

Data type representing a set of Ordered Pairs.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
orderedPairList	OrderedPair	1..*	Data type representing a set of Ordered Pairs.

Table 64-SetOfOrderedPair Attributes

## 17.15 Time

A data type used to represent time in various units.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description

number	Number	1	Time as a number.
Unit	String Enum:  <ul style="list-style-type: none"> <li>• nanoSeconds</li> <li>• microSeconds</li> <li>• millisecond</li> <li>• seconds</li> </ul>	1	Time units as set of enumerations.

Table 65-Time Attributes

## 17.16 TimeIntervalT

This attribute sets the time interval to evaluate the performance for the SLS. All performances of this SLS use the same time interval T, which itself may not be constrained, e.g., 1 month.

Schema File Name: carrierEthernet/carrierEthernetServiceLevelSpecification.yaml			
Attribute Name	Type	Multiplicity	Description
number	Integer	1	This denotes the value (for the unit).
unit	String Enum:  <ul style="list-style-type: none"> <li>• day</li> <li>• month</li> <li>• week</li> <li>• year</li> </ul>	1	Time interval unit.

Table 66-TimeIntervalT Attributes

## Appendix A Usage examples (Informative)

This appendix aims to provide an extensive set of examples to cover:

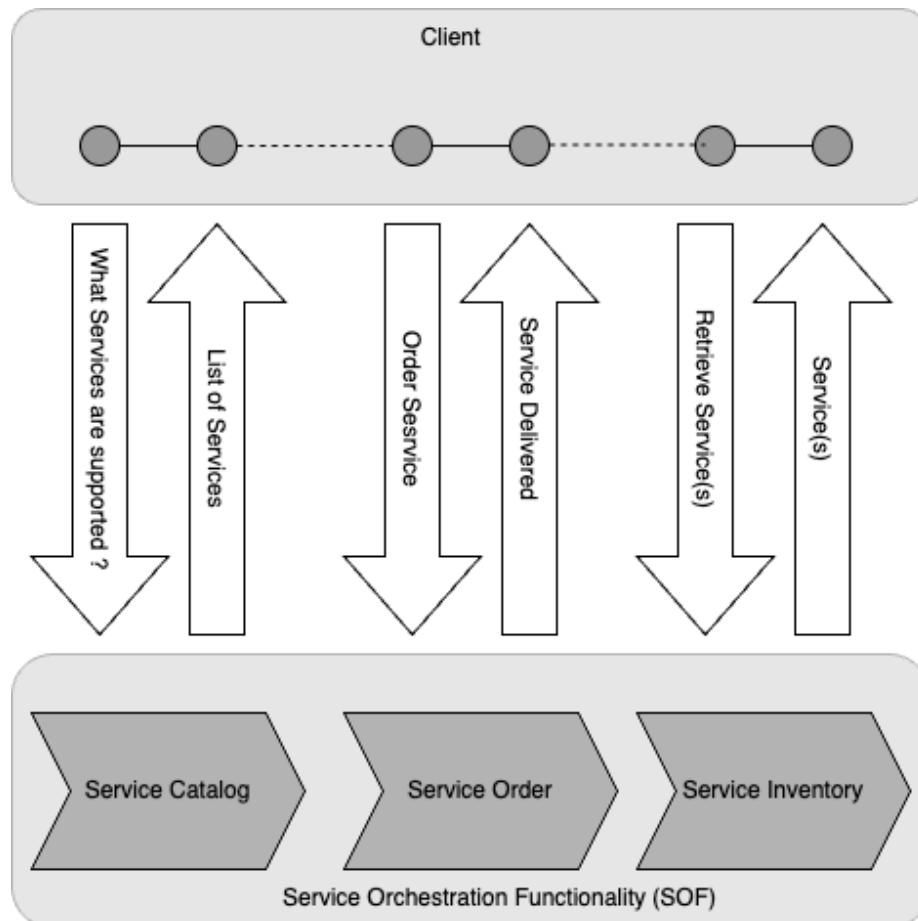
- Different Service Order configuration variants,
- Basic Service Order API walkthrough to order a Carrier Ethernet Service,
- Common modifications,
- Deletion of a Carrier Ethernet Service

The examples are delivered in two forms:

- As part of this document – to allow comments and rich explanation.
- As a Postman collection – for ease of use in testing.

### A.1 High-level Flow

The Legato Interface Reference Points each form a set of APIs that service different functions in the end-to-end flow.



**Figure 22-Service End-to-End Function Flow**

Service Catalog – allows the Client to query SOF for available Services as well as what attributes are fixed and/or elastics with values/ranges.

Service Order – allows the Client to request the SOF to initiate and complete the fulfillment process of installation of a Service Offering, an update to an existing Service, or a disconnect of an existing Service.

Service Inventory – allows the Client to retrieve information about existing Service instances from the SOF's Service Inventory.

All the above-mentioned APIs are provided in the SDK together with accompanying Developer Guides. Please refer to those documents for more details and examples of functional APIs.

**A.2 Integration of Service Specification into the Service Order API**

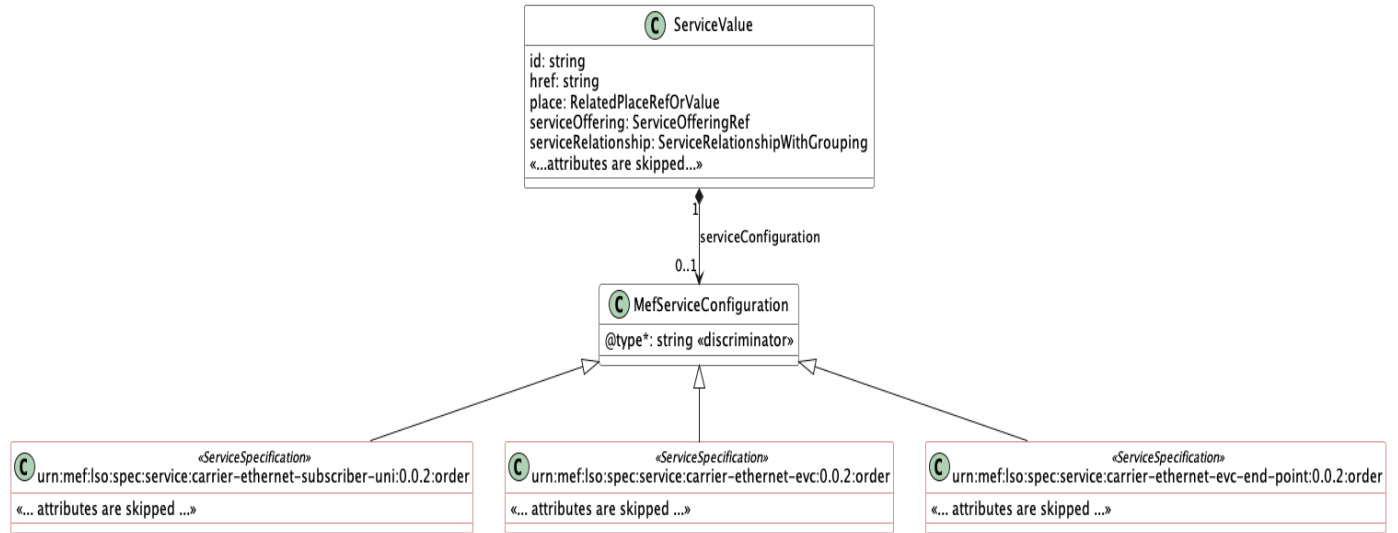
The Service Order API is service-agnostic in the meaning that they serve as an interaction between the Client and the Server (SOF) and they do not contain any service-specific information in their specifications. To pass the service-specific information, an extension pattern is used. This applies to any of the Service APIs that carry service-specific information: Service Catalog, Service Order and Service Inventory [11].

The extension hosting type in the API data model is `MefServiceConfiguration`. The `@type` attribute of that type must be set of a value that uniquely identifies the service specification. See Figure 23 and Figure 24. A unique identifier for MEF standard service specifications is in URN format and is assigned by MEF. This identifier is provided as root schema `$id` and in service specification documentation. The example below shows a header of a Carrier Ethernet Subscriber UNI, where **`$id: urn:mef:lso:spec:service:carrier-ethernet-subscriber-uni:v0.0.2:all`** the above-mentioned URN:

```
$id: urn:mef:lso:spec:service:carrier-ethernet-subscriber-uni:v0.0.3:all  
$schema: http://json-schema.org/draft-07/schema#  
title: MEF LSO - Carrier Ethernet Subscriber UNI Specification
```

In this case, this will be in format of examples below:

- `urn:mef:lso:spec:service:carrier-ethernet-subscriber-uni:v0.0.2:all`
- `urn:mef:lso:spec:service:carrier-ethernet-evc:v.0.0.2:all`
- `urn:mef:lso:spec:service:carrier-ethernet-evc-end-point:v.0.0.2:all`



**Figure 23-Extension Pattern: Subscriber Carrier Ethernet Service-Specific Extensions**

- urn:mef:iso:spec:service:carrier-ethernet-operator-uni:v0.0.2:all
- urn:mef:iso:spec:service:carrier-ethernet-ovc:v.0.0.2:all
- urn:mef:iso:spec:service:carrier-ethernet-ovc-end-point:v.0.0.2:all
- urn:mef:iso:spec:service:carrier-ethernet-enni:v.0.0.2:all
- urn:mef:iso:spec:service:carrier-ethernet-enni-service:v.0.0.2:all
- urn:mef:iso:spec:service:carrier-ethernet-virtual-uni:v0.0.2:all



**Figure 24-Extension Pattern: Operator Carrier Ethernet**

Use of non-MEF standard service definitions is allowed. In such a case the schema identifier must be agreed upon between the Client and the SOF.

### A.3 Action: Add

This section guides through all the steps of Service Order API that is needed to be performed to successfully order a Subscriber Carrier Ethernet UNI service.

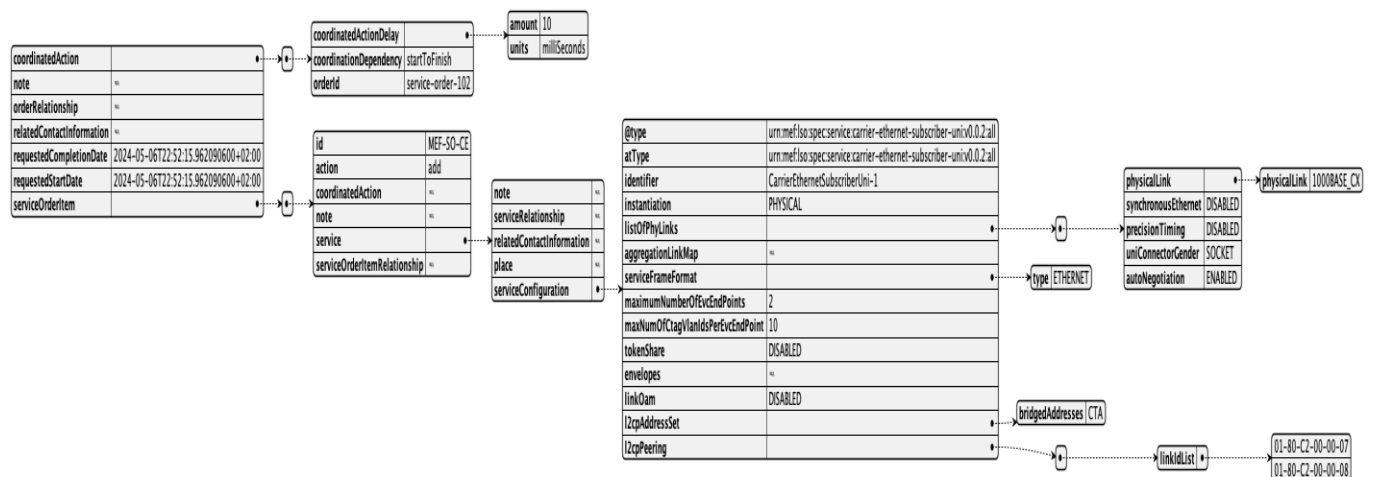
NOTE: SOF is free to mandate some of these steps.

NOTE: As the examples of steps in many cases will replicate the service-specific information, in some of the snippets some parts of it will be omitted for better readability.

There are rules for all request items for creation requests (Service Order):

- `item.action` must be set to `add`
- `item.service.id` must be provided.
- `service.serviceConfiguration` must contain all desired configurations

### A.3.1 Use Case 1: Service Order



### Figure 25-UC1: Service Order Request-Add Subscriber UNI



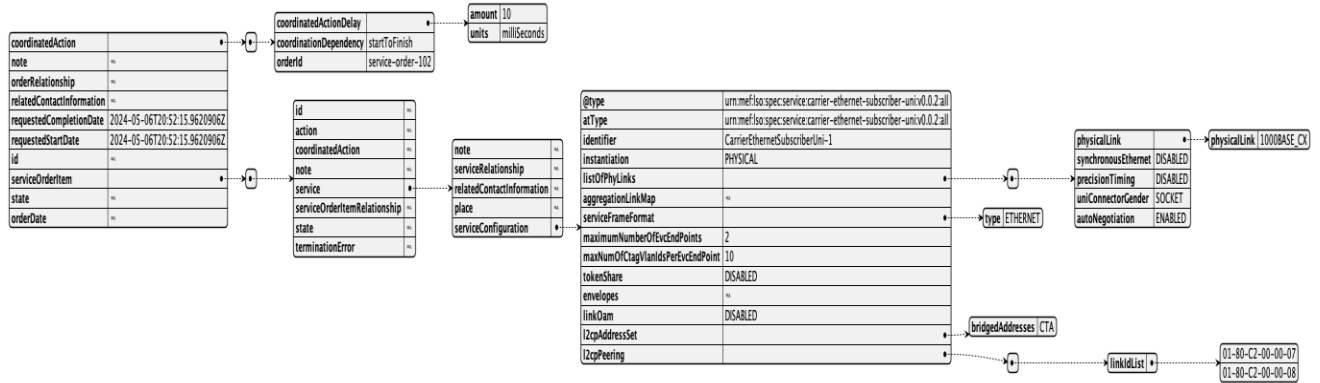


Figure 26-Service Order Response-Add Subscriber UNI

## A.4 Action: Modify

This section guides through all the steps of Service Order API that is needed to be performed to successfully modify a Subscriber Carrier Ethernet UNI service.

NOTE: SOF is free to mandate some of these steps.

NOTE: As the examples of steps in many cases will replicate the service-specific information, in some of the snippets some parts of it will be omitted for better readability.

There are rules for all request items for creation requests (Service Order):

- `item.action` must be set to `modify`
- `item.service.id` must be provided.
- `service.serviceConfiguration` must contain all desired configurations

## A.5 Action: Delete

This section guides through all the steps of Service Order API that is needed to be performed to successfully delete a Subscriber Carrier Ethernet UNI service.

NOTE: SOF is free to mandate some of these steps.

There are rules for all request items for creation requests (Service Order):

- `item.action` for each Service Order Item must be set to `delete`

## 18 References

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- [11] MEF 99 LSO Service Ordering Management API-Developer Guide, October 2023.