



Letter Ballot
MEF W125

LSO Cantata and LSO Sonata - Subscriber Ethernet
Product Schemas and Developer Guide

October 2022

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Table of Contents

49			
50	1	List of Contributing Members	1
51	2	Abstract	2
52	3	Terminology and Abbreviations	4
53	4	Compliance Levels	8
54	5	Numerical Prefixes	9
55	6	Introduction	10
56	7	Overview of LSO Cantata and LSO Sonata	12
57	8	Overview of Subscriber Ethernet Services	14
58	8.1	EVCs	14
59	8.2	EPL, EVPL, EP-LAN, EVP-LAN, EP-TREE, EVP-TREE	15
60	9	Data Model Design Principles and Assumptions	18
61	9.1	Mandatory Product-Specific Attributes	19
62	9.2	Optional Product-Specific Attributes	20
63	9.3	Fixed Product-Specific Attributes	20
64	10	Order Milestones	22
65	11	Information Model for Subscriber Ethernet Product Data Model	23
66	11.1	Organization of Service Attributes	23
67	12	Data Models for Subscriber Ethernet Products	28
68	12.1	Organization and Structure of the Schemas	28
69	12.2	Service Attribute Groupings	29
70	12.3	Example Schema	29
71	12.4	Additional Details	31
72	12.4.1	Naming Conventions	31
73	12.4.2	EVC End Point Service Attributes	31
74	12.4.3	Additional EVC End Point Attributes	31
75	13	Relationship Between Entities	33
76	14	Subscriber Ethernet Service Attributes	37
77	14.1	Subscriber Ethernet EVC Groups	38
78	14.1.1	EVC and EVC End Point Group – Common	38
79	14.1.2	EVC End Point Group – EPL	41
80	14.1.3	EVC and EVC End Point Group – Not EPL	41
81	14.1.4	EVC and EVC End Point Group – Virtual	43
82	14.2	Subscriber Ethernet EVC and EVC End Point Service Attributes	45
83	14.2.1	EPL Service Attributes	45
84	14.2.2	EVPL Service Attributes	46
85	14.2.3	EP-LAN Service Attributes	47
86	14.2.4	EVP-LAN Service Attributes	48
87	14.2.5	EP-TREE Service Attributes	49
88	14.2.6	EVP-TREE Service Attributes	50



89	14.3	Subscriber Ethernet UNI Service Attributes	51
90	15	Common Classes and Types.....	54
91	15.1	Bandwidth Profiles	54
92	15.2	Class of Service	58
93	15.3	Color Identifier	62
94	15.4	EVC Egress Maps.....	64
95	15.5	EVC End Point Maps	65
96	15.6	EVC External Interfaces	66
97	15.7	External Interfaces	67
98	15.8	Layer 2 Control Protocols (L2CP).....	69
99	15.9	Link Aggregation.....	70
100	15.10	Service Level Specification	71
101	15.11	Standard Enums	82
102	15.12	Utility Classes.....	85
103	16	Service Attributes Not Included.....	88
104	17	References	89
105	Appendix A	Acknowledgements	90
106			

List of Figures

107		
108	Figure 1 – LSO Cantata and LSO Sonata Reference Diagram	12
109	Figure 2 – LSO Cantata and LSO Sonata API Structure	13
110	Figure 3 – E-Line Service Type.....	15
111	Figure 4 – E-LAN Service Type.....	16
112	Figure 5 – E-Tree Service Type.....	16
113	Figure 6 – Components of a Subscriber Ethernet Service	23
114	Figure 7 – Subscriber Ethernet Superclasses	24
115	Figure 8 – EPL and EVPL	25
116	Figure 9 – EP-LAN, EVP-LAN, EP-TREE and EVP-TREE	26
117	Figure 10 – Schema File Organization	28
118	Figure 11 – Relationships for EPL and EVPL.....	36
119	Figure 12 – Relationships for EP-LAN, EVP-LAN, EP-TREE and EVP-TREE.....	36
120		

List of Tables

121	
122	Table 1 – Terminology and Abbreviations 7
123	Table 2 – Numerical Prefix Conventions..... 9
124	Table 3 – MEF 6.3 Compliant Subscriber Ethernet Services 14
125	Table 4 – Order Milestones for Subscriber Ethernet 22
126	Table 5 – Service Attribute Groupings 29
127	Table 6 – Product Relationship Roles..... 33
128	Table 7 – Place Relationship Role 35
129	Table 8 – Service Attributes Not Included in Schemas 88

130

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.

- Amartus
- Cisco Systems
- Colt Technology Services
- Lumen Technologies
- Proximus

2 Abstract

The MEF Standard consisting of this schema guide and its associated software artifacts (JSON Schemas) defines and describes the product-specific information used in LSO Cantata and LSO Sonata APIs for a set of Business Functions - specifically, Product Offering Qualification, Quote, Order and Inventory, for Subscriber Ethernet Services conforming to MEF 6.3 [7]. The document starts with an overview of LSO Cantata, LSO Sonata and Subscriber Ethernet Services. It then provides a basic information model for the MEF Subscriber Ethernet Service Attributes. The final sections describe the Data Model focused on the JSON Schemas associated with this specification.

This document can be thought of as a user's guide for the Subscriber Ethernet 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 [9]. The Services, themselves, are specified in MEF 6.3 based on the Service Attributes defined in MEF 10.4.

MEF 10.4 includes 11 EVC Service Attributes, 13 EVC End Point and 17 Subscriber UNI Service Attributes to describe the various components that compose a Subscriber Ethernet Service. This document defines a data model that includes 33 of these Service Attributes and also lists the 8 Service Attributes that are not included in the data model and the reason why each is not included. It also describes how they are organized across the various schemas to support the different types of Subscriber Ethernet Services.

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-Sonata-SDK> at commit ID: c9c742c81d9a0ac5c19edc8c86e50e41ed3c51fa):

Schemas for Subscriber Ethernet Classes:

- carrierEthernet/subscriberEthernet/epl/ethernetPrivateLineEvc.yaml
- carrierEthernet/subscriberEthernet/epl/ethernetPrivateLanEvc.yaml
- carrierEthernet/subscriberEthernet/epl/ethernetPrivateLanEvcEp.yaml
- carrierEthernet/subscriberEthernet/eptree/ethernetPrivateTreeEvc.yaml
- carrierEthernet/subscriberEthernet/eptree/ethernetPrivateTreeEvcEp.yaml
- carrierEthernet/subscriberEthernet/evpl/ethernetVirtualPrivateLineEvc.yaml
- carrierEthernet/subscriberEthernet/evplan/ethernetVirtualPrivateLanEvc.yaml
- carrierEthernet/subscriberEthernet/evplan/ethernetVirtualPrivateLanEvcEp.yaml
- carrierEthernet/subscriberEthernet/evptree/ethernetVirtualPrivateTreeEvc.yaml
- carrierEthernet/subscriberEthernet/evptree/ethernetVirtualPrivateTreeEvcEp.yaml

- carrierEthernet/subscriberEthernet/carrierEthernetSubscriberUni/carrierEthernetSubscriberUni.yaml
- carrierEthernet/subscriberEthernet/evcProductComponents/carrierEthernetEvcCommon.yaml
- carrierEthernet/subscriberEthernet/evcProductComponents/carrierEthernetEvcVirtualPrivate.yaml
- carrierEthernet/subscriberEthernet/evcProductComponents/carrierEthernetEvcEpNotEpl.yaml
- carrierEthernet/subscriberEthernet/evcProductComponents/carrierEthernetEvcEpVirtualPrivate.yaml
- carrierEthernet/subscriberEthernet/evcProductComponents/carrierEthernetEvcEpEline.yaml
- carrierEthernet/subscriberEthernet/subscriberEthernetCommon/evcEndPointMaps.yaml
- carrierEthernet/subscriberEthernet/subscriberEthernetCommon/evcEgressMaps.yaml
- carrierEthernet/subscriberEthernet/subscriberEthernetCommon/evcExternalInterfaces.yaml

Schemas for Carrier Ethernet Common Classes:

- carrierEthernet/carrierEthernetCommon/carrierEthernetExternalInterfaces.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetLinkAggregation.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetBandwidthProfile.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetL2cp.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetClassOfService.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetColorIdentifier.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetServiceLevelSpecification.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetEnums.yaml
- carrierEthernet/carrierEthernetCommon/carrierEthernetUtilityClasses.yaml

3 Terminology and Abbreviations

This section defines the terms used in this document. In many cases, the normative definitions to terms are found in other documents. In these cases, the third column is used to provide the reference that is controlling, in other MEF or external documents.

Term	Definition	Reference
Business Functions	In the context of this document Business Functions refer to <i>Product Offering Qualification (POQ)</i> , <i>Order Management</i> , <i>Quote Management</i> , and <i>Inventory Management</i> .	This Document
Buyer	In the context of this document, a Buyer is the organization acting as the Subscriber who is ordering from a Service Provider (aka, Seller).	MEF 57.2 [13]
Cantata	The Management Interface Reference Point supporting the management and operations interactions (e.g., quote, order, billing, etc.) between a Service Provider (Seller) and a Subscriber(Buyer).	MEF 55.1 [12]
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 [4]
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 [10]
ENNI	External Network Network Interface	MEF 26.2 [10]
EPL	Ethernet Private Line	MEF 6.3 [7]
EP-LAN	Ethernet Private LAN	MEF 6.3 [7]
EP-Tree	Ethernet Private Tree	MEF 6.3 [7]
Ethernet Private Line	A Port-based Service of E-Line Service Type.	MEF 6.3 [7]
Ethernet Private LAN	A Port-based Service of E-LAN Service Type.	MEF 6.3 [7]
Ethernet Private Tree	A Port-based Service of E-Tree Service Type.	MEF 6.3 [7]
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 [9]
Ethernet Subscriber	The end-user of an Ethernet Service.	MEF 10.4 [9]
Ethernet UNI	The demarcation point between the responsibility of the Service Provider and the Subscriber for an Ethernet Service.	MEF 10.4 [9]
Ethernet Virtual Connection	An association of EVC End Points.	MEF 10.4 [9]

Term	Definition	Reference
Ethernet Virtual Private Line	A VLAN-based Service of E-Line Service Type.	MEF 6.3 [7]
Ethernet Virtual Private LAN	A VLAN-based Service of E-LAN Service Type.	MEF 6.3 [7]
Ethernet Virtual Private Tree	A VLAN-based Service of E-Tree Service Type.	MEF 6.3 [7]
EVC	Ethernet Virtual Connection	MEF 10.4 [9]
EVC End Point	A construct at a (Ethernet) UNI that selects a subset of the Service Frames that pass over the UNI.	MEF 10.4 [9]
EVPL	Ethernet Virtual Private Line	MEF 6.3 [7]
EVP-LAN	Ethernet Virtual Private LAN	MEF 6.3 [7]
EVP-Tree	Ethernet Virtual Private Tree	MEF 6.3 [7]
External Interface	In the context of this document, a UNI.	MEF 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 [4]
Inventory	Product Inventory	MEF 81 [17]
Milestone	An event that occurs during the fulfillment process that indicates a significant step in the process has been completed.	This Document
Operator	The administrative entity of a Carrier Ethernet Network.	MEF 26.2 [10]
Order	One or more Product Order Items formulated into a fulfillment request made by a Buyer to a Seller.	MEF 57.2 [13]
Port-based Service	Any service with EVC EP Map Service Attribute value equal to <i>All</i> for each EVC EP in the EVC.	MEF 6.3 [7]
Product	One or more goods or services that is or may be sold to a Buyer by a Seller.	MEF 79 [15]
Product Catalog	A Product Catalog lists and describes the Product Offerings made available by a Seller to potential Buyers.	This Document
Product Offering	The commercial and technical details of a Product sold by a Seller. A Product Offering defines all of the commercial terms and, through association with a particular Product Specification, defines all of the technical attributes and behaviors of the Product. A Product Offering may constrain the allowable set of configurable technical attributes and/or behaviors specified in the associated Product Specification.	MEF 79 [15]

Term	Definition	Reference
Product Order Item	An individual item included in a Product Order that describes the action to be taken on a Product or Product Offering by the Seller. The objective is for the Seller to complete the fulfilment process of this Product or Product Offering at the place defined by the Buyer.	This Document
Product Inventory	The inventory managed by the Seller resulting from Order completion.	MEF 81 [17]
Product-Specific Attributes	The Service Attributes and their parameters for a Product that would be delivered to fulfill a Business Function.	This Document
Product Specification	A Product Specification defines the template or detailed description from which Product Offerings can be defined.	MEF 79 [15]
POQ	Product Offering Qualification	MEF 79 [15]
Product Offering Qualification	One or more Product Offering Qualification Items formulated into a requirement made by a Buyer to a Seller.	MEF 79 [15]
Product Offering Qualification Item	An individual article included in a POQ that describes a product of a particular type (product offering). The objective is to determine if it is feasible for the Seller to deliver this item as described and for the Seller to inform the Buyer of the estimated time interval to complete this delivery.	MEF 79 [15]
Quote	One or more Quote Items formulated into a request for pricing of a Product or Product Offering made by a Buyer to a Seller.	MEF 80 [16]
Quote Item	An individual item included in a Quote that describes the Buyer's interest in a price from the Seller for a Product or Product Offering. The objective is to determine the charges and timeframe for the Seller to deliver this item as described by the Buyer.	MEF 80 [16]
Seller	In the context of this document, a Seller is the Service Provider who is providing the product to the Buyer.	MEF 57.2 [13]
Service Attribute	Specific information that is agreed between the provider and the user of the service, as described in a MEF Standard, that describes some aspect of the service behavior or capability.	MEF 61.1 [14]
Service Frame	An Ethernet Frame that is exchanged across a UNI between a Subscriber and a Service Provider.	MEF 10.4 [9]

Term	Definition	Reference
Service Provider	In the context of this document, a Service Provider is an organization that provides a Subscriber Ethernet Service to Subscribers.	This Document
Sonata	The Management Interface Reference Point supporting the management and operations interactions (e.g., ordering, billing, trouble management, etc.) between two network providers (e.g., Service Provider Domain (Seller) and Partner Domain (Buyer)).	MEF 55.1 [12]
Subscriber	In the context of this document, a Subscriber is an Ethernet Subscriber.	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
Subscriber UNI Service Attributes	The Service Attributes used to describe an agreement between a Subscriber and a Service Provider for a UNI as part of a Subscriber Ethernet Service.	MEF 10.4 [9]
UNI	In the context of this document, a UNI means an Ethernet UNI.	MEF 10.4 [9]
VLAN-based Service	Any service with the EVC EP Map value equal to <i>UT/PT</i> or <i>List</i> for each EVC EP in the EVC.	MEF 6.3 [7]

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 specification are to be interpreted as described in BCP 14 (RFC 2119 [3], RFC 8174 [5]) 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.

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 Cantata provides a programmatic interface for establishing an automated exchange of information between business applications (Quote, Order, etc.) between a Service Provider (Seller) and a Subscriber (Buyer). LSO Sonata provides a similar programmatic interface between two network providers, a Service Provider (Seller) and Partner (Buyer). These APIs are hierarchically structured. 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., Quote, Order, etc.) and the inner-most structure contains information relating to the specific product, for example Ethernet Private Line (EPL).

A Subscriber Ethernet Service is an Ethernet Service that is provided by a Service Provider (Seller) to provide connectivity to Subscribers (Buyers), between two or more UNIs. The Service Attributes that are agreed to between the parties are defined in MEF 10.4 [9]. The Service definition which is, in effect, a set of constraints on the values of the Service Attributes is provided MEF 6.3 [7].

This specification is accompanied by a data model for the Subscriber Ethernet components instantiated as a set of JSON schemas that can be used within the Cantata/Sonata API to perform Product Offering Qualification, Quote, Order, and Inventory for Subscriber Ethernet Products consisting of:

- Subscriber Ethernet EVC and EVC End Point Service Attributes
- Subscriber Ethernet UNI Service Attributes

The document contains the following sections:

- An overview of LSO Cantata and LSO Sonata (section 7)
- An overview of Subscriber Ethernet Services (section 8)
- Data Model Design Principles (section 9)
- Order Milestones (section 10)
- An abbreviated Information Model for Subscriber Ethernet and explanation of the organization of the Service Attributes in MEF 10.4 (section 11)
- Organization of the data model for Subscriber Ethernet (section 12)
- The relationship between the entities in the service (section 13)

These sections are followed by three sections that contain tables that describe the details of the data model. These includes the JSON Name, description, data type, details about allowed values, and, in some cases, some additional information about relationships between Service Attributes.

- Section 14 contains the details of the Subscriber Ethernet Service Attributes for EVC, EVC End Point, and UNI
- Section 15 contains all of the common classes and types referenced by the Service Attributes
- Section 16 lists the Service Attributes that are not included in the data models

7 Overview of LSO Cantata and LSO Sonata

MEF 55.1 [12] describes the Reference Architecture for Lifecycle Service Orchestration (LSO) of MEF-defined services. MEF 55.1 defines seven LSO Interface Reference Points (see Figure 1) that are abstract interconnection points between different entities—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 Cantata which defines the abstract interconnection point between a Subscriber (Buyer) and a Service Provider (Seller) and another is LSO Sonata which defines the abstract interconnection point between a Service Provider (Buyer) and an Operator (Seller). It is at these Interface Reference Points – LSO Cantata and LSO Sonata – that the Buyer and the Seller interact to orchestrate business transactions for the different Business Functions. Examples of inter-provider Business Functions include address qualification, product offering qualification, quote, ordering, trouble ticketing, and billing/settlement management.

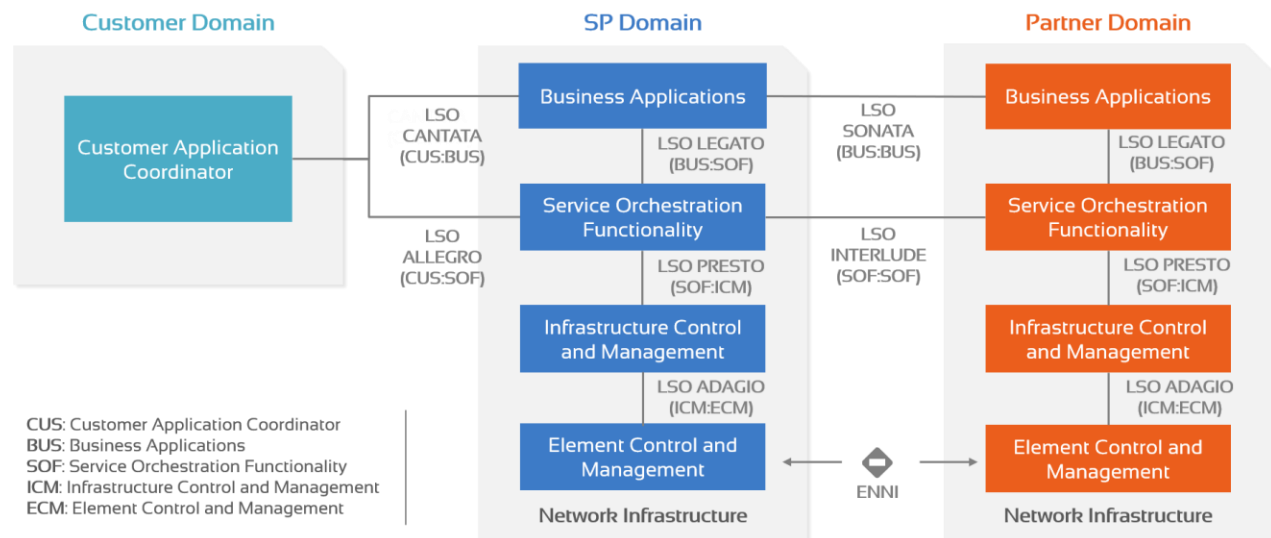


Figure 1 – LSO Cantata and LSO Sonata Reference Diagram

The mutual access to Business Functionalities is automated via APIs at the LSO Cantata and LSO Sonata Interface Reference Points which are standardized by MEF as LSO Cantata and LSO Sonata APIs, and which are made available by MEF in a series of releases of the LSO Cantata SDK and LSO Sonata SDK.

The LSO Cantata and LSO Sonata APIs comprise two parts—a product-agnostic API and a set of product-specific data models, as shown in Figure 2.

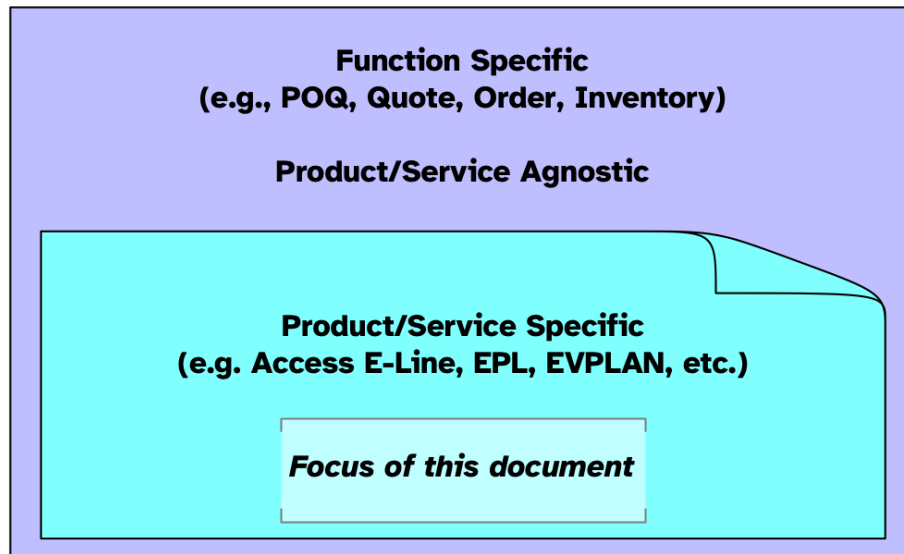


Figure 2 – LSO Cantata and LSO Sonata API Structure

This document describes the product-specific data model for a MEF Subscriber Ethernet Services as defined in MEF 6.3 [7].

8 Overview of Subscriber Ethernet Services

This specification describes a data model for MEF-defined Subscriber Ethernet Services. A UNI is used to interconnect a Subscriber Network to the Service Provider Network and instantiate the Ethernet Services covered in the specification. An Ethernet Service consists of the EVC (Ethernet Virtual Connection) and the corresponding EVC End Points, each located at a UNI, that are defined using the Service Attribute values agreed to between the Service Provider and the Subscriber.

The following sub-sections provide background on EVCs and the different types of Subscriber Ethernet EVC Services (EPL, EVPL, EP-LAN, EVP-LAN, EP-TREE, EVP-TREE) defined in MEF 6.3 [7]. It starts with a brief explanation of EVCs.

8.1 EVCs

A Subscriber Ethernet Service is built on an Ethernet Virtual Connection (EVC) which is an association of two or more EVC End Points. An EVC End Point is a construct located at a UNI that represents the logical attachment of an EVC to a UNI and selects a subset of Service Frames that pass over the UNI. A given UNI can support more than one EVC End Point, but each EVC End Point has to be in a different EVC.

EVCs and their Service Attributes are defined in MEF 10.4 [9]. There are three types of EVC Services based on the type of connectivity provided: point-to-point, multipoint-to-multipoint, and rooted-multipoint. MEF 6.3 defines these three EVC Service Type constructs: E-Line (point-to-point), E-LAN (multipoint-to-multipoint), and E-Tree (rooted-multipoint). In addition, both a Port-based service and VLAN-based service is defined for each of the three EVC Service Type constructs, resulting in a total of six Subscriber Ethernet Services that are compliant with MEF 6.3. The VLAN-based services support Subscribers that desire one type of service while accessing other services from one or more UNIs at the same time.

In Port-based service, the C-Tag VLAN ID is not used in the mapping of Service Frames to the EVC End Point, whereas in a VLAN-based service, the presence and/or value of the C-Tag VLAN ID is used in the mapping of Service Frames to the EVC End Point. The six Subscriber Ethernet Services defined in MEF 6.3 are shown in Table 3.

EVC Service Type	Port-Based EVC Services	VLAN-Based EVC Services
Point-to-Point (E-Line)	EPL (Ethernet Private Line)	EVPL (Ethernet Virtual Private Line)
Multipoint-to-Multipoint (E-LAN)	EP-LAN (Ethernet Private LAN)	EVP-LAN (Ethernet Virtual Private LAN)
Rooted-Multipoint (E-Tree)	EP-Tree (Ethernet Private Tree)	EVP-Tree (Ethernet Virtual Private Tree)

Table 3 – MEF 6.3 Compliant Subscriber Ethernet Services

EVCs are sold to a Subscriber by a Service Provider. In most cases, the Service Provider is also an Operator that provides some or all of the network resources for the EVC. If all of the UNIs in an EVC are accessible on the Service Provider's network, then the Service Provider can deliver the EVC without having to coordinate with other Operators.

8.2 EPL, EVPL, EP-LAN, EVP-LAN, EP-TREE, EVP-TREE

The key differentiator between the three types of EVC services is the value of the EVC Type Service Attribute which determines the type of connectivity provided to the Subscriber.

Any Ethernet Service that has the EVC Type Service Attribute equal to **Point-to-Point** is classified as an E-Line Service Type (EPL, EVPL). E-Line services are intended to be highly transparent, in the sense that Service Frames received at the ingress UNI are delivered at the egress UNI with as few modifications as possible. An E-Line service can only associate exactly two Root EVC End Points, as shown in Figure 3.

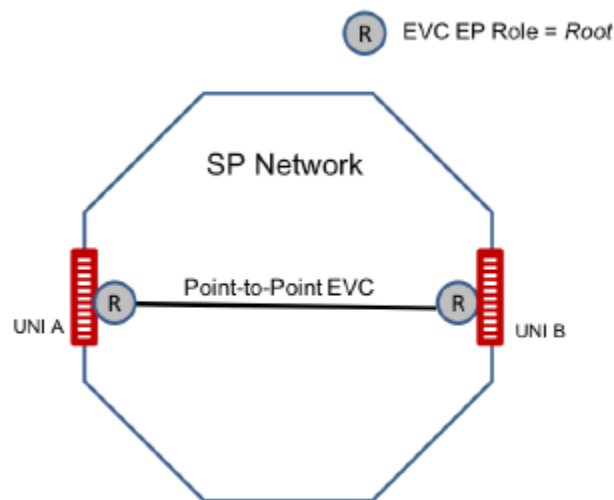


Figure 3 – E-Line Service Type

Any Ethernet Service that has the EVC Type Service Attribute equal to **Multipoint-to-Multipoint** is classified as an E-LAN Service Type (EP-LAN, EVP-LAN). E-LAN services enable Subscribers with multiple sites to interconnect them so that all sites appear to be on the same Local Area Network (LAN) and have the same performance and access to resources such as servers and storage. An E-LAN service can associate more than two EVC End Points and can only associate Root EVC End Points, as shown in Figure 4.

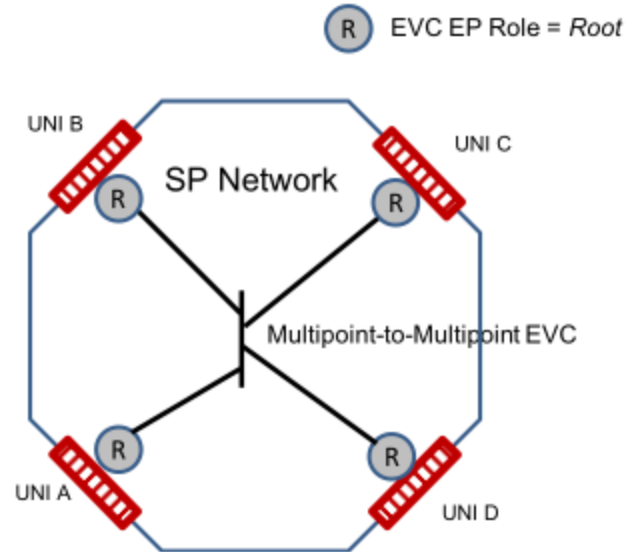


Figure 4 – E-LAN Service Type

Any Ethernet Service that has the EVC Type Service Attribute equal to ***Rooted-Multipoint*** is classified as an E-Tree Service Type (EP-TREE, EVP-TREE). An E-Tree service is a highly transparent service that enables Subscribers with multiple sites to interconnect them in a way that does not resemble a LAN. The sites can be connected with a centralized site (or a few core sites), which are designated as a Root and all remaining sites designated as Leaf.

An E-Tree service can associate more than two EVC End Points, at least one of which must be a Root EVC End Point and any number of which are Leaf EVC End Points. A restriction on a Leaf EVC End Point is that ingress Service Frames can only be delivered to Root EVC End Points. There is no such restriction on a Root EVC End Point. An E-Tree service with a single Root is illustrated in Figure 5.

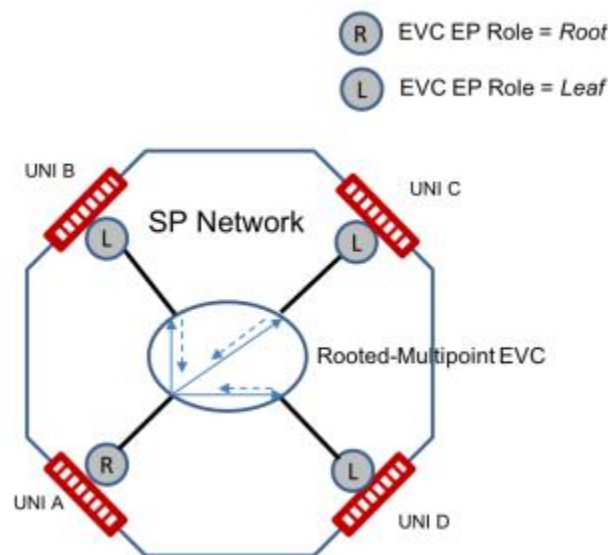


Figure 5 – E-Tree Service Type

The LSO Cantata and LSO Sonata API with the Subscriber Ethernet product configuration as described in this specification allows the Business Functions associated with purchasing these products (Product Offering Qualification, Quote, Order, and Inventory) to be performed programmatically.

9 Data Model Design Principles and Assumptions

A Service Attribute for a Product 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 such as a Bandwidth Profile or a composition of objects such as an End Point Map. Within this document, each simple value (integer, string, boolean, etc.) is referred to as a Product-Specific Attribute. A Product-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. There are no Product-Specific Attributes that are tagged as “Required” in the Subscriber Ethernet data model and, as such, each must be assigned by each Seller into one of three classifications as defined below.

Note: The one exception to the previous paragraph are the two EVC End Points for EPL and EVPL for the EVC. These must be included in the Subscriber Ethernet data model since the EVC is incomplete without them and are therefore tagged as “Required”.

The design for the Subscriber Ethernet data model is based on a number of assumptions:

- None of the Product-Specific Attributes included in the schemas are coded as “Required”.
- The Buyer and Seller agree to assign each Product-Specific Attributes included in the schemas into one of three classifications. The classification for each Product-Specific Attribute may be different across Business Function, Product Action and Product Offering:
 - Mandatory - attributes that must be provided by the Buyer in a POQ/Quote/Order request or must be returned by the Seller for an Inventory request as specified in section 9.1.
 - Optional - attributes that may be provided by the Buyer in a POQ/Quote/Order request and may be returned by the Seller for an Inventory request as specified in section 9.2.
 - Fixed - attributes that are hard coded and may be specified by the Buyer in a POQ/Quote/Order request (subject to agreement between the Buyer and Seller) and may be returned by the Seller for an Inventory request (subject to agreement between the Buyer and Seller) as specified in section 9.3.

As noted above, the classification may depend on:

- Business Function - a given Product-Specific Attribute may, for example, be classified as Fixed for the Create POQ request; while it may be considered as Mandatory for the Create Order request.
- Product Action - a given Product-Specific Attribute may, for example, be classified as Mandatory for the Create POQ request for an INSTALL of a new Product, while it may be classified as Fixed for the Create POQ request for a CHANGE of an installed Product.

- Product Offering - a given Product-Specific Attribute may, for example, be classified as Mandatory for the Create POQ request for a Product Offering (e.g., Premium Service), while it may be classified as Fixed for the Create POQ request for a different Product Offering (e.g., Basic Service).

The Product-Specific Attribute classification can be defined and negotiated during the onboarding process or defined in a Product Catalog.

- [R1]** The Seller and Buyer **MUST** agree, for each Product-Specific Attribute, whether the attribute is Mandatory, Optional or Fixed for each Business Function (POQ, Quote, Order) and Product Action (INSTALL, CHANGE) for a Product Offering.
- [R2]** The Seller and Buyer **MUST** agree, for each Product-Specific Attribute, whether the attribute is Mandatory, Optional or Fixed for Inventory for a Product Offering.
- [R3]** If, for Product Offering, a Product-Specific Attribute is classified as Optional for any Business Function and, if applicable, Product Action, the Seller and Buyer **MUST** agree on a default value for the attribute.
- [R4]** The Seller **MUST** reject an API request if the value for a Product-Specific Attribute requested by the Buyer is not a supported value for the applicable Product Offering.

The Subscriber Ethernet data model supports both INSTALL and CHANGE actions for POQ, Quote, and Order for the EVC and Subscriber UNI. Note that the DISCONNECT action does not require support by the data model.

The Subscriber Ethernet data model supports the RETRIEVE action for Inventory for the EVC and Subscriber UNI.

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

9.1 Mandatory Product-Specific Attributes

- [R5]** If a Product-Specific Attribute is agreed to be Mandatory for a Business Function (POQ, Quote, Order), Product Action (INSTALL, CHANGE), and Product Offering, then the Buyer **MUST** include a value for the attribute in the corresponding API request.
- [R6]** If a Product-Specific Attribute is agreed to be Mandatory for Inventory for a Product Offering, then the Seller **MUST** include a value for the attribute in the corresponding API response.

- [R7] When the Seller receives a POQ, Quote or Order request in which any of the Mandatory Product-Specific Attributes are not included, the request **MUST** be rejected by the Seller.

9.2 Optional Product-Specific Attributes

- [O1] If a Product-Specific Attribute is agreed to be Optional for a Business Function (POQ, Quote, Order), Product Action (INSTALL, CHANGE), and Product Offering, then the Buyer **MAY** include a value for the attribute in the corresponding API request.
- [R8] The Seller **MUST** apply the agreed default value for an Optional Product-Specific Attribute if a value is not included by the Buyer in the corresponding API request.
- [R9] If a Product-Specific Attribute is agreed to be Optional for Inventory for a Product Offering, then the Seller **MUST** include a value for the attribute in the corresponding API response if the value is not the agreed default value.
- [O2] If a Product-Specific Attribute is agreed to be Optional for Inventory for a Product Offering, then the Seller **MAY** include a value for the attribute in the corresponding API response if the value has the agreed default value.

9.3 Fixed Product-Specific Attributes

A Product-Specific Attribute may be classified as Fixed for a Business Function, Product Action, and Product Offering when only one value is applicable for the Seller. This can be the case for example if:

- the Seller supports only a single value, or
- the value is derived from the value of one or more other Product-Specific Attributes, or
- the Seller specifies a single value in the Product Catalog for a specific Product Offering, or
- the Buyer and the Seller agree on a single value during onboarding

Since these are Product-Specific Attributes, each value must still be agreed in some way between the Buyer and the Seller, which implies that even in the first two cases, the Seller must make the Buyer aware of what the value is or how it is derived, before the Buyer places an order. How this is done is outside the scope of this document.

The Seller applies the one applicable value for every request for which the Product-Specific Attribute is classified as Fixed.

- [R10] The Buyer and Seller **MUST** agree on whether the Buyer can include Product-Specific Attributes that have been classified as Fixed in API requests for POQ, Quote and Order.

- [R11] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed cannot be included in API requests (see [R10]), the Buyer and Seller **MUST** agree on whether the Seller includes Product-Specific Attributes classified as Fixed in the corresponding API responses.
- [R12] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed cannot be included in a API requests (see [R10]), the Seller **MUST** reject an API request from the Buyer if it includes a Product-Specific Attribute that has been classified as Fixed for the Business Function (POQ, Quote, Order), Product Action (INSTALL, CHANGE), and Product Offering.
- [R13] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed cannot be included in API requests (see [R10]), and if a Product-Specific Attribute is classified to be Fixed for Inventory for a Product Offering, then the Seller **MUST NOT** include a value for the Product-Specific Attribute in the corresponding API response.
- [R14] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed can be included in API requests (see [R10]), the Seller **MUST** reject an API request from the Buyer if it includes a Product-Specific Attribute that has been classified as Fixed for the Business Function (POQ, Quote, Order), Product Action (INSTALL, CHANGE), and Product Offering and includes a value that is different than the agreed-on fixed value.
- [R15] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed can be included in API requests (see [R10]), and if a Product-Specific Attribute is classified to be Fixed for Inventory for a Product Offering, then the Seller **MUST** include a value for the Product-Specific Attribute in the Inventory API responses.

10 Order Milestones

The Service Provider (Seller) can provide Product-Specific Product Order Item Milestone notifications to the Buyer on the status of an Order as a sequence of Milestones for that Order as they are achieved. For ordering a Subscriber Ethernet Service (EVC and UNI) the following milestones are commonly used (a Service Provider may support some or all of these milestones and not all milestones are applicable for all orders):

Milestone Value	Description	Applies To
SITE_SURVEY_SCHEDULED	Site Survey Scheduled	UNI
SITE_SURVEY_COMPLETE	Site Survey Complete	UNI
PLANNING_COMPLETE	Planning Complete	UNI, EVC
FIRM_DELIVERY_DATE_PROVIDED	Firm Delivery Date Provided	UNI, EVC
AWAITING_MUNICIPAL_APPROVAL	Awaiting Municipal Approval	UNI
MUNICIPAL_APPROVAL_GRANTED	Municipal Approval Granted	UNI
AWAITING_LANDLORD_APPROVAL	Awaiting Landlord Approval	UNI
LANDLORD_APPROVAL_GRANTED	Landlord Approval Granted	UNI
CONSTRUCTION_STARTED	Construction Started	UNI
CONSTRUCTION_COMPLETED	Construction Completed	UNI
AWAITING_ACCESS	Awaiting Site Access Permission (for end-to-end test)	UNI, EVC
ACCESS_DENIED	Site Access Denied (for end-to-end test). Issue is to be resolved with the Buyer and access may be re-attempted.	UNI, EVC
AWAITING_WIRING	Awaiting Installation of Inside Wiring by Landlord	UNI
WIRING_COMPLETE	Installation of Inside Wiring by Landlord Complete	UNI
EQUIPMENT_DISPATCHED	Equipment Dispatched	UNI
EQUIPMENT_DELIVERED	Equipment Delivered	UNI
EQUIPMENT_INSTALLED	Equipment Installed	UNI
E2E_TESTING_SCHEDULED	End-to-End Testing Scheduled	EVC
E2E_TESTING_COMPLETED	End-to-End Testing Completed	EVC
E2E_TESTING_FAILED	End-to-End Testing Failed. Issue is to be resolved and testing may be re-attempted.	EVC

Table 4 – Order Milestones for Subscriber Ethernet

The Milestone Value in the first column of Table 4 is included in *ProductOrderEventPayload.milestoneName* in the Product Order Notification API.

11 Information Model for Subscriber Ethernet Product Data Model

Subscriber Ethernet Services are composed of three primary classes of objects: The Virtual Connection (EVC), the UNI, and the EVC End Points. This product specification provides a data model for the Service Attributes for these three components.

The function that logically connects the EVC to each UNI is the Service End Point (EVC End Point). Although an abstract element, the End Point can be thought of as the container for the EVC Service Attributes that can vary independently at each UNI. For example, the EVC Type (is the EVC point-point or multipoint?) is an EVC Service Attribute and is invariant at all points for a given EVC. However, which VLAN(s) to map to the Service or how much bandwidth to allow are attributes of the EVC that can be different at each UNI, and these Service Attributes are encapsulated in the EVC End Points.

All of these elements are shown in the following diagram.

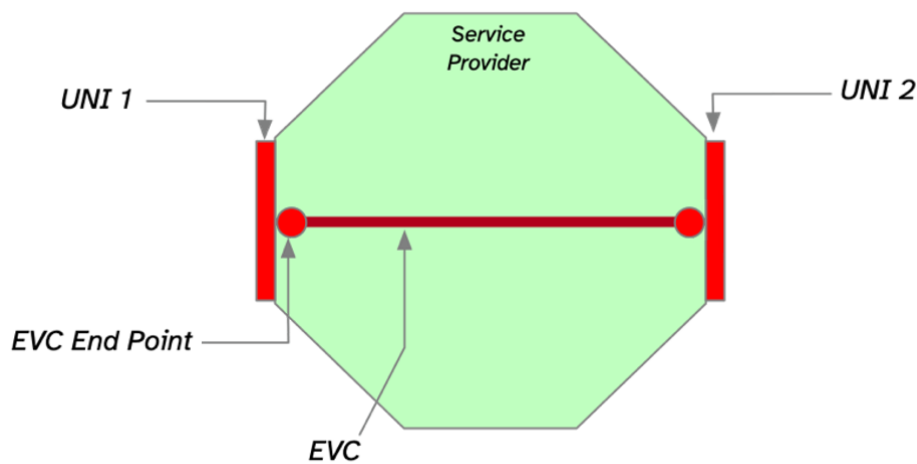


Figure 6 – Components of a Subscriber Ethernet Service

In this diagram, the Service Provider (large green octagon) is providing an EVC between UNI 1 and UNI 2. The EVC End Points (small red circles) are each located at the corresponding UNI.

11.1 Organization of Service Attributes

A Subscriber Ethernet Service is defined as having an EVC and two or more UNIs. The EVC will have an association with two or more EVC End Points. Each EVC End Point is associated with a single UNI (as shown in Figure 6). The Subscriber Ethernet configuration is based on the Service Attributes documented in MEF 10.4[9]. The MEF Services Model (MSM) for Subscriber Ethernet Services described in MEF 7.4 [8] defines three superclasses that contain all the common service attributes for the EVC, EVC End Point and Subscriber UNI. These superclasses (CarrierEthernetService, CarrierEthernetExternalInterface and CarrierEthernetServiceEndPoint) are shown in green in the following Figure 7 along with their sub-classes. The sub-classes relevant to Subscriber

Ethernet (CarrierEthernetSvc, CarrierEthernetSubscriberUni and CarrierEthernetSvcEndPoint) are shown in the colored boxes.

Note: the EVC Group Membership Service Attribute is not included in the EVC Product Schemas nor part of the MEF Services Model, MEF 7.4 [8], because this attribute is related to more than one service.

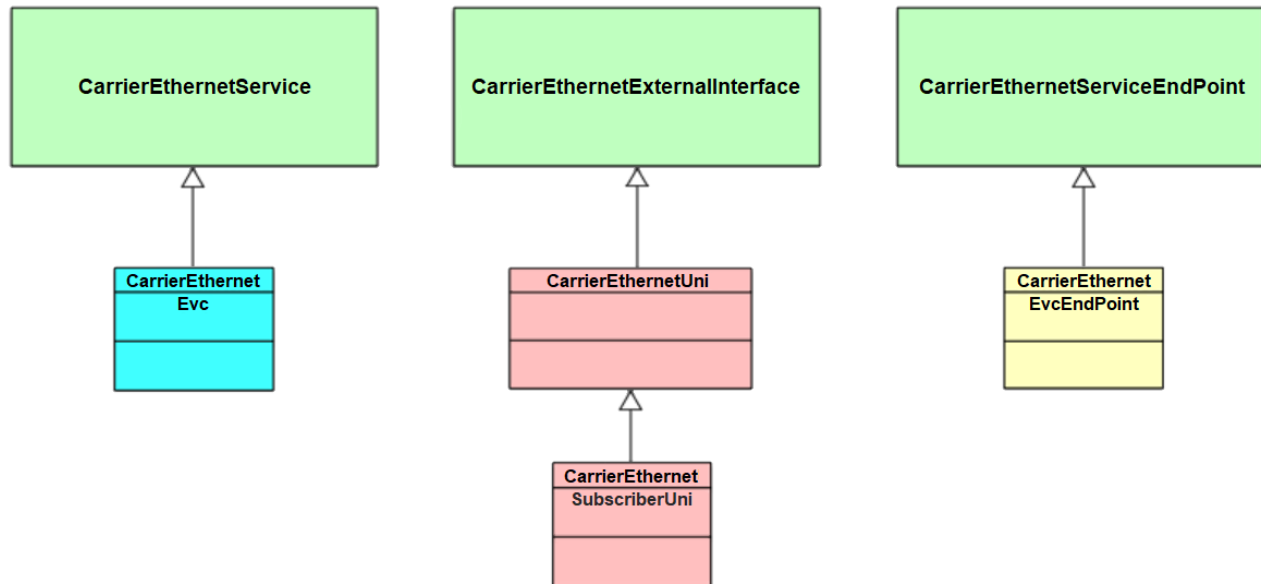


Figure 7 – Subscriber Ethernet Superclasses

Although this provides an abstract model for understanding how the services are defined and how the various components of the Carrier Ethernet Services are organized, the model for the Carrier Ethernet Products is somewhat more complicated.

For example, while the EVC and OVC classes do share a few Service Attributes in common, in some cases the allowable values are different (e.g., the *maximumFrameSize* Service Attribute for EVC must be 1522 or greater, while *maximumFrameSize* for OVC must be 1526 or greater). Since these constraints must be reflected in the schemas, the two Service Attributes appear to be the same, but are actually different. While there are a few Service Attributes that could be included in a common superclass – for example, the *carrierEthernetSls* – a more flexible approach is taken whereby both the EVC and OVC classes (and product-specific variants of each) incorporate a common utility class (e.g. *CarrierEthernetSls*) by composition.

In addition, the EVC Service Attributes and EVC End Point Service Attributes are partitioned into multiple classes that are composed in different combinations for the six Subscriber Ethernet Services as described in Table 5.

As a result, the actual organization of the Subscriber Ethernet schemas differs somewhat from the service model shown in Figure 7.

In the context of Subscriber Ethernet Service, and the Service Attributes in MEF 6.3 [7] and MEF 10.4 [9], the EVC, UNI and EVC End Points are organized as shown in Figure 8 and Figure 9

below (the items in the blue, yellow and red boxes match the colors of the corresponding sub-classes in Figure 7):

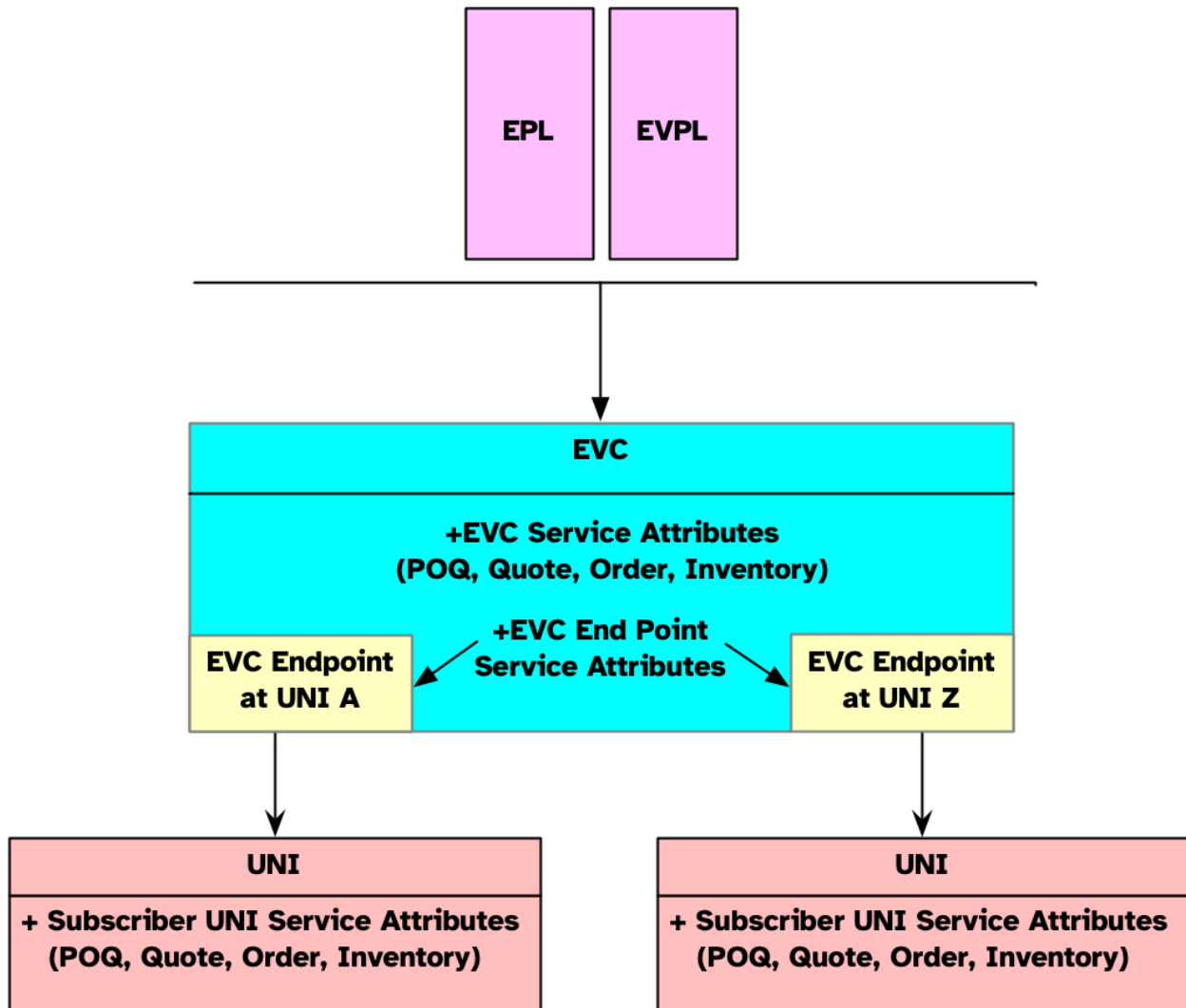


Figure 8 – EPL and EVPL

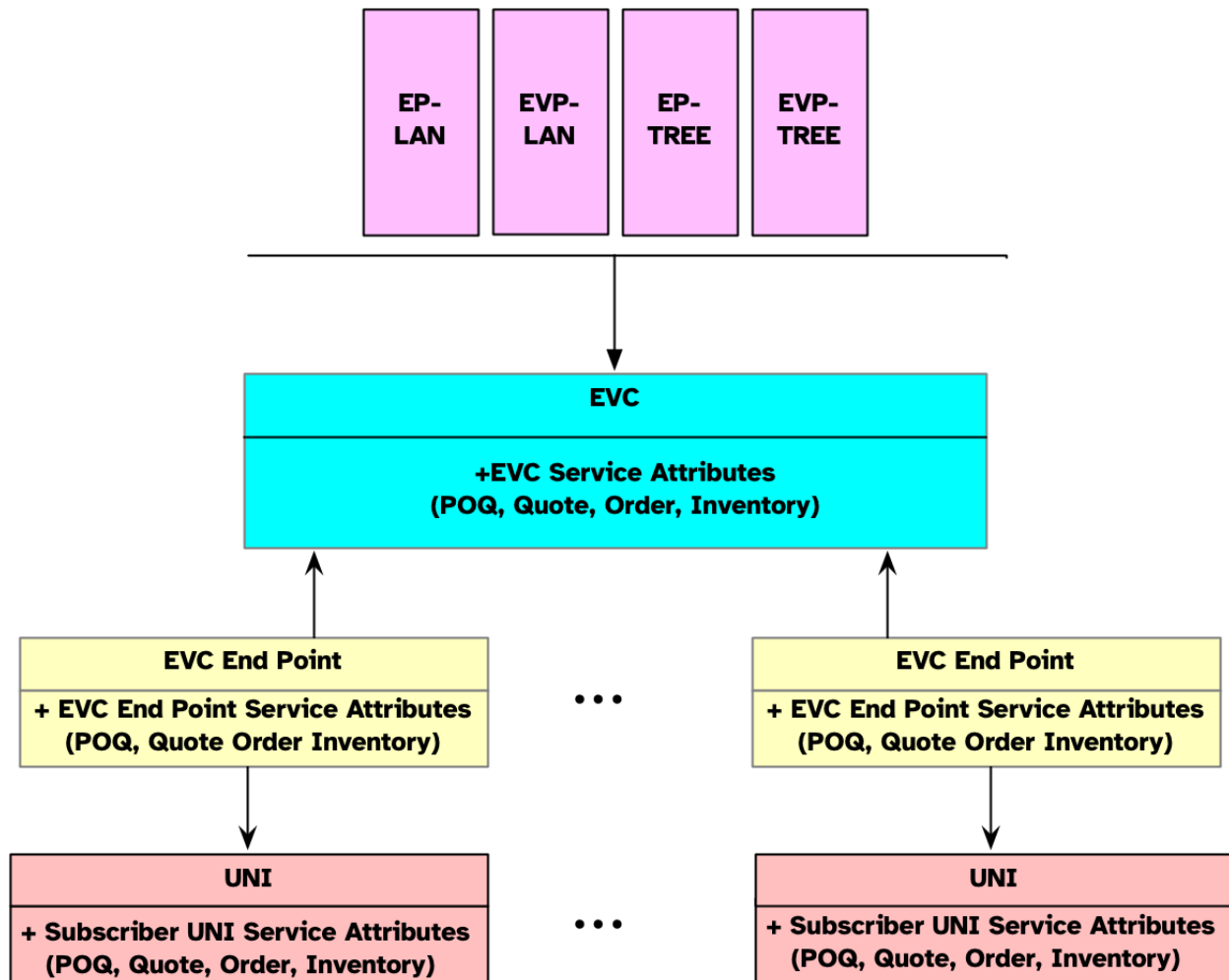


Figure 9 – EP-LAN, EVP-LAN, EP-TREE and EVP-TREE

The Subscriber Ethernet products defined in this specification are:

- EPL EVC (section 14.2.1)
- EVPL EVC (section 14.2.2)
- EP-LAN EVC (section 14.2.3)
- EP-LAN EVC End Point (section 14.2.3)
- EVP-LAN EVC (section 14.2.4)
- EVP-LAN EVC End Point (section 14.2.4)
- EP-TREE EVC (section 14.2.5)
- EP-TREE EVC End Point (section 14.2.5)

- EVP-TREE EVC (section 14.2.6)
- EVP-TREE EVC End Point (section 14.2.6)
- Subscriber UNI (section 14.3)

12 Data Models for Subscriber Ethernet Products

The data models for the Subscriber Ethernet product configuration in the LSO Cantata and LSO Sonata API are expressed as a set of JSON schemas that accompany this specification. This section explains the organization and structure of the schemas.

12.1 Organization and Structure of the Schemas

The schemas are organized into a file structure as shown in Figure 10.

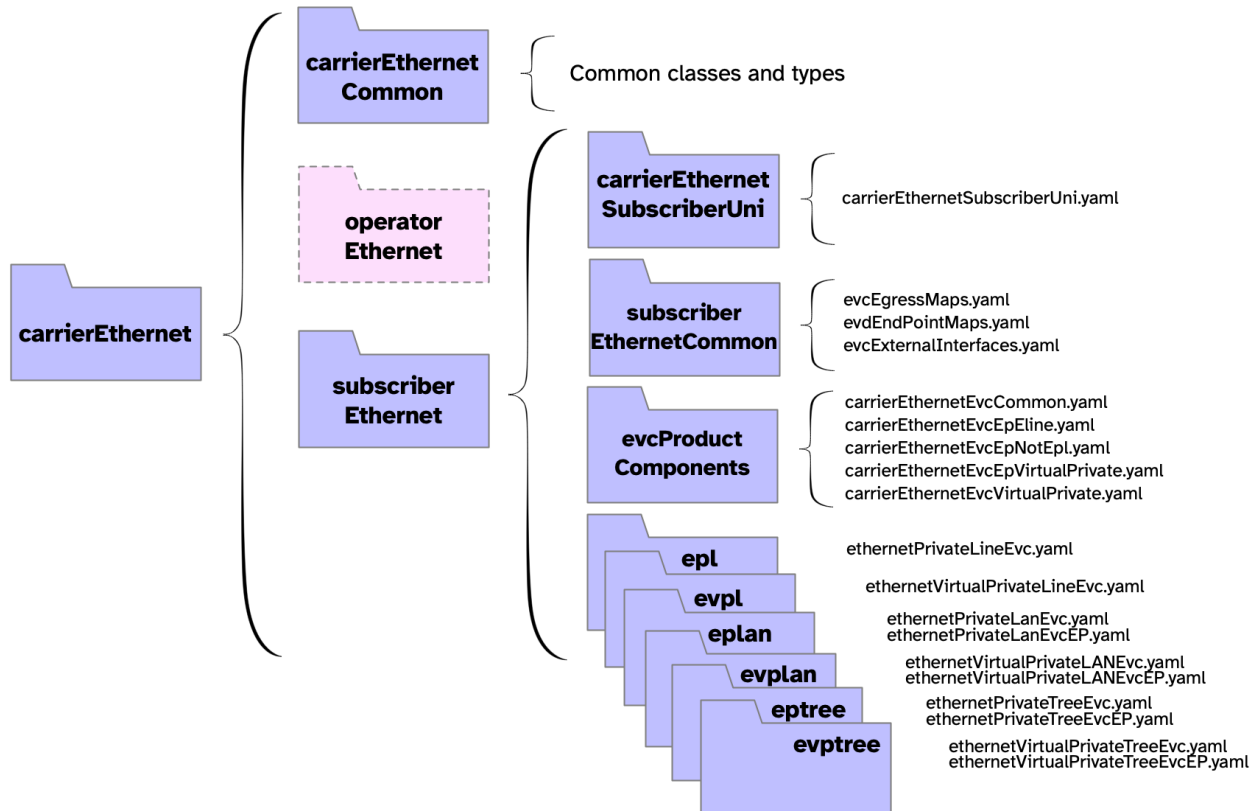


Figure 10 – Schema File Organization

For each of the major product components, Subscriber UNI, EPL, EVPL, etc., there is a folder which contain the relevant schema files.

In addition, there is a *common* folder that contains several files with classes that are common across several Carrier Ethernet service components as well as a number of utility classes and types. The files are organized in separate files by function, for example, bandwidth profile-related classes, service level specification-related classes, etc.

Note that the “Carrier Ethernet” prefix for a schema indicates that it is not specific to a particular service. For example, the carrierEthernetSubscriberUni.yaml schema is used with the Subscriber Ethernet service schemas, but it is also used with other Operator Ethernet Services such as Access E-Line or Transit E-LAN (when schemas for those services are developed).

On a CHANGE request a single Product-Specific Attribute cannot be changed. The Buyer must send a full product configuration including all Mandatory Product-Specific Attributes (section 9.1) and all Optional Product-Specific Attributes (section 9.2) that were previously specified by the Buyer (in an INSTALL request or previous CHANGE request). Any Optional Product-Specific Attributes that are not specified in a CHANGE request are reset to their default value.

12.2 Service Attribute Groupings

The EVC and EVC End Point Service Attributes are organized into 6 groups, 3 EVC and 3 EVC End Point, with the schemas for each of the different types of Subscriber Ethernet Services (EPL, EVPL, EP-LAN, EVP-LAN, EP-TREE, EVP-TREE) defined as compositions of the appropriate EVC and EVC End Point groups for the corresponding EVC type.

Table 5 below shows how the EVC and EVC End Point Service Attributes schemas for each of the Subscriber Ethernet EVC types are constructed from these 6 Service Attributes groups (the composite schema tables are listed in section 14.2).

EVC Type	Service Attributes						
	EVC Groups			EVC End Point Groups			
	Common	Not EPL	Virtual	Common	EPL	Not EPL	Virtual
EPL	x			x	x		
EVPL	x	x	x	x	x	x	x
EP-LAN	x	x		x		x	
EVP-LAN	x	x	x	x		x	x
EP-TREE	x	x		x		x	
EVP-TREE	x	x	x	x		x	x

Table 5 – Service Attribute Groupings

Examples:

For EPL:

- EVC Service Attributes consists of the EVC group *Common*

For EP-LAN:

- EVC End Point Service Attributes consists of the EVC End Point groups *Common* and *Not EPL*

12.3 Example Schema

Following is an example schema (from carrierEthernetLinkAggregation.yaml – chosen only because it is one of the shortest files):

```
"$schema": http://json-schema.org/draft-07/schema#
title:
  MEF LSO Sonata - Carrier Ethernet Link Aggregation (Common) Product Specification
  # MEF Forum - Date: 2021318 Edit-level: 192
```

File: carrierEthernet/common/carrierEthernetLinkAggregation.yaml

definitions:

ConversationIdToAggregationLinkMap:

type: object

description: >-

This is a 2-tuple (x,y) where x is a list of Port Conversation IDs or ranges of Port Conversation IDs (a Port Conversation ID is a VLAN ID or 0 for untagged frames) and y is a list of Link Aggregation Links. This is used in the Port Conversation to Aggregation Link Map for the UNI.

properties:

conversationIDs:

description: >-

802.1AX-2014 §6.6.2.1 - A Port Conversation ID is a VLAN ID (1 to 4094) or 0 to represent untagged and priority-tagged frames.

type: array

minItems: 1

uniqueItems: TRUE

items:

type: object

\$ref: "#/definitions/ConversationIdRange"

aggLinkList:

description: 802.1AX-2014 §6.6.2.1 - An ordered list of Aggregation Link Numbers

See additional validation notes in the Schema Guide

type: array

minItems: 1

uniqueItems: TRUE

items:

type: integer

minimum: 1

required:

- conversationIDs

- aggLinkList

ConversationIdRange:

type: object

description: >-

A range of ConversationID (either a VLAN Id or 0 for untagged frames) allowing three forms: start, start → start, and start → end

properties:

start:

description: >-

The starting Conversation ID of the range or the only Conversation ID if there is no end value

start must be less than or equal to end

See additional validation notes in the Schema Guide

type: integer

minimum: 0

maximum: 4094

end:

description: The final Conversation ID in the range

end, if specified, must be greater than or equal to start

See additional validation notes in the Schema Guide

type: integer

minimum: 0

maximum: 4094

required:

- start

This schema contains two classes related to Link Aggregation, *ConversationIdToAggregationLinkMap*, and a class that it uses, *ConversationIdRange*.

ConversationIdToAggregationLinkMap is referenced by the UNI as follows (from carrierEthernetSubscriberUni.yaml) (for any of POQ, Quote, Order, Product Inventory):

```
aggregationLinkMap:
  description: >-
    MEF 26.2 §14.6 and 802.1AX-2014 § 6.6.2.1 - A mapping of a
    list of Port Conversation IDs (i.e., VLAN IDs or zero for untagged
    frames) to an ordered list of physical links if there are multiple
    physical links in the UNI and the link aggregation is ALL_ACTIVE.
    # See additional validation notes in the Schema Guide
  type: array
  minItems: 0
  uniqueItems: TRUE
  items:
    type: object
    $ref: "../../common/carrierEthernetLinkAggregation.yaml#/definitions/ConversationIdToAggregationLinkMap"
```

12.4 Additional Details

This section includes explanation of some additional conventions for the schema structure as well as some additional attributes that have been added to facilitate product specification for some common edge cases.

12.4.1 Naming Conventions

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

12.4.2 EVC End Point Service Attributes

The EVC End Points are the repositories for EVC Service Attributes that can be different at each UNI whereas the EVC Service Attributes have the same value at every point in the EVC.

For EPL and EVPL, EVC End Points are not separately orderable items. They are part of the EVC. The Subscriber Ethernet EVC schema for EPL and EVPL includes, in the EVC class, two instances of the EVC End Point Service Attributes, that refer to the EVC End Points class.

For EP-LAN, EVP-LAN, EP-TREE and EVP-TREE the EVC End Points are separately orderable items. They are associated with the EVC as related products as shown in Figure 12.

12.4.3 Additional EVC End Point Attributes

There is one Service Attribute, the *EVC End Point Envelopes* that is included in the schemas, but is not part of MEF 10.4. This Service Attribute supports adding a bandwidth profile without having to modify the UNI.

Envelopes listed in the *EVC End Point Envelopes Service Attribute* can be specified when all of the Bandwidth Profile Flows contained in the Envelopes are specific to a given EVC End Point. They must be specified using one of the following EVC End Point Service Attributes:

- Ingress Bandwidth Profile Per EVC End Point

- Egress Bandwidth Profile Per EVC End Point
- Ingress Bandwidth Profile Per Class of Service Name
- Egress Bandwidth Profile Per Egress Equivalence Class Name

To create an Envelope containing Bandwidth Profile Flows for more than one EVC End Point, the UNI Envelopes Service Attribute must be used.

13 Relationship Between Entities

This section describes the constraints and relationships between the three primary Order Items (EVC, UNI, and EVC End Points).

The use case for Subscriber Ethernet described above is based on purchasing the Subscriber Ethernet EVC, a set of new or existing UNIs, and in 4 of the 6 cases, the EVC End Points.

The Subscriber Ethernet Service is associated with exactly one EVC (with appropriate Service Attribute values), but it depends on two or more UNIs. For EPL and EVPL, the relationship between the EVC and the UNI is captured in the product-agnostic part of the POQ, Quote and Order APIs. For the 4 other types of Subscriber Ethernet Services (EP-LAN, EVP-LAN, EP-TREE, EVP-TREE), there is no direct relationship between the EVC and the UNI. Instead, both the EVC and UNI have a relationship with the EVC End Points, which is also captured in the product-agnostic part of the POQ, Quote and Order APIs, as described below.

The values in the Relationship Type column in the table below are used in the *relationshipType* field of the *ProductRelationship*, *QualificationItemRelationship*, *QuoteItemRelationship* and *OrderItemRelationship* types. This relationship is also shown in Figure 11 and Figure 12 below.

#	Source Product	Relationship Type	Cardinality	Target Product
1	EPL EVC	CONNECTS_TO_UNI_A	1	Subscriber UNI
		CONNECTS_TO_UNI_Z	1	Subscriber UNI
2	EVPL EVC	CONNECTS_TO_UNI_A	1	Subscriber UNI
		CONNECTS_TO_UNI_Z	1	Subscriber UNI
3	EP-LAN EVC End Point	ENDPOINT_OF_EVC	1	EP-LAN EVC
		CONNECTS_TO_UNI	1	Subscriber UNI
4	EVP-LAN EVC End Point	ENDPOINT_OF_EVC	1	EVP-LAN EVC
		CONNECTS_TO_UNI	1	Subscriber UNI
5	EP-TREE EVC End Point	ROOT_ENDPOINT_OF_EVC	0..1	EP-TREE EVC
		LEAF_ENDPOINT_OF_EVC	0..1	EP-TREE EVC
		CONNECTS_TO_UNI	1	Subscriber UNI
6	EVP-TREE EVC End Point	ROOT_ENDPOINT_OF_EVC	0..1	EVP-TREE EVC
		LEAF_ENDPOINT_OF_EVC	0..1	EVP-TREE EVC
		CONNECTS_TO_UNI	1	Subscriber UNI

Table 6 – Product Relationship Roles

[R16] For a product listed in Source Product column in Table 6, the Relationship Type field of the Product Relationship, POQ Item Relationship, Quote Item Relationship and Order Item Relationship types **MUST** contain one of the corresponding values shown in the Relationship Type column.

- [R17] For POQ, Quote and Order, relationships to both Subscriber UNIs **MUST** be specified for every INSTALL of, or CHANGE to an EPL EVC or EVPL EVC product.
- [R18] For POQ, Quote and Order, a relationship to an EP-LAN EVC or an EVP-LAN EVC **MUST** be specified for every INSTALL of, or CHANGE to an EP-LAN EVC End Point or EVP-LAN EVC End Point product respectively.
- [R19] For POQ, Quote and Order, exactly one of the End Point relationships (either ROOT_ENDPOINT_OF_EVC or LEAF_ENDPOINT_OF_EVC in Table 6) to an EP-TREE EVC or an EVP-TREE EVC **MUST** be specified for every INSTALL of, or CHANGE to an EP-TREE EVC End Point or EVP-TREE EVC End Point product respectively.
- [R20] For POQ, Quote and Order, a relationship to a Subscriber UNI **MUST** be specified for every INSTALL of, or CHANGE to an EP-LAN EVC End Point, EVP-LAN EVC End Point, EP-TREE EVC End Point or EVP-TREE EVC End Point product.
- [R21] For an EPL EVC or EVPL EVC product, the relationship to a UNI **MUST** reference a Subscriber UNI, or an equivalent POQ Item, Quote Item or Order Item.
- [R22] For an EP-LAN EVC End Point, EVP-LAN EVC End Point, EP-TREE EVC End Point or EVP-TREE EVC End Point product, the relationship to a UNI **MUST** reference a Subscriber UNI, or an equivalent POQ Item, Quote Item or Order Item.
- [R23] For an EP-LAN EVC End Point, EVP-LAN EVC End Point, EP-TREE EVC End Point or EVP-TREE EVC End Point product, the relationship to an EVC **MUST** reference an EP-LAN EVC, EVP-LAN EVC, EP-TREE EVC or EVP-TREE EVC respectively, or an equivalent POQ Item, Quote Item or Order Item.
- [R24] For a CHANGE to an EPL EVC or EVPL EVC product, the relationship to the Subscriber UNI **MUST NOT** be changed from the value present in the Product Inventory.
- [R25] For a CHANGE to an EP-LAN EVC End Point, EVP-LAN EVC End Point, EP-TREE EVC End Point or EVP-TREE EVC End Point product, the relationship to the Subscriber UNI **MUST NOT** be changed from the value present in the Product Inventory.
- [R26] For a CHANGE to an EP-LAN EVC End Point, EVP-LAN EVC End Point, EP-TREE EVC End Point or EVP-TREE EVC End Point product, the relationship to the EP-LAN EVC, EVP-LAN EVC, EP-TREE EVC or EVP-TREE EVC respectively **MUST NOT** be changed from the value present in the Product Inventory.

Note that [R24] indicates that once a EPL EVC or EVPL EVC is associated with a Subscriber UNI, it cannot be associated with a different Subscriber UNI.

Note that [R25] and [R26] indicates that once an EP-LAN EVC End Point, EVP-LAN EVC End Point, EP-TREE EVC End Point or EVP-TREE EVC End Point is associated with a Subscriber UNI, the EVC End Point cannot be associated with a different Subscriber UNI. Once an EVC End Point is associated with an EVC, the EVC End Point cannot be associated with a different EVC.

A UNI and an EVC End Point may be included in the same 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 such, the same `INSTALL_LOCATION` value must be specified for every `CHANGE`. The install location is captured in the product-agnostic part of the POQ, Quote and Order APIs. The value in the Place Relationship Role column in the table below is used in the *role* field of the *RelatedPlaceRefOrValue* type.

Product	Place Relationship Role	Cardinality	Install	Change
Subscriber UNI	INSTALL_LOCATION	1	Mandatory	Mandatory (Must be same value as Product Inventory)

Table 7 – Place Relationship Role

- [R27] For a Subscriber Ethernet UNI product, the Role field (role) of the Related Place (RelatedPlaceRefOrValue) type **MUST** contain one of the values shown in the Place Relationship Role in Table 7.
- [R28] For POQ, Quote and Order, the Related Place (*RelatedPlaceRefOrValue*) **MUST** be specified for every `INSTALL` of, or `CHANGE` to, a Subscriber Ethernet UNI.
- [R29] For a `CHANGE` to a Subscriber Ethernet UNI product, the Related Place **MUST NOT** be changed from the value present in the Product Inventory.

Changing the UNI Location is not supported for a Subscriber Ethernet Service. The value included in a `CHANGE` request must be identical to the value in the Inventory.

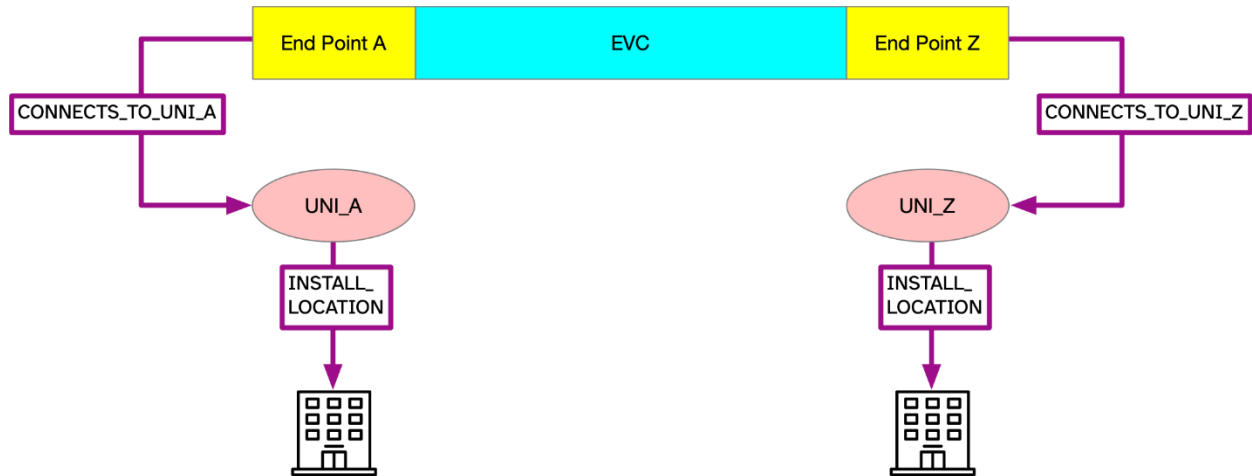


Figure 11 – Relationships for EPL and EVPL

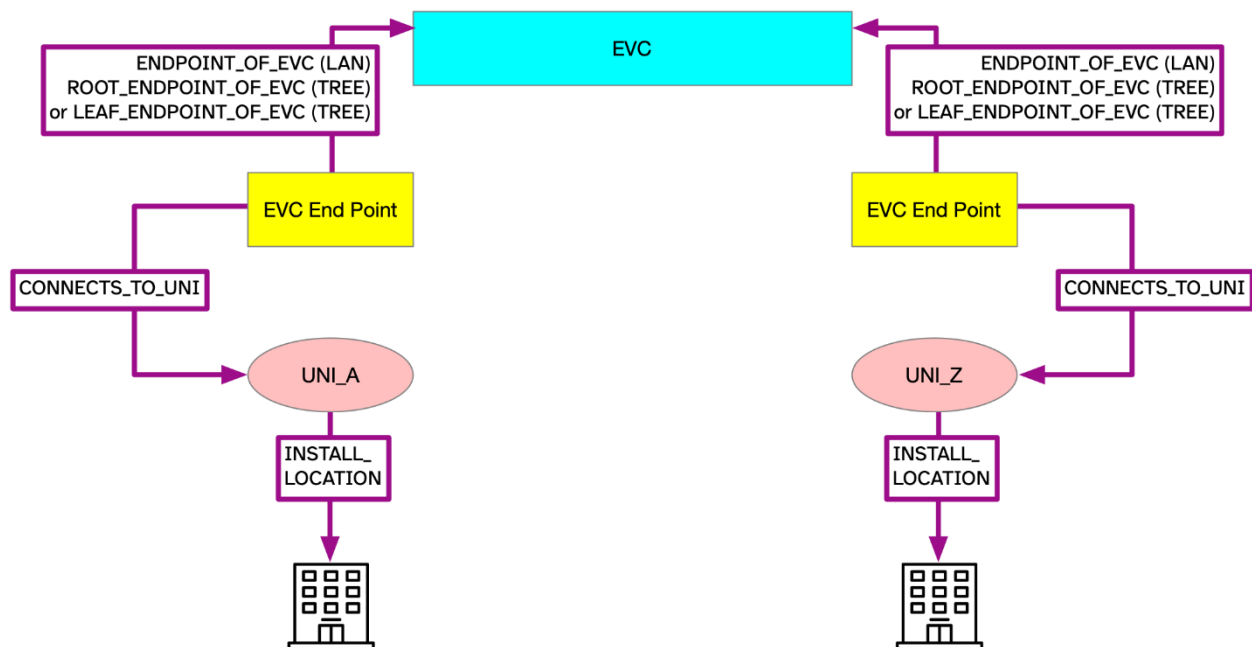


Figure 12 – Relationships for EP-LAN, EVP-LAN, EP-TREE and EVP-TREE

14 Subscriber Ethernet Service Attributes

The following Subscriber Ethernet Service Attributes Schemas are described in the tables in this section:

- EVC Groups
- EVC End Point Groups
- EVC Service Attributes (constructed from the appropriate EVC Groups)
- EVC End Point Service Attributes (constructed from the appropriate EVC End Point Groups)
- Subscriber Ethernet UNI Service Attributes

The following sections enumerate the Service Attributes. For each Service Attribute, the first line includes the Service Attribute name, the JSON Name, and the argument type and allowed values. The second line contains a description and reference. Some entries include additional coding and validation notes when the value of the field depends on (or in some cases is depended on) by another field.

Not all MEF 10.4 Service Attributes are included in the data models. The Service Attributes that are not included are also listed in section 16. Some Service Attributes are not included because they are included in the product-agnostic information portion of the API (e.g., some of the Identifiers) and some Service Attributes are not included because they are constants (i.e., can only have one possible value) either because they are defined that way (e.g., the Subscriber UNI Service Frame Format Service Attribute must be “802.3-2012”) or because the value is constrained to a single value by MEF 6.3 [7] (e.g., the EVC Type Service attribute for an EPL Service must be point-to-point).

There is one Service Attribute, the EVC End Point Envelopes that is included in the schemas, but not part of MEF 10.4 (see section 12.4.3).

The following schema tables are organized by schema file. The first part (in blue) specifies the filename and the list of classes included in the file. Following that, for each class there is a class description (white background) followed by a list of properties in the class (yellow background) and, in some cases, validation notes (light red background).

Note that several of the validation notes specify a relationship between properties, for example, the validation note for the *EVC Maximum Service Frame Size* Service Attribute includes that it must be less than the *Subscriber UNI Maximum Service Frame Size* + 4. This is not a statement about whether either of these properties must appear in the API request — one might be required and the other fixed or optional, or they might both be fixed or optional. Rather, it is an indication of the required relationship between the properties regardless of whether values are derived directly from the API request or from the Product Catalog or from another source.

14.1 Subscriber Ethernet EVC Groups

This section enumerates the Subscriber Ethernet Service Attributes Schemas for the three EVC Groups (Common, Not EPL, Virtual) and the four EVC Endpoint Groups (Common, EPL, Not EPL, Virtual).

14.1.1 EVC and EVC End Point Group – Common

This EVC and EVC End Point Service Attributes group is common to all Subscriber Ethernet Services.

Carrier Ethernet EVC Common

Schema File Name: carrierEthernetEvcCommon

Includes classes:

CarrierEthernetEvcCommon (Carrier Ethernet EVC Common)

CarrierEthernetEvcEpCommon (Carrier Ethernet EVC EP Common)

Class: CarrierEthernetEvcCommon (**Carrier Ethernet EVC Common**)

These are the MEF 10.4 EVC Service Attributes that are common to all Subscriber (EVC-based) Ethernet Services defined in MEF 6.3.

Property Name: EVC List of Class of Service Names Service Attribute

Reference: MEF 10.4 sec. 8.7

JSON Name: listOfCosNames – **Type:** List of string

Description: The EVC List of Class of Service Names Service Attribute is used to specify all of the Class of Service Names supported by an EVC. The value of the EVC List of Class of Service Names Service Attribute is a non-empty list of Class of Service Names (which may include one or more of the CoS Labels defined in MEF 23.2).

Allowed values: List of [1…*] Unique [Any String]

Property Name: EVC Service Level Specification Service Attribute

Reference: MEF 10.4 sec. 8.8

JSON Name: carrierEthernetSls – **Type:** List of object

Description: The SLS includes technical details of the service level in terms of Performance Objectives, agreed between the Service Provider and the Subscriber or between Service Provider and the Operator as part of the Service Level Agreement. A given SLS might contain 0,1 or more Performance Objectives for each Performance Metric. If the value of this attribute is an empty list, it is equivalent to a value of None per MEF 10.4.

Allowed values: List of [0…1] Class: CarrierEthernetSls

Property Name: EVC Maximum Service Frame Size Service Attribute

Reference: MEF 10.4 sec. 8.10

JSON Name: maximumFrameSize – **Type:** integer

Description: Maximum size of Service frames that can be carried over the EVC. This **must** be at least 1522 (1518+C-tag).

Allowed values: Minimum: 1522

Validation Notes: The value of the EVC Maximum Service Frame Size Service Attribute **MUST** be less than or equal to the value of the Subscriber UNI Maximum Service Frame Size Service Attribute, *SubscriberUniCommon.maximumServiceFrameSize*, for all UNIs in the EVC.

Property Name: *EVC Available MEG Level Service Attribute*

Reference: MEF 10.4 sec. 8.11

JSON Name: *availableMegLevel* – **Type:** *enum*

Description: The lowest MEG level for which SOAM Frames are not peered or discarded by the Service Provider. If this attribute is *NONE* there is no such level (that is, SOAM frames at all MEG levels may be peered or discarded by the Service Provider). For all Subscriber Ethernet Services defined in MEF 6.3 the value is constrained to the range 0...6.

Allowed values: Type: AvailableMegLevel

Class: CarrierEthernetEvcEpCommon (**Carrier Ethernet EVC EP Common**)

This set of EVC End Point Service Attributes are applicable to all Subscriber (EVC-based) Ethernet Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4.

Property Name: *EVC EP ID Service Attribute*

Reference: MEF 10.4 sec. 10.1

JSON Name: *identifier* – **Type:** *string*

Description: The value of the EVC EP ID Service Attribute is a string that is used to allow the Subscriber and Service Provider to uniquely identify the EVC EP for operations purposes.

Allowed values: String: Min Length: 1 Max Length: 45 Pattern (regex): [\x20-\x7F]+

Property Name: *EVC End Point Envelopes Service Attribute*

JSON Name: *evcEndPointEnvelopes* – **Type:** *List of object*

Description: The Envelopes and Envelope Coupling Flag values to which Bandwidth Profile Flows for this EVC End Point can be mapped. Value is list of {envelopeID, couplingFlagForIndexZero}. Envelopes listed in the EVC End Point Envelopes Service Attribute can be used when all of the Bandwidth Profile Flows contained in the Envelope are specific to a given EVC End Point. They are specified using one of the following EVC End Point Service Attributes:

- Ingress Bandwidth Profile Per EVC End Point
- Egress Bandwidth Profile Per EVC End Point
- Ingress Bandwidth Profile Per Class of Service Name
- Egress Bandwidth Profile Per Egress Equivalence Class Name

To create an Envelope containing Bandwidth Profile Flows for more than one EVC End Point, the UNI Envelopes Service Attribute must be used. If this is an empty list, then there are no Envelopes defined at this End Point or the Envelopes are defined at the UNI.

Allowed values: List of [0...*] Unique Class: Envelope

Validation Notes: All Bandwidth Profile Flows in the specified envelopes must be for this EVC End Point. The envelopIDs specified in this Service Attribute must be unique with the envelopIDs specified in the UNI Envelopes Service Attribute (as appropriate for the EVC End Point).

Property Name: *EVC EP Ingress Class of Service Map Service Attribute*

Reference: MEF 10.4 sec. 10.5 and MEF 45.1 sec. 6.2

JSON Name: *ingressClassOfServiceMap* – **Type:** *object*

Description: The value of the EVC EP Ingress Class of Service Map Service Attribute is a 3-tuple of the form (F, M, P) where: F is one of the values *ENDPOINT*, *C_TAG_PCP*, or *DSCP*, M is a map that can be used to assign Class of Service Names to Service Frames. (The form of M depends on the value of F.), and P is a map with entries of the form (Layer 2 Control Protocol type → Class of Service Name) where the Layer 2 Control Protocol type is determined by the Protocol Identifier (see Section 6.2 of MEF 45.1).

Allowed values: Select (oneOf): Class: CosNameFromEp, Class: CosNameFromCtagPcp, Class: CosNameFromDscp **with Discriminator:** mapType

Validation Notes: The Class of Service Name or Names **must** be included in the *CarrierEthernetEvcCommon.listOfCosNames*. Per MEF 6.3 if there is only one Class of Service in *CarrierEthernetEvcCommon.listOfCosNames* the *mapType* element of this property **should** be *ENDPOINT*.

Property Name: *EVC EP Color Map Service Attribute*

Reference: MEF 10.4 sec. 10.6

JSON Name: *colorMap* - **Type:** *object*

Description: The value of the EVC EP Color Map Service Attribute is a pair of the form (F, M) 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.

Allowed values: Select (oneOf): Class: ColorFromEp, Class: ColorFromDei, Class: ColorFromPCP, Class: ColorFromDSCP **with Discriminator:** mapType

Property Name: *EVC EP Egress Map Service Attribute*

Reference: MEF 10.4 sec. 10.7

JSON Name: *egressMap* - **Type:** *object*

Description: The value of the EVC EP Egress Map Service Attribute is None or a map of the form {Corresponding Ingress Service Frame Class of Service Name, Corresponding Ingress Service Frame Color} to {Egress Service Frame C-Tag PCP value, Egress Service Frame C-Tag DEI value} or Discard. An empty list indicates the value *None*.

Allowed values: List of [0...1] Class: EvcEgressMap

Validation Notes: Per R140 in MEF 10.4, the value of the EVC EP Egress Map Service Attribute MUST NOT be *None* (an empty list) unless one of the following conditions :

- The value of the EVC EP Map Service Attribute (MEF 10.4, section 10.4) is UT/PT.
- The value of the EVC C-Tag PCP Preservation Service Attribute (MEF 10.4, section 8.5) = *Enabled*, the value of the EVC C-Tag DEI Preservation Service Attribute (MEF 10.4, section 8.6) = *Enabled*, and the value of the EVC EP Map Service Attribute (MEF 10.4, section 10.4) = *List* for all EVC EPs in the EVC.
- The value of the EVC C-Tag PCP Preservation Service Attribute (MEF 10.4, section 8.5) = *Enabled*, the value of the EVC C-Tag DEI Preservation Service Attribute (MEF 10.4, section 8.6) = *Enabled*, and the value of the EVC EP Map Service Attribute (MEF 10.4, section 10.4) = *All*.

Property Name: *EVC EP Class of Service Name Ingress Bandwidth Profile Service Attribute*

Reference: MEF 10.4 sec. 10.9

JSON Name: *ingressBandwidthProfilePerClassOfServiceName* - **Type:** *object*

Description: The EVC EP Class of Service Name Ingress Bandwidth Profile Service Attribute is used to limit the rate of Ingress Service Frames with a given Class of Service Name at a UNI. The value is *None* or a non-empty list of pairs of the form (x,y), where x is a Class of Service Name that is in the value of the EVC List of Class of Service Names Service Attribute and y = BWP Flow Parameters. An empty list indicates the value *None*.

Allowed values: List of [0...*] Unique Class: BandwidthProfilePerClassOfServiceName

Property Name: *EVC EP Subscriber MEG MIP Service Attribute*

Reference: MEF 10.4 sec. 10.13

JSON Name: *subscriberMegMip* - **Type:** *enum*

Description: The value of the EVC EP Subscriber MEG MIP Service Attribute is either None or an integer in the range 0 – 7 that indicates the MEG Level of a Subscriber MEG MIP.

Allowed values: Type: MegLevel

14.1.2 EVC End Point Group – EPL

This EVC End Point Service Attribute group is used for EPL and EVPL.

Carrier Ethernet EVC EP Eline

Schema File Name: carrierEthernetEvcEpEline

Includes classes:

CarrierEthernetEvcEpEline (Carrier Ethernet EVC EP Eline)

Class: CarrierEthernetEvcEpEline (**Carrier Ethernet EVC EP Eline**)

Property Name: EVC End Point Identifier Service Attribute

Reference: MEF 10.4 sec. 10.1

JSON Name: identifier – **Type:** string

Description: The value of the EVC EP ID Service Attribute is a string that is used to allow the Subscriber and Service Provider to uniquely identify the EVC EP for operations purposes.

Allowed values: String: Min Length: 1 Max Length: 45 Pattern (regex): [\x20-\x7F]+

14.1.3 EVC and EVC End Point Group – Not EPL

This EVC and EVC End Point Service Attributes group is used for all Subscriber Ethernet Services other than EPL.

Carrier Ethernet EVC EP Not EPL

Schema File Name: carrierEthernetEvcEpNotEpl

Includes classes:

CarrierEthernetEvcNotEpl (Carrier Ethernet EVC Not EPL)

CarrierEthernetEvcEpNotEpl (Carrier Ethernet EVC EP Not EPL)

Class: CarrierEthernetEvcNotEpl (**Carrier Ethernet EVC Not EPL**)

These are the MEF 10.4 EVC Service Attributes that are common to all Subscriber (EVC-based) Ethernet Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4 – except EPL.

Property Name: EVC Data Service Frame Disposition Service Attribute

Reference: MEF 10.4 sec. 8.4

JSON Name: frameDisposition – **Type:** object

Description: A 3-tuple that indicates how Unicast, Multicast, and Broadcast Frames are delivered by the service. For each, the value can be *UNCONDITIONAL*, the frames are delivered without condition, *CONDITIONAL*, the frames are delivered based on conditions agreed to between buyer and seller (e.g., based on learned addresses), and *DISCARD*. If *CONDITIONAL* is chosen for any of the elements, the conditions must be agreed on by the Service Provider and Subscriber by some other means.

Allowed values: Class: FrameDisposition

Validation Notes: For EPL this must be unconditional for all 3 entries so not included

Class: CarrierEthernetEvcEpNotEpl (**Carrier Ethernet EVC EP Not EPL**)

This set of EVC End Point Service Attributes are applicable to all Subscriber (EVC-based) Ethernet Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4 except EPL.

Property Name: *EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute*

Reference: MEF 10.4 sec. 10.11

JSON Name: *egressBandwidthProfilePerClassOfServiceName* - **Type:** *object*

Description: 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 (MEF 10.4 Section 10.5). The value of the EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute is either None or a non-empty list of pairs of the form $\langle x, y \rangle$ where x is a Class of Service Name contained in the value of the EVC List of Class of Service Names Service Attribute (MEF 10.4 Section 8.7) but not equal to Discard and $y =$ the 3-tuple $\langle \text{CIR}, \text{CIRmax}, \text{ER} \rangle$ where the elements of the 3-tuple are defined in MEF 10.4 Section 12.1.2. An empty list indicates the value *None*.

Allowed values: List of $[0...1]$ Class: *BandwidthProfilePerClassOfServiceName*

Property Name: *EVC EP Source MAC Address Limit Service Attribute*

Reference: MEF 10.4 sec. 10.12

JSON Name: *sourceAddressMacLimit* - **Type:** *object*

Description: The value of the EVC EP Source MAC Address Limit Service Attribute is either None or the pair $\langle N, t \rangle$ where N is an integer ≥ 1 and t is a time duration. When the value of the EVC EP Source MAC Address Limit Service Attribute = $\langle N, t \rangle$ the number of source MAC Addresses that can be used in Ingress Service Frames is limited. An empty list indicates the value *None*.

Allowed values: List of $[0...1]$ Class: *SourceMacAddressLimit*

Validation Notes: Per MEF 6.3, the value of this must be NONE (absent) for EPL and EVPL.

14.1.4 EVC and EVC End Point Group – Virtual

This EVC Service Attributes group is common to all Virtual Private Services (EVPL, EVP-LAN, EVP-TREE).

Carrier Ethernet EVC Virtual Private

Schema File Name: carrierEthernetEvcVirtualPrivate

Includes classes:

CarrierEthernetVpEvcCommon (Carrier Ethernet Virtual Private EVC Common)

Class: CarrierEthernetVpEvcCommon (**Carrier Ethernet Virtual Private EVC Common**)

These are the MEF 10.4 EVC Service Attributes that are common to all Virtual Private Subscriber (EVC-based) Ethernet Services (EVPL, EVP-LAN, EVP_TREE) defined in MEF 6.3.

Property Name: EVC C-Tag PCP Preservation Service Attribute

Reference: MEF 10.4 sec. 8.5

JSON Name: cTagPcpPreservation – **Type:** object

Description: The EVC C-Tag PCP Preservation Service Attribute can be used to preserve the value of the PCP field in C-Tagged Service Frames across an EVC. The value of the EVC C-Tag PCP Preservation Service Attribute is either Enabled or Disabled.

Allowed values: Type: EnabledDisabled

Validation Notes: For Private Services this **must** be *Enabled* so it is only included for Virtual Private Services.

Property Name: EVC C-Tag DEI Preservation Service Attribute

Reference: MEF 10.4 sec. 8.6

JSON Name: cTagDeiPreservation – **Type:** object

Description: If *ENABLED*, then the value of the C-Tag DEI field is preserved from Ingress to Egress.

Allowed values: Type: EnabledDisabled

Validation Notes: For Private Services this **must** be *Enabled* so it is only included for Virtual Private Services.

This EVC End Point Service Attribute group is common to all Virtual Private Services (EVPL, EVP-LAN, EVP-TREE).

Carrier Ethernet EVC EP Virtual Private

Schema File Name: carrierEthernetEvcEpVirtualPrivate

Includes classes:

CarrierEthernetEvcEpVirtualPrivate (Carrier Ethernet EVC EP Virtual Private)

Class: CarrierEthernetEvcEpVirtualPrivate (**Carrier Ethernet EVC EP Virtual Private**)

Property Name: EVC EP Map Service Attribute

Reference: MEF 10.4 sec. 10.4

JSON Name: evcEndPointMap – **Type:** object

Description: The EVC EP Map Service Attribute is used to map Service Frames to the EVC EP. The value of the EVC EP Map Service Attribute (in MEF 10.4) is one of *ALL*, *LIST*, or *UT/PT*. This attribute is only available for Virtual Private services since Private services always require *All*. For Virtual Private Services it can be *UT/PT* (Untagged/Priority Tagged) or *LIST*. When the value of the EVC EP Map Service Attribute = *List*, a non-empty list of unique integers, each in the range 1,2,...,4094 is specified.

Allowed values: Class: EndPointMapEvc

Validation Notes: For Virtual Private services, this **must** be **LIST** or **UT/PT**.

For a given UNI, the values of all of the EVC End Point Map Service Attribute **must** be such that each possible C-VLAN ID value maps to at most one EVC End Point.

Coding hint: This must be ALL for EPL, EP-LAN, EP-TREE Services, LIST or UT/PT for EVPxxx Services

14.2 Subscriber Ethernet EVC and EVC End Point Service Attributes

This section lists the Subscriber Ethernet EVC and EVC End Point Service Attribute Schemas for each of the Subscriber Ethernet EVC types that are constructed from the appropriate set of 7 Service Attribute groups described in sections 12.2 above.

14.2.1 EPL Service Attributes

Ethernet Private Line EVC

Schema File Name: ethernetPrivateLineEvc
urn:mef:iso:spec:cantata-sonata:epl-evc:v1.0.0:common
Includes classes:
EplEvc (EPL EVC Service Attributes)
EplEvcEndPoint (EPL EVC End Point Service Attributes)

Class: EplEvc (**EPL EVC Service Attributes**)

The EVC Service Attributes for Ethernet Private Line (EPL) Service as defined in MEF 6.3 based on the Service Attributes defined in MEF 10.4.

Property Name: EPL EVC Service Attributes **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcCommon

Property Name: EPL End Point A

Reference: MEF 10.4 sec. 10

JSON Name: evcEndPointA – **Type:** object

Description: EVC End Point at UNI A. UNI EVC End Point A and UNI EVC End Point Z must be included in the EPL Product.

Allowed values: Type: EplEvcEndPoint

Property Name: EPL End Point Z

Reference: MEF 10.4 sec. 10

JSON Name: evcEndPointZ – **Type:** object

Description: EVC End Point at UNI Z. UNI EVC End Point A and UNI EVC End Point Z must be included in the EPL Product.

Allowed values: Type: EplEvcEndPoint

Type: EplEvcEndPoint (**EPL EVC End Point Service Attributes**)

An EVC End Point is a logical entity at a given UNI that is associated with a distinct set of frames passing over that UNI. EVC End Point Service Attributes are the attributes of an EVC that can be different at each UNI in the EVC. These are the EVC End Point Service Attributes applicable to Ethernet Private Line (EPL) Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4.

Property Name: EPL EVC End Point **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcEpEline, Class: CarrierEthernetEvcEpCommon

14.2.2 EVPL Service Attributes

Ethernet Virtual Private Line EVC

Schema File Name: ethernetVirtualPrivateLineEvc
urn:mef:iso:spec:cantata-sonata:evpl-etc:v1.0.0:common
Includes classes:
EvplEvc (EVPL EVC Service Attributes)
EvplEvcEndPoint (EVPL EVC End Point Service Attributes)

Class: EvplEvc (**EVPL EVC Service Attributes**)

The EVC Service Attributes for Ethernet Virtual Private Line (EVPL) Service as defined in MEF 6.3 based on the Service Attributes defined in MEF 10.4.

Property Name: EVPL EVC Service Attributes **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcCommon, Class: CarrierEthernetVpEvcCommon, Class: CarrierEthernetEvcNotEpl

Property Name: EVPL EVC Endpoint A

Reference: MEF 10.4 sec. 10

JSON Name: evcEndPointA – **Type:** object

Description: EVC End Point at UNI A. UNI EVC End Point A and UNI EVC End Point Z must be included in the EVPL Product.

Allowed values: Type: EvplEvcEndPoint

Property Name: EVPL EVC Endpoint Z

Reference: MEF 10.4 sec. 10

JSON Name: evcEndPointZ – **Type:** object

Description: EVC End Point at UNI Z. UNI EVC End Point A and UNI EVC End Point Z must be included in the EVPL Product.

Allowed values: Type: EvplEvcEndPoint

Type: EvplEvcEndPoint (**EVPL EVC End Point Service Attributes**)

An EVC End Point is a logical entity at a given UNI that is associated with a distinct set of frames passing over that UNI. EVC End Point Service Attributes are the attributes of an EVC that can be different at each UNI in the EVC. These are the EVC End Point Service Attributes applicable to Ethernet Virtual Private Line (EVPL) Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4.

Property Name: EVPL EVC End Point **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcEpEline, Class: CarrierEthernetEvcEpCommon, Class: CarrierEthernetEvcEpVirtualPrivate, Class: CarrierEthernetEvcEpNotEpl

14.2.3 EP-LAN Service Attributes

Ethernet Private LAN EVC

Schema File Name: ethernetPrivateLanEvc
urn:mef:iso:spec:cantata-sonata:eplan-evc:v1.0.0:common
Includes classes:
EplanEvc (EP-LAN EVC Service Attributes)

Class: EplanEvc (**EP-LAN EVC Service Attributes**)

The EVC Service Attributes for Ethernet Private LAN (EP-LAN) Service as defined in MEF 6.3 based on the Service Attributes defined in MEF 10.4.

Property Name: EP-LAN EVC Service Attributes **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcCommon, Class: CarrierEthernetEvcNotEpl

Ethernet Private LAN EVC EP

Schema File Name: ethernetPrivateLanEvcEP
urn:mef:iso:spec:cantata-sonata:eplan-evc-ep:v1.0.0:common
Includes classes:
EplanEvcEndPoint (EP-LAN EVC End Point Service Attributes)

Type: EplanEvcEndPoint (**EP-LAN EVC End Point Service Attributes**)

An EVC End Point is a logical entity at a given UNI that is associated with a distinct set of frames passing over that UNI. EVC End Point Service Attributes are the attributes of an EVC that can be different at each UNI in the EVC. These are the EVC End Point Service Attributes applicable to Ethernet Private LAN (EP-LAN) Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4.

Property Name: EP-LAN EVC End Point **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcEpCommon, Class: CarrierEthernetEvcEp-NotEpl

14.2.4 EVP-LAN Service Attributes

Ethernet Virtual Private LAN EVC

Schema File Name: ethernetVirtualPrivateLanEvc
urn:mef:iso:spec:cantata-sonata:evplan-etc:v1.0.0:common
Includes classes:
EvplanEvc (EVP-LAN EVC Service Attributes)

Class: EvplanEvc (***EVP-LAN EVC Service Attributes***)

The EVC Service Attributes for Ethernet Virtual Private LAN (EVP-LAN) Service as defined in MEF 6.3 based on the Service Attributes defined in MEF 10.4.

Property Name: EVP-LAN EVC Service Attributes **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcCommon, Class: CarrierEthernetVpEvcCommon, Class: CarrierEthernetEvcNotEpl

Ethernet Virtual Private LAN EVC EP

Schema File Name: ethernetVirtualPrivateLanEvcEp
urn:mef:iso:spec:cantata-sonata:evplan-etc-ep:v1.0.0:common
Includes classes:
EvplanEvcEndPoint (EVP-LAN EVC End Point Service Attributes)

Type: EvplanEvcEndPoint (***EVP-LAN EVC End Point Service Attributes***)

An EVC End Point is a logical entity at a given UNI that is associated with a distinct set of frames passing over that UNI. EVC End Point Service Attributes are the attributes of an EVC that can be different at each UNI in the EVC. These are the EVC End Point Service Attributes applicable to Ethernet Virtual Private LAN (EVP-LAN) Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4.

Property Name: EVP-LAN EVC End Point **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcEpCommon, Class: CarrierEthernetEvcEpVirtualPrivate, Class: CarrierEthernetEvcEpNotEpl

14.2.5 EP-TREE Service Attributes

Ethernet Private Tree EVC

Schema File Name: ethernetPrivateTreeEvc
urn:mef:iso:spec:cantata-sonata:eptree-evc:v1.0.0:common
Includes classes:
EptreeEvc (EP-TREE EVC Service Attributes)

Class: EptreeEvc (**EP-TREE EVC Service Attributes**)

The EVC Service Attributes for Ethernet Private TREE (EP-TREE) Service as defined in MEF 6.3 based on the Service Attributes defined in MEF 10.4.

Property Name: EP-TREE EVC Service Attributes **Type:** object

Allowed values: Compose (allof): Class: CarrierEthernetEvcCommon, Class: CarrierEthernetEvcNotEpl

Ethernet Private Tree EVC EP

Schema File Name: ethernetPrivateTreeEvcEp
urn:mef:iso:spec:cantata-sonata:eptree-evc-ep:v1.0.0:common
Includes classes:
EptreeEvcEndPoint (EP-TREE EVC End Point Service Attributes)

Type: EptreeEvcEndPoint (**EP-TREE EVC End Point Service Attributes**)

An EVC End Point is a logical entity at a given UNI that is associated with a distinct set of frames passing over that UNI. EVC End Point Service Attributes are the attributes of an EVC that can be different at each UNI in the EVC. These are the EVC End Point Service Attributes applicable to Ethernet Private Tree (EP-TREE) Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4.

Property Name: EP-TREE EVC End Point **Type:** object

Allowed values: Compose (allof): Class: CarrierEthernetEvcEpCommon, Class: CarrierEthernetEvcEp-NotEpl

14.2.6 EVP-TREE Service Attributes

Ethernet Virtual Private Tree EVC

Schema File Name: ethernetVirtualPrivateTreeEvc
urn:mef:iso:spec:cantata-sonata:evptree-evc:v1.0.0:common
Includes classes:
EvptreeEvc (EVP-TREE EVC Service Attributes)

Class: EvptreeEvc (**EVP-TREE EVC Service Attributes**)

The EVC Service Attributes for Ethernet Virtual Private TREE (EVP-TREE) Service as defined in MEF 6.3 based on the Service Attributes defined in MEF 10.4.

Property Name: EVP-TREE EVC Service Attributes **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcCommon, Class: CarrierEthernetVpEvcCommon, Class: CarrierEthernetEvcNotEpl

Ethernet Virtual Private Tree EVC EP

Schema File Name: ethernetVirtualPrivateTreeEvcEp
urn:mef:iso:spec:cantata-sonata:evptree-evc-ep:v1.0.0:common
Includes classes:
EvptreeEvcEndPoint (EVP-TREE EVC End Point Service Attributes)

Type: EvptreeEvcEndPoint (**EVP-TREE EVC End Point Service Attributes**)

An EVC End Point is a logical entity at a given UNI that is associated with a distinct set of frames passing over that UNI. EVC End Point Service Attributes are the attributes of an EVC that can be different at each UNI in the EVC. These are the EVC End Point Service Attributes applicable to Ethernet Virtual Private Tree (EVP-TREE) Services defined in MEF 6.3 based on the Service Attributes in MEF 10.4.

Property Name: EVP-TREE EVC End Point **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetEvcEpCommon, Class: CarrierEthernetEvcEpVirtualPrivate, Class: CarrierEthernetEvcEpNotEpl

14.3 Subscriber Ethernet UNI Service Attributes

This section enumerates the Subscriber Ethernet UNI Service Attributes.

Carrier Ethernet Subscriber UNI

Schema File Name: carrierEthernetSubscriberUni
urn:mef:iso:spec:cantata-sonata:carrier-ethernet-subscriber-uni:v1.0.0:common
Includes classes:
SubscriberUni (Subscriber UNI Service Attributes)

Class: SubscriberUni (**Subscriber UNI Service Attributes**)

The Subscriber UNI Service Attributes values are agreed to by the Subscriber and the Service Provider to describe the behavior of the UNI.

Property Name: Subscriber UNI Instantiation Service Attribute

Reference: MEF 10.4 sec. 9.2

JSON Name: instantiation - Type: enum

Description: When the value is *Physical*, the UNI is implemented using one or more instances of a standard Physical Layer. When the value is *Virtual*, the physical layer is not specified.

Allowed values: Enum: "PHYSICAL", "VIRTUAL"

Property Name: Subscriber UNI Virtual Frame Map Service Attribute

Reference: MEF 10.4 sec. 9.2 and sec. 9.3

JSON Name: virtualFrameMap - Type: List of object

Description: When the value of the Subscriber UNI Instantiation Service Attribute = *Virtual* there **must** exist a map that maps the set of Virtual Frames that cross the UNI to a sequence of pairs of the form $\langle s, t \rangle$ where s is a standard Ethernet frame per Clause 3 of IEEE Std 802.3 – 2015 [5] and t is the arrival time at the UNI for all bits in s . Since MEF 10.4 does not specify the contents or format of this map, it is currently defined as an arbitrary length string. An empty list can be specified if the value of the Subscriber UNI Instantiation Service Attribute \neq *Virtual*.

Allowed values: List of [0...1] Class: VirtualFrameMap

Property Name: Subscriber UNI List of Physical Links Service Attribute

Reference: MEF 10.4 sec. 9.4

JSON Name: listOfPhyLinks - Type: List of object

Description: The value of the Subscriber UNI List of Physical Links Service Attribute is a list of *UNIPhysicalLinks*, one entry for each physical link that composes the UNI. *UNIPhysicalLinks* specifies several properties of the physical link such as the PHY type and the connector type. An empty list indicates a value of *Not Applicable*.

Allowed values: List of [0...*] Type: UniPhysicalLink

Validation Notes: If **Subscriber UNI Instantiation Service Attribute** is *PHYSICAL*, there must be at least one Physical Link (i.e., the list cannot be empty). If **Subscriber UNI Instantiation Service Attribute** is *VIRTUAL*, the list must be empty.

Property Name: Subscriber UNI Link Aggregation Service Attribute

Reference: MEF 10.4 sec. 9.5

JSON Name: linkAggregation - Type: enum

Description: Data type representing Link Aggregation types. **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.

Allowed values: Type: LinkAggType

Validation Notes: If the value of *SubscriberUniCommon.listOfPhyLinks* =

- 1: The value must be NONE
- 2: The value must be 2_LINK_ACTIVE-STANDBY, ALL_ACTIVE, or OTHER
- >2: The value must be ALL_ACTIVE or OTHER

Property Name: *Subscriber UNI Port Conversation ID to Aggregation Link Map Service Attribute*

Reference: MEF 10.4 sec. 9.6

JSON Name: *portConversation* - **Type:** List of object

Description: A mapping of Port Conversation IDs (i.e., VLAN IDs or zero for untagged frames) to an ordered list of physical links if there are multiple physical links in the UNI and the link aggregation is ALL_ACTIVE. This must be an empty list if and only if the value of *SubscriberUniCommon.linkAggregation* is not ALL_ACTIVE or OTHER.

Allowed values: List of [0...*] Class: ConversationIdToAggregationLinkMap

Validation Notes: If this is not an empty list, it must map every C-VLAN ID mapped to the EVC. (See MEF 10.4 R77, R78, R80.)

Property Name: *Subscriber UNI Maximum Service Frame Size Service Attribute*

Reference: MEF 10.4 sec. 9.8

JSON Name: *maximumServiceFrameSize* - **Type:** integer

Description: Specifies the maximum size of Service Frames that can be transmitted across UNI.

Allowed values: Minimum: 1522

Property Name: *Subscriber UNI Maximum Number of EVC Eps Service Attribute*

Reference: MEF 10.4 sec. 9.9

JSON Name: *maximumNumberOfEndPoints* - **Type:** integer

Description: The maximum number of EVC End Points that can be supported at the UNI.

Allowed values: Minimum: 1 Maximum: 4094

Property Name: *Subscriber UNI Maximum Number of C-Tag VLAN IDs per EVC EP Service Attribute*

Reference: MEF 10.4 sec. 9.10

JSON Name: *maximumNumberOfCtagVlanIdsPerEndPoint* - **Type:** integer

Description: 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.

Allowed values: Minimum: 1 Maximum: 4094

Property Name: *Subscriber UNI Token Share Service Attribute*

Reference: MEF 10.4 sec. 9.11

JSON Name: *tokenShare* - **Type:** object

Description: An attribute that indicates whether Bandwidth Profile Envelopes containing more than one Bandwidth Profile Flow are supported by the Service Provider at the Subscriber UNI.

Allowed values: Type: EnabledDisabled

Property Name: *Subscriber UNI Envelopes Service Attribute*

Reference: MEF 10.4 sec. 9.12

JSON Name: *envelopes* - **Type:** List of object

Description: The Envelopes and Envelope Coupling Flag values to which Bandwidth Profile Flows can be mapped. Value is None or non-empty list of {envelopeID, couplingFlagForIndexZero}. An empty list indicates the value None.

Allowed values: List of [0...*] Unique Class: Envelope

Validation Notes: If the ***couplingFlagForIndexZero*** = 1 (TRUE) for this service attribute, then the ***couplingFlag*** for each Bandwidth Profile Flow in the Envelope must be 0 (FALSE).

Property Name: *Subscriber UNI Link OAM Service Attribute*

Reference: MEF 10.4 sec. 9.13

JSON Name: *linkOam* - **Type:** *object*

Description: Controls when and how Link OAM per IEEE Std 802.3-2015 is run on the physical links in the UNI.

Allowed values: Type: EnabledDisabled

Property Name: *Subscriber UNI MEG Service Attribute*

Reference: MEF 10.4 sec. 9.14

JSON Name: *meg* - **Type:** *object*

Description: Indicates if the Service Provider has instantiated a MEG End Point (MEP) at the UNI Maintenance Entity Group (MEG) Level (**ENABLED**) or not (**DISABLED**).

Allowed values: Type: EnabledDisabled

Property Name: *Subscriber UNI LAG Link MEG Service Attribute*

Reference: MEF 10.4 sec. 9.15

JSON Name: *lagLinkMeg* - **Type:** *object*

Description: Indicates if the Service Provider has instantiated a LAG Link MEG End Point (MEP) on each physical link in the UNI if the UNI has more than one physical link (**ENABLED**) or not (**DISABLED**).

Allowed values: Type: EnabledDisabled

Property Name: *Subscriber UNI L2CP Address Set Service Attribute*

Reference: MEF 10.4 sec. 9.16 and MEF 45.1 sec. 8.1

JSON Name: *l2cpAddressSet* - **Type:** *enum*

Description: L2CP Address Set Service Attribute is defined in MEF 45.1. **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.

Allowed values: Type: L2cpAddressSet

Property Name: *Subscriber UNI L2CP Peering Service Attribute*

Reference: MEF 10.4 sec. 9.17 and MEF 45.1 sec. 8.2

JSON Name: *l2cpPeering* - **Type:** *object*

Description: L2CP Peering Service Attribute defined in MEF 45.1 specifies which protocols, if any, are peered at the UNI. The L2CP Peering service attribute value must be an empty list, or a list of entries identifying protocols to be Peered where each entry consists of {Destination Address, Protocol Identifier} or {Destination Address, Protocol Identifier, Link Identifier}.

Allowed values: Class: L2cpPeering

15 Common Classes and Types

This section is structured 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 and hence have filenames that are prefixed with “Carrier Ethernet”. This means that several of them include options and values that aren’t appropriate for some services such as, in this case Subscriber Ethernet. Whenever that situation arises the details are included in the description and/or validation notes for the specific Subscriber Ethernet Service Attribute and, if appropriate, in the common class.

The following schema tables are organized by schema file. The first part (in blue) specifies the filename and the list of classes included in the file. Following that, for each class there is a class description (white background) followed by a list of properties in the class (yellow background).

15.1 Bandwidth Profiles

Carrier Ethernet Bandwidth Profile

Schema File Name: carrierEthernetBandwidthProfile

Includes classes:

BwpFlow (Bandwidth Profile Flow)

Envelope (Envelope)

BandwidthProfilePerClassOfServiceName (COS Bandwidth Profile)

Class: BwpFlow (**Bandwidth Profile Flow**)

The Bandwidth Profile Flow, BwpFlow, object class represents the Bandwidth Profile Flow which includes the bandwidth profile parameter CIR, CIRmax, CBS, EIR, EIRmax, EBS, Coupling Flag, Color Mode, Envelope and Rank, and Token Request Offset. The BwpFlow is used with Service Attributes for CarrierEthernetOperatorUni, CarrierEthernetSubscriberUni, CarrierEthernetVuni,, and ENNI as well as OVC and EVC End Points. Reference MEF 10.4 Section 12 and MEF 26.2 Section 17.

Property Name: Committed Information Rate

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: cir – **Type:** object

Description: cir represents **Committed Information Rate**. When added to unused committed bandwidth provided from higher-ranked Bandwidth Profile Flows (depending on the value of **couplingFlag** for the higher-ranked Bandwidth Profile Flows), limits the average rate in bits per second at which External Interface Frames for this Bandwidth Profile Flow can be declared Green.

Allowed values: Class: InformationRate

Property Name: The Maximum Committed Information Rate

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: cirMax – **Type:** object

Description: cirMax represents **Maximum Committed Information Rate**. It limits the average rate in bits per second at which External Interface Frames for this Bandwidth Profile Flow can be declared Green (regardless of unused committed bandwidth from higher-ranked Bandwidth Profile Flows).

Allowed values: Class: InformationRate

Property Name: Committed Burst Size

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: cbs – **Type:** object

Description: **cbs** represents **Committed Burst Size**. Limits by how much, and for how long, the amount of traffic declared Green for this Bandwidth Profile Flow in the short term can exceed the committed bandwidth made available to this Bandwidth Profile Flow over the long term, in bytes.

Allowed values: Class: DataSize

Validation Notes: If cir and/or cirmax are greater than 0, cbs must be greater than 0. MEF 23.2 recommends that cbs should be at least twice the Maximum Frame size (although in practice it is usually quite a bit more than that).

Property Name: *Excess Information Rate*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *eir* – **Type:** *object*

Description: **eir** represents **Excess Information Rate**. When added to unused excess bandwidth from higher-ranked Bandwidth Profile Flows, and to un-used committed bandwidth (depending on the value of **couplingFlag** for this Bandwidth Profile Flow and **couplingFlagForIndexZero** for the Envelope), limits the average rate in bits per second at which External Interface Frames for this Bandwidth Profile Flow can be declared Yellow.

Allowed values: Class: InformationRate

Property Name: *Maximum Excess Information Rate*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *eirMax* – **Type:** *object*

Description: **eirMax** represents **Maximum Excess Information Rate**. It limits the average rate in bits per second at which External Interface Frames for this Bandwidth Profile Flow can be declared Yellow (regardless of unused excess bandwidth from higher-ranked Bandwidth Profile Flows or unused committed bandwidth).

Allowed values: Class: InformationRate

Property Name: *Excess Burst Size*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *ebs* – **Type:** *object*

Description: **ebs** represents **Excess Burst Size**. It limits by how much, and for how long, the amount of traffic declared Yellow for this Bandwidth Profile Flow in the short term can exceed the excess bandwidth made available to this Bandwidth Profile Flow over the long term.

Allowed values: Class: DataSize

Validation Notes: If eir and/or eirmax are greater than 0, ebs must be greater than 0. Similar to cbs, ebs should be at least twice the Maximum Frame size (although in practice it is usually quite a bit more than that).

Property Name: *Coupling Flag*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *couplingFlag* – **Type:** *boolean*

Description: The **couplingFlag** 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.

Allowed values:

Validation Notes: This must be 0 (FALSE) if **Envelope.couplingFlagForIndexZero** is 1 (TRUE)

Property Name: *Color Mode*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *colorMode* – **Type:** *enum*

Description: **colorMode** indicates whether or not External Interface Frames for this Bandwidth Profile Flow that are identified as *Yellow* on input to the Bandwidth Profile Algorithm can be declared *Green*.

Allowed values: Enum: "COLOR_BLIND", "COLOR_AWARE"

Property Name: *Envelope Name*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *envelopeId* – **Type:** *string*

Description: The name of the envelope that this Bandwidth Profile Flow resides in.

Allowed values: String; Min Length: 1 Max Length: 45 Pattern (regex): [\x20-\x7F]+

Validation Notes: This **must** match an Envelope ID in exactly one of the Envelopes at the External Interface where this Bandwidth Profile Flow is applied:

For Operator Ethernet Services: *OperatorUNI.envelopes*, *EnniService.envelopes*, *AccessElineOvcEpCommon.ovcEndPointEnvelopes*.

For Subscriber Ethernet Services: *SubscriberUNI.envelopes*, *CarrierEthernetEvcEpCommon.evcEndPointEnvelopes*.

All Bandwidth Profile Flows in the same envelope **must** satisfy the same criterion listed in R230 of MEF 26.2 for Operator Ethernet Services and R165 of MEF 10.4 for Subscriber Ethernet Services.

Property Name: *Envelope Rank*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *envelopeRank* – **Type:** *integer*

Description: The rank in the envelope of this Bandwidth Profile Flow

Allowed values: Minimum: 1

Property Name: *Token Request Offset Field*

Reference: MEF 26.2 sec. 17.1.2 and MEF 10.4 sec. 12.1.2

JSON Name: *tokenRequestOffset* – **Type:** *integer*

Description: **tokenRequestOffset** adjusts the bandwidth consumed by each External Interface Frame in the Bandwidth Profile Flow by a fixed number of octets.

Allowed values: [Any Integer]

Class: Envelope (***Envelope***)

Bandwidth Profiles are organized into Envelopes. Multiple Bandwidth Profiles in an envelope can share bandwidth resources. Each Envelope has a name and a Coupling Flag for Index Zero (CF0) that indicates whether unused green tokens are discarded or converted to yellow tokens. All Bandwidth Profile Flows in the same envelope satisfy the same criterion listed in R230 of MEF 26.2.

Property Name: *Envelope Name*

Reference: MEF 10.4 sec. 9.12 and MEF 26.2 sec. 14.19

JSON Name: *envelopeID* – **Type:** *string*

Description: The attribute is a string that identifies the Envelope

Allowed values: String; Min Length: 1 Max Length: 45 Pattern (regex): [\x20-\x7F]+

Property Name: *Envelope CF0*

Reference: MEF 10.4 sec. 9.12 and MEF 26.2 sec. 14.19

JSON Name: *couplingFlagForIndexZero* – **Type:** *boolean*

Description: 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).

Allowed values:

Class: BandwidthProfilePerClassOfServiceName (***COS Bandwidth Profile***)

The value is a list of pairs of the form (x, y) For ingress, x is a Class of Service Name that is in the value of the EVC/OVC List of Class of Service Names Service Attribute (MEF 10.4 sec. 8.7 and MEF 26.2 sec. 12.12) for the EVC/OVC that associates the EVC/OVC End Point. For egress, x is a Class of Service from the EVC

List of Class of Service Names Service Attribute or an Egress Equivalence Class Name (for OVC). If specified, *y* is a reference to a Bandwidth Profile Flow and Disabled otherwise. There is at most one pair in the list for each CoS or EEC Name (Except Discard).

For EVCs it is used by the EVC EP Class of Service Name Ingress Bandwidth Profile Service Attribute (MEF 10.4 sec. 10.9). and EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute (MEF 10.4 sec. 10.11).

For OVCs it is used by the Ingress Bandwidth Profile per Class of Service Name (MEF 26.2 sec. 16.12) Egress Bandwidth Profile per Egress Equivalence Class Name (MEF 26.2 sec. 16.13).

Property Name: CoS or EEC Name

Reference: MEF 26.2 sec. 16.12 and 16.13

JSON Name: *classOfServiceName* – **Type:** *string*

Description: For Ingress, this is the Name of the Class of Service that this bandwidth profile flow is applied to. For Operator Ethernet Services this should be an item from *ovc.listOfClassOfServiceNames* and for Subscriber Ethernet Services this should be an item from *evc.listOfClassOfServiceNames*.

For Egress, for Operator Ethernet Services this is the OVC Egress Equivalence Class (EEC) Name and for Subscriber Ethernet Services this is the EVC Class of Service. If the specific Egress Equivalence Class/Class of Service is not used/configured at the End Point, then the Bandwidth Profile can be an empty list.

Allowed values: [Any String]

Property Name: CoS Bandwidth Profile

JSON Name: *bwpFlow* – **Type:** *object*

Description: The Bandwidth Profile to be applied to all items that are in the specified Class of Service or Egress Equivalence Class.

Allowed values: Class: BwpFlow

15.2 Class of Service

Carrier Ethernet Class of Service

Schema File Name: carrierEthernetClassOfService

Includes classes:

CosNameFromEp (CoS Name From EP)
 CosNameFromCtagPcp (CoS Name From C-Tag PCP)
 CosUniPcpMapEntry (PCP To CoS Map Entry)
 CosNameFromDscp (CoS Name From DSCP)
 CosDscpMap (DSCP to CoS Name Map)
 CosDscpMapEntry (DSCP to CoS Name Map Entry)
 DscpValues (List of DSCP Values)
 CosL2cp (L2CP to CoS Name)

Class: CosNameFromEp (**CoS Name From EP**)

Ingress CoS Name is derived from {F,M,P} where F=OVC_EP or EVC_EP as appropriate.

Property Name: CoS Map Type – EP

JSON Name: mapType – **Type:** const

Description: The field that indicates F = EVC/OVC EP.

Allowed values: "ENDPOINT"

Property Name: CoS Map

JSON Name: map_M – **Type:** string

Description: The single CoS Name at this EVC/OVC EP

Allowed values: [Any String]

Validation Notes: The value must be in the *listOfClassOfServiceNames* for the EVC/OVC.

Property Name: CoS L2CP

JSON Name: l2cp_P – **Type:** object

Description: This specifies the CoS Name for L2CPs carried over the EVC/OVC.

Allowed values: List of [0...*] Unique Class: CosL2cp

Class: CosNameFromCtagPcp (**CoS Name From C-Tag PCP**)

Ingress CoS Name is derived from {F,M,P} where F=C_TAG_PCP. This maps each of the 8 PCP values in the C-tag to a Class of Service Name. It also maps UNTAGGED frames to a Class of Service Name.

Property Name: CoS Map Type – CTAG

JSON Name: mapType – **Type:** const

Description: The Field that indicates F = C_TAG_PCP.

Allowed values: "C_TAG_PCP"

Property Name: CoS Map

JSON Name: map_M – **Type:** List of object

Description: This maps each of the possible C-tag PCP values (0-7) and Untagged to a specific CoS Name.

Allowed values: List of [9...9] Unique Class: CosUniPcpMapEntry

Property Name: CoS L2CP

JSON Name: l2cp_P – **Type:** object

Description: This specifies the CoS Name for L2CPs carried over the EVC/OVC.

Allowed values: List of [0…*] Unique Class: CosL2cp

Class: CosUniPcpMapEntry (**PCP To CoS Map Entry**)

2-tuple {PCP, CoSName} that maps a PCP value (or Untagged) to a CoS Name.

Property Name: C-Tag PCP Value

JSON Name: pcpVal – **Type:** enum

Description: A PCP value 0 to 7 or UNTAGGED

Allowed values: Enum: "0", "1", "2", "3", "4", "5", "6", "7", "UNTAGGED"

Property Name: CoS Name

JSON Name: pcpCosName – **Type:** string

Description: A CoS Name from the EVC/OVC List of Class of Service Names Service Attribute.

Allowed values: [Any String]

Validation Notes: The CoS Name must be in listOfClassOfServiceNames for the EVC/OVC.

Class: CosNameFromDscp (**CoS Name From DSCP**)

Ingress CoS Name is derived from {F,M,P} where F=DSCP. This maps groups of DSCP values (independently for IPv4 and IPv6) to a Class of Service Name. It also provides a Class of Service mapping for DSCP values that are not specified and for frames that do not contain IP Packets.

Property Name: CoS Map Type – DSCP

JSON Name: mapType – **Type:** const

Description: The Field that indicates F = DSCP.

Allowed values: "DSCP"

Property Name: CoS Map

JSON Name: map_M – **Type:** object

Description: This maps DSCP values to CoS Names for each of IPv4 and IPv6 and also to non-IP packets.

Allowed values: Class: CosDscpMap

Property Name: CoS L2CP

JSON Name: l2cp_P – **Type:** object

Description: This specifies the CoS Names for L2CPs carried over the EVC/OVC.

Allowed values: List of [0…*] Unique Class: CosL2cp

Class: CosDscpMap (**DSCP to CoS Name Map**)

This is a list of DSCP to CoS Name Entries followed by items for Not an IP Packet and All Other Values.

Property Name: DSCP Value to CoS List

JSON Name: dscpValueCoSList – **Type:** List of object

Description: This is a list of DSCP to CoS Map Entries: {ipv4DSCPs, ipv6DSCPs, CoSName}

Allowed values: List of [0...*] Unique Class: CosDscpMapEntry

Validation Notes: The ipv4 DSCP values in the different entries in the list must not overlap. The ipv6 DSCP values in the different entries in the list must not overlap.

Property Name: *CoS for Other IPv4*

JSON Name: *otherIPv4* – **Type:** *string*

Description: This is the CoS Name for IPv4 packets with DSCP values other than those listed.

Allowed values: [Any String]

Property Name: *CoS for Other IPv6*

JSON Name: *otherIPv6* – **Type:** *string*

Description: This is the CoS Name for IPv6 packets with DSCP values other than those listed.

Allowed values: [Any String]

Property Name: *CoS for Not IP Packet*

JSON Name: *notIP* – **Type:** *string*

Description: This is the CoS Name for packets that are not IP packets when CoS is determined from DSCP

Allowed values: [Any String]

Class: CosDscpMapEntry (***DSCP to CoS Name Map Entry***)

This is a 3-tuple {ipv4list, ipv6list, cosName}

Property Name: *IPv4 List of DSCPs*

JSON Name: *ipv4List* – **Type:** *object*

Description: List of IPv4 DSCP values

Allowed values: Class: DscpValues

Property Name: *IPv6 List of DSCPs*

JSON Name: *ipv6List* – **Type:** *object*

Description: List of IPv6 DSCP values

Allowed values: Class: DscpValues

Property Name: *Class of Service Name*

JSON Name: *cosName* – **Type:** *string*

Description: The Class of Service Name to associate with the indicated lists of IPv4 and IPv6 DSCP values

Allowed values: [Any String]

Class: DscpValues (***List of DSCP Values***)

A list of 6 bit values

Property Name: *List of DSCP Values*

JSON Name: *dscpValues* – **Type:** *List of integer*

Description: A list of unique 6-bit (0-63) values

Allowed values: List of [1...*] Unique Minimum: 0 Maximum: 63

Class: CosL2cp (*L2CP to CoS Name*)

2-tuple {L2CP Ident, CoS Name}

Property Name: *L2CP Identifier*

Reference: MEF 45.1 sec. 8.2

JSON Name: *l2cpIdentifier* – **Type:** *object*

Description: Protocol Identifier

Allowed values: Class: L2cpProtocol

Property Name: *L2CP CoS Name*

JSON Name: *l2cpCosName* – **Type:** *string*

Description: CoS Name String to associate with the L2CP

Allowed values: [Any String]

15.3 Color Identifier

Carrier Ethernet Color Identifier

Schema File Name: carrierEthernetColorIdentifier

Includes classes:

- ColorFromDei (Color From DEI)
- ColorFromPCP (Color From PCP)
- ColorFromPCPMapEntry (Color from PCP Map Entry)
- ColorFromDscp (Color From DSCP)
- ColorFromDscpEntry (Color From DSCP Entry)
- ColorFromEp (Color From EP)

Class: ColorFromDei (**Color From DEI**)

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.

Property Name: Color Map Type – DEI

JSON Name: mapType – **Type:** const

Allowed values: "DEI"

Class: ColorFromPCP (**Color From PCP**)

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.

Property Name: Color Map Type – PCP

JSON Name: mapType – **Type:** const

Allowed values: "PCP"

Property Name: Color Map

JSON Name: colorFromPcpMap – **Type:** List of object

Description: This is a list of 8 Color mappings, one for each PCP value.

Allowed values: List of [8...8] Unique Class: ColorFromPCPMapEntry

Class: ColorFromPCPMapEntry (**Color from PCP Map Entry**)

Property Name: PCP Value

JSON Name: pcpValue – **Type:** enum

Allowed values: Type: PcpValue

Property Name: PCP Color

JSON Name: pcpColor – **Type:** enum

Allowed values: Type: FrameColor

Class: ColorFromDscp (**Color From DSCP**)

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.

Property Name: *Color Map Type – DSCP*

JSON Name: *mapType – Type: const*

Allowed values: "DSCP"

Property Name: *colorMap*

JSON Name: *colorFromDscpMap – Type: List of object*

Allowed values: List of [1...*] Unique Class: ColorFromDscpEntry

Class: ColorFromDscpEntry (**Color From DSCP Entry**)

Property Name: *DSCP List*

JSON Name: *dscpList – Type: List of integer*

Description: This is a list of DSCP values

Allowed values: List of [1...*] Unique Minimum: 0 Maximum: 63

Property Name: *IPv4 Color*

JSON Name: *ipv4Color – Type: enum*

Allowed values: Type: FrameColor

Property Name: *IPv6 Color*

JSON Name: *ipv6Color – Type: enum*

Allowed values: Type: FrameColor

Class: ColorFromEp (**Color From EP**)

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

Property Name: *Map Type – ENDPOINT*

JSON Name: *mapType – Type: const*

Allowed values: "ENDPOINT"

Property Name: *Color*

JSON Name: *epColor – Type: enum*

Allowed values: Type: FrameColor

15.4 EVC Egress Maps

EVC Egress Maps

Schema File Name: evcEgressMaps

Includes classes:

EvcEgressMap (EVC Egress Map)

EvcEgressMapEntry (Evc Egress Map Entry)

Class: EvcEgressMap (**EVC Egress Map**)

This map is a table with one entries 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.

Property Name: List of EVC Egress Map Entries

JSON Name: evcEgressMapEntries - **Type:** List of object

Description: 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.

Allowed values: List of [0...*] Unique Class: EvcEgressMapEntry

Class: EvcEgressMapEntry (**Evc Egress Map Entry**)

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

Property Name: CoS Name

JSON Name: cosName - **Type:** string

Allowed values: [Any String]

Validation Notes: This must be a CoS Name from **EVC List of Class of Service Names**

Property Name: PCP Green

JSON Name: pcpGreen - **Type:** object

Description: A PCP value (0-7) or DISCARD to use for Green Frames

Allowed values: Type: PcpValueAndDiscard

Property Name: PCP Yellow

JSON Name: pcpYellow - **Type:** object

Description: A PCP value (0-7) or DISCARD to use for Yellow frames

Allowed values: Type: PcpValueAndDiscard

Property Name: DEI Green

JSON Name: deiGreen - **Type:** object

Description: A DEI value to use for Green frames

Allowed values: Type: DeiValueAndDiscard

Validation Notes: This is optional ONLY if **pcpGreen** is set to **DISCARD**

Property Name: *DEI Yellow*

JSON Name: *deiYellow* - **Type:** *object*

Description: A DEI value to use for Yellow frames

Allowed values: Type: *DeiValueAndDiscard*

Validation Notes: This is optional ONLY if *pcpYellow* is set to *DISCARD*

15.5 EVC End Point Maps

EVC End Point Maps

Schema File Name: *evcEndPointMaps*

Includes classes:

EvcEndPointMap (EVC End Point Map)

Class: *EvcEndPointMap* (**EVC End Point Map**)

*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.*

Property Name: *VLAN Listing Type*

JSON Name: *vlanType* - **Type:** *enum*

Description: 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.

Allowed values: Enum: "LIST", "UT/PT"

Property Name: *VLAN ID List*

JSON Name: *vlanId* - **Type:** *List of integer*

Description: A list of VLAN IDs if the value of *vlanType* is "LIST".

Allowed values: List of [1...4094] Unique Minimum: 1 Maximum: 4094

Validation Notes: This element must be specified if and only if *EndPointMapEvc.vlanType* = "LIST"

15.6 EVC External Interfaces

EVC Ethernet External Interfaces

Schema File Name: evcEthernetExternalInterfaces

Includes classes:

VirtualFrameMap (Virtual Frame Map)

Class: VirtualFrameMap (*Virtual Frame Map*)

A map for virtual frame mapping. The absence of this attribute corresponds to a Service Attribute value of Not Applicable. Reference MEF 10.4 Section 9.3 Subscriber UNI Virtual Frame Map Service Attribute.

Property Name: *Virtual Frame Map*

Reference: MEF 10.4 sec. 9.2 and sec. 9,3

JSON Name: *vfMap* - **Type:** *string*

Description: When the value of the Subscriber UNI Instantiation Service Attribute = Virtual, there **must** exist a map that maps the set of Virtual Frames that cross the UNI to a sequence of pairs of the form (s,t) where s is a standard Ethernet frame per Clause 3 of IEEE Std 802.3 – 2015 [5] and t is the arrival time at the UNI for all bits in s . Since MEF 10.4 does not specify the contents or format of this map, it is currently defined as an arbitrary length string.

Allowed values: String: Min Length: 0

15.7 External Interfaces

Carrier Ethernet External Interfaces

Schema File Name: carrierEthernetExternalInterfaces

Includes classes:

UniPhysicalLink (UNI Physical Link)

CarrierEthernetPhysicalLink (Carrier Ethernet Physical Link)

UniSpecificAttributes (UNI Specific)

Type: UniPhysicalLink (**UNI Physical Link**)

This class is the composition of the generic physical link attributes CarrierEthernetPhysicalLink and the UniSpecificAttributes.

Property Name: UNI Physical Link **Type:** object

Allowed values: Compose (allOf): Class: CarrierEthernetPhysicalLink, Class: UniSpecificAttributes

Class: CarrierEthernetPhysicalLink (**Carrier Ethernet Physical Link**)

*A 2-tuple of the form (id, physicalLink). The value of **id** is an identifier for the physical link. The value of **physicalLink** is the specific Ethernet physical layer type.*

Property Name: Physical Link Identifier

JSON Name: id - **Type:** string

Description: An identifier for the physical link.

Allowed values: String: Min Length: 1 Max Length: 45 Pattern (regex): [\x20-\x7F]+

Property Name: Physical Link PHY Type

JSON Name: physicalLink - **Type:** enum

Description: An Ethernet physical layer

Allowed values: Enum: "1BASE5", "2BASE_TL", "10BASE2", "10BASE5", "10BASE_F", "10BASE_FB", "10BASE_FL", "10BASE_FP", "10BASE_T", "10BASE_T1L", "10BASE_T1S", "10BASE_TE", "10BROAD36", "10PASS_TS", "100BASE_BX10", "100BASE_FX", "100BASE_LX10", "100BASE_T", "100BASE_T1", "100BASE_T2", "100BASE_T4", "100BASE_TX", "100BASE_X", "1000BASE_BX10", "1000BASE_CX", "1000BASE_KX", "1000BASE_LX", "1000BASE_LX10", "1000BASE_PX10", "1000BASE_PX20", "1000BASE_RHA", "1000BASE_RHB", "1000BASE_RHC", "1000BASE_SX", "1000BASE_T", "1000BASE_T1", "1000BASE_X", "2_5GBASE_KX", "2_5GBASE_T", "2_5GBASE_T1", "5GBASE_KR", "5GBASE_T", "5GBASE_T1", "10GBASE_CX4", "10GBASE_E", "10GBASE_ER", "10GBASE_EW", "10GBASE_KR", "10GBASE_KX4", "10GBASE_L", "10GBASE_LR", "10GBASE_LRM", "10GBASE_LW", "10GBASE_LX4", "10GBASE_R", "10GBASE_S", "10GBASE_SR", "10GBASE_SW", "10GBASE_T", "10GBASE_T1", "10GBASE_W", "10GBASE_X", "25GBASE_CR", "25GBASE_CR_S", "25GBASE_ER", "25GBASE_KR", "25GBASE_KR_S", "25GBASE_LR", "25GBASE_SR", "25GBASE_T", "40GBASE_CR4", "40GBASE_ER4", "40GBASE_FR", "40GBASE_KR4", "40GBASE_LR4", "40GBASE_R", "40GBASE_SR4", "40GBASE_T", "50GBASE_CR", "50GBASE_ER", "50GBASE_FR", "50GBASE_KR", "50GBASE_LR", "50GBASE_SR", "100GBASE_CR10", "100GBASE_CR2", "100GBASE_CR4", "100GBASE_DR", "100GBASE_ER4", "100GBASE_KP4", "100GBASE_KR2", "100GBASE_KR4", "100GBASE_LR4", "100GBASE_R", "100GBASE_SR10", "100GBASE_SR2", "100GBASE_SR4", "200GBASE_CR4", "200GBASE_DR4", "200GBASE_ER4", "200GBASE_FR4", "200GBASE_KR4", "200GBASE_LR4", "200GBASE_SR4", "400GBASE_DR4", "400GBASE_ER8", "400GBASE_FR8", "400GBASE_LR8", "400GBASE_SR16", "400GBASE_SR4_2", "400GBASE_SR8", "OTHER"

Class: UniSpecificAttributes (**UNI Specific**)

This is a 5-tuple that specifies UNI specific link attributes (in addition to the general physical link attributes). The components of the 5-tuple are: (1) whether Synchronous Ethernet is enabled or disabled, (2) whether PTP is used on the link, (3) UNI connector type, (4) the UNI connector gender, and (5) whether autonegotiation is used on the link.

Property Name: *Physical Link Synchronous Ethernet*

JSON Name: *synchronousEthernet* - **Type:** *object*

Description: Indicates if synchronous Ethernet is used on the physical link and has the value either **Enabled** or **Disabled**.

Allowed values: Type: EnabledDisabled

Property Name: *Physical Link Precision Timing*

JSON Name: *precisionTiming* - **Type:** *object*

Description: Indicates if the Precision Time Protocol is used on the physical link and has the value either **Enabled** or **Disabled**

Allowed values: Type: EnabledDisabled

Property Name: *UNI Connector Type*

JSON Name: *uniConnectorType* - **Type:** *enum*

Description: This indicates the type of connector that is presented to the Subscriber.

Allowed values: Enum: "SC", "LC", "RJ45", "OTHER"

Property Name: *UNI Connector Gender*

JSON Name: *uniConnectorGender* - **Type:** *enum*

Description: This indicates whether the Subscriber is presented with a SOCKET (common) or a PLUG (less common).

Allowed values: Enum: "SOCKET", "PLUG"

Property Name: *Auto Negotiation*

Reference: IEEE Std 802.3-2018 Clause 28 and 37

JSON Name: *autoNegotiation* - **Type:** *object*

Description: Indicates whether 802.3 autonegotiation is enabled on the UNI link.

Allowed values: Type: EnabledDisabled

15.8 Layer 2 Control Protocols (L2CP)

Carrier Ethernet L2CP

Schema File Name: carrierEthernetL2cp

Includes classes:

L2cpPeering (L2CP Peering Identifier)

L2cpProtocol (L2CP Protocol Identifier)

Class: L2cpPeering (**L2CP Peering Identifier**)

This 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

Property Name: Protocol ID

JSON Name: protocolID - **Type:** object

Description: This specifies the Protocol Type for the L2CP. It consists of a field specification (ETHERTYPE or LLC), the EtherType or LLC value, and an optional subtype.

Allowed values: Class: L2cpProtocol

Property Name: Destination MAC Address

JSON Name: destinationAddress - **Type:** string

Description: The Destination MAC Address of the L2CP to be peered in the standard format of 6 hex bytes separated by hyphen (-).

Allowed values: String: Pattern (regex): [0-9a-fA-F][0-9a-fA-F]([-][0-9a-fA-F][0-9a-fA-F]){5}

Property Name: Link ID List

JSON Name: linkIdList - **Type:** List of string

Description: Identifiers for the links on which the specified protocol will be peered. If no links are specified the protocol is peered on all links.

Allowed values: List of [0...*] String: Min Length: 1 Max Length: 45 Pattern (regex): [\x20-\x7F]+

Class: L2cpProtocol (**L2CP Protocol Identifier**)

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

Property Name: Protocol Type

JSON Name: l2cpProtocolType - **Type:** enum

Description: The protocol field to inspect to identify the L2CP.

Allowed values: Enum: "ETHERTYPE", "LLC"

Property Name: EtherType or LLC Value

JSON Name: llcAddressOrEtherType - **Type:** integer

Description: The EtherType value or LLC value

Allowed values: Minimum: 0

Property Name: EtherType SubType

JSON Name: subType - **Type:** integer

Description: The EtherType can be modified by an optional sub-type.

Allowed values: Minimum: 0

15.9 Link Aggregation

Carrier Ethernet Link Aggregation

Schema File Name: carrierEthernetLinkAggregation

Includes classes:

ConversationIdToAggregationLinkMap (Conversation To Aggregation Link Map)

ConversationIdRange (ConversationID Range)

Class: ConversationIdToAggregationLinkMap (**Conversation To Aggregation Link Map**)

This is a 2-tuple $\langle x, y \rangle$ where x is a list of Port Conversation IDs or ranges of Port Conversation IDs (a Port Conversation ID is a VLAN ID or 0 for untagged frames) and y is a list of Link Numbers. This is used in the Port Conversation to Aggregation Link Map for the UNI and ENNI.

Property Name: List of Conversation ID Ranges

Reference: 802.1AX-2014 sec. 6.6.2.1

JSON Name: conversationIDs - **Type:** List of object

Description: A Port Conversation ID is a VLAN ID (1 to 4094) or 0 to represent untagged and priority-tagged frames.

Allowed values: List of [1...*] Unique Class: ConversationIdRange

Property Name: Aggregation Link List

Reference: 802.1AX-2014 sec. 6.6.2.1

JSON Name: aggLinkList - **Type:** List of integer

Description: An ordered list of Aggregation Link Numbers

Allowed values: List of [1...*] Unique Minimum: 1

Validation Notes: The values in the list must be in the range $1 \dots n$ where n is the number of physical links (i.e. the cardinality of the list of physical links (For Operator Ethernet Services: *OperatorUNI.listOfPhysicalLinks* or *EnniCommon.listOfPhysicalLinks* and for Subscriber Ethernet Services: *SubscriberUNI.listOfPhysicalLinks*))

Class: ConversationIdRange (**ConversationID Range**)

A range of ConversationID (either a VLAN Id or 0 for untagged frames) allowing three forms: start, start → end, and start → end

Property Name: Start Conversation ID

JSON Name: start - **Type:** integer

Description: The starting Conversation ID of the range or the only Conversation ID if there is no end value

Allowed values: Minimum: 0 Maximum: 4094

Validation Notes: The **start** value **must** be less than or equal to the **end** value if that is specified.

Coding hint: start must be less than or equal to end

Property Name: End Conversation ID

JSON Name: end - **Type:** integer

Description: The final Conversation ID in the range

Allowed values: Minimum: 0 Maximum: 4094

Validation Notes: The **end** value, if specified, **must** be greater than or equal to the **start** value.

Coding hint: end, if specified, must be greater than or equal to start

15.10 Service Level Specification

Carrier Ethernet Service Level Specification

Schema File Name: carrierEthernetServiceLevelSpecification

Includes classes:

CarrierEthernetSls (Carrier Ethernet SLS)
 SlsCosNameEntry (SLS CoS Name Entry)
 OneWayFrameDelayPmMetric (One Way Frame Delay)
 OneWayMeanFrameDelayPmMetric (One Way Mean Frame Delay)
 OneWayFrameDelayRangePmMetric (One Way Frame Delay Range)
 OneWayInterFrameDelayVariationPmMetric (One Way InterFrame Delay Variation)
 OneWayFrameLostRatioPmMetric (One Way Frame Loss Ratio)
 OneWayAvailabilityPmMetric (One Way Availability)
 OneWayHighLossIntervalPmMetric (One Way High Loss Intervals)
 OneWayConsecutiveHighLossIntervalsPmMetric (One Way Consecutive High Loss Intervals)
 OneWayCompositePmMetric (One Way Composite)
 OneWayGroupAvailabilityPmMetric (One Way Group Availability)
 OrderedPair (Ordered Pair)
 OrderedPairList (Sets of Ordered Pairs)

Class: CarrierEthernetSls (**Carrier Ethernet SLS**)

The Service Level Specification Service Attribute (SLS) is, as part of the Service Level Agreement, the technical details of the service level, in terms of Performance Objectives, agreed between the Service Provider and the Subscriber for the Subscriber Ethernet Services and between the SP/SO and Operator for Operator Ethernet Services as part of the Service Level Agreement. A given SLS might contain 0, 1, or more Performance Objectives for each Performance Metric. The SLS is described in section 8.8 (EVC Service Level Specification Service Attribute) of MEF 10.4 for EVCs and section 12.13 (OVC Service Level Specification Service Attribute) for OVCs. MEF 10.4 defines 10 Performance Metrics (all of which are included here). MEF 26.2 defines only 9 Performance Metrics. MEF 26.2 does not include the One Way Composite PM. The other 9 are the same.

Property Name: Start Time

Reference: MEF 10.4 sec. 8.8 and MEF 26.2 sec. 12.13

JSON Name: *startTime* - **Type:** *object*

Description: This represents the date and time for the start of the SLS. It is the beginning of the first *timeInterval*. This is referred to as *ts* in MEF 10.4 and MEF 26.2. The value is a string in ISO 8601 format.

Allowed values: String; Format: date-time

Property Name: Time Duration

Reference: MEF 10.4 sec. 8.8 and MEF 26.2 sec. 12.13

JSON Name: *timeDuration* - **Type:** *object*

Description: The **timeDuration** (referred to as *T* in MEF 10.4 and 26.2) is a time duration, e.g., 1 month, 2 weeks, that is used in conjunction with *startTime* to specify time intervals for determining when Performance Objectives are met. Note that the units for *timeDuration* are not constrained; in particular, 1 month is an allowable value, corresponding to a calendar month, e.g. from midnight on the 10th of one month up to but not including midnight the 10th of the following month.

Allowed values: Class: TimeDuration

Property Name: SLS CoS Entries

Reference: MEF 10.4 sec. 8.8 and MEF 26.2 sec. 12.13

JSON Name: *slsCosNameEntry* - **Type:** *List of object*

Description: This is a list of Performance Metrics. Each entry contains a set of parameters and Performance Metrics for one Class of Service.

Allowed values: List of [1...*] Unique Class: SlsCosNameEntry

Class: SlsCosNameEntry (SLS CoS Name Entry)

This is the specification of Performance Metrics (and parameters) for one Class of Service. The first element is the CoS Name. This MUST be unique, i.e. there can not be two instances of this Class with the same CoS Name. The CoS Name is followed by three parameters and then lists of Performance Metrics.

Property Name: CoS Name

JSON Name: cosName - **Type:** string

Description: This is the CoS Name for this PM Entry.

Allowed values: String; Min Length: 1

Validation Notes: The CoS Name should be included in the OVC List of Class of Service Names (*AccessElineOvc.listOfClassOfServiceNames*) for Operator Ethernet Services and the EVC List of Class of Service Names (*CarrierEthernetEvcCommon.listOfCosNames*) for Subscriber Ethernet Services.

Property Name: Delta T

Reference: MEF 10.4 sec. 8.8 and MEF 26.2 sec. 12.13

JSON Name: deltaT - **Type:** integer

Description: **deltaT** is a time duration in seconds much smaller than **timeInterval**. This is used, primarily, in calculations associated with Availability, High Loss Intervals and Consecutive High Loss Intervals. MEF 10.4 and MEF 26.2 refer to this as Δt and the k-th interval starting at t_s is referred to as Δt_k (k is subscript).

Allowed values: Minimum: 1

Validation Notes: **deltaT** is a time duration in seconds much smaller than **timeInterval** (e.g. 10 seconds).

Property Name: Frame Loss Threshold

Reference: MEF 10.4 sec. 8.8 and MEF 26.2 sec. 12.13

JSON Name: thresholdC - **Type:** number

Description: **thresholdC** is a real number in the range [0,1] used as a threshold to determine whether a given time interval Δt_k has high loss.

Allowed values: Minimum: 0 Maximum: 1

Property Name: HLI Consecutive Intervals

Reference: MEF 10.4 sec. 8.8 and MEF 26.2 sec. 12.13

JSON Name: consecutiveIntervalN - **Type:** integer

Description: **consecutiveIntervalN** is an integer ≥ 1 , used to identify how many consecutive Δt_k intervals must have high loss to trigger a change in Availability.

Allowed values: Minimum: 1

Property Name: One Way Frame Delay

Reference: MEF 10.4 sec. 8.8.2 and MEF 26.2 sec. 12.13.2

JSON Name: oneWayFrameDelayPmMetric - **Type:** List of object

Description: **oneWayFrameDelayPmMetric** is a reference to zero or more instances of One Way Frame Delay Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Frame Delay. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayFrameDelayPmMetric

Property Name: One Way Mean Frame Delay

Reference: MEF 10.4 sec. 8.8.3 and MEF 26.2 sec. 12.13.3

JSON Name: oneWayMeanFrameDelayPmMetric - **Type:** List of object

Description: **oneWayMeanFrameDelayPmMetric** is a reference to zero or more instances of One Way Mean Frame Delay Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Mean Frame Delay. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayMeanFrameDelayPmMetric

Property Name: *One Way Frame Delay Range*

Reference: MEF 10.4 sec. 8.8.4 and MEF 26.2 sec. 12.13.4

JSON Name: *oneWayFrameDelayRangePmMetric* - **Type:** *List of object*

Description: **oneWayFrameDelayRangePmMetric** is a reference to zero or more instances of One Way Frame Delay Range Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Frame Delay Range. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayFrameDelayRangePmMetric

Property Name: *One Way Inter Frame Delay Variation*

Reference: MEF 10.4 sec. 8.8.5 and MEF 26.2 sec. 12.13.5

JSON Name: *oneWayInterFrameDelayVariationPmMetric* - **Type:** *List of object*

Description: **oneWayInterFrameDelayVariationPmMetric** is a reference to zero or more instances of One Way Inter Frame Delay Variation Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Inter Frame Delay Variation. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayInterFrameDelayVariationPmMetric

Property Name: *One Way Frame Loss Ratio*

Reference: MEF 10.4 sec. 8.8.6 and MEF 26.2 sec. 12.13.6

JSON Name: *oneWayFrameLossRatioPmMetric* - **Type:** *List of object*

Description: **oneWayFrameLossRatioPmMetric** is a reference to zero or more instances of One Way Frame Loss Ratio Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Frame Loss Ratio. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...1] Class: OneWayFrameLostRatioPmMetric

Property Name: *One Way Availability*

Reference: MEF 10.4 sec. 8.8.7 and MEF 26.2 sec. 12.13.7

JSON Name: *oneWayAvailabilityPmMetric* - **Type:** *List of object*

Description: **oneWayAvailabilityPmMetric** is a reference to zero or more instances of One Way Availability Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Availability. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayAvailabilityPmMetric

Property Name: *One Way HLI*

Reference: MEF 10.4 sec. 8.8.8 and MEF 26.2 sec. 12.13.8

JSON Name: *oneWayHighLossIntervalsPmMetric* - **Type:** *List of object*

Description: **oneWayHighLossIntervalsPmMetric** is a reference to zero or more instances of One Way High Loss Intervals Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way HLI. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayHighLossIntervalPmMetric

Property Name: *One Way CHLI*

Reference: MEF 10.4 sec. 8.8.9 and MEF 26.2 sec. 12.13.9

JSON Name: *oneWayConsecutiveHighLossIntervalsPmMetric* - **Type:** *List of object*

Description: **oneWayConsecutiveHighLossIntervalsPmMetric** is a reference to zero or more instances of One Way Consecutive High Loss Intervals Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way CHLI. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayConsecutiveHighLossIntervalsPmMetric

Property Name: *One Way Composite Performance*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *oneWayCompositePmMetric* - **Type:** *List of object*

Description: **oneWayCompositePmMetric** is a reference to zero or more instances of One Way Composite Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Composite Performance. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayCompositePmMetric

Property Name: *One Way Group Availability*

Reference: MEF 10.4 sec. 8.8.11 and MEF 26.2 sec. 12.13.10

JSON Name: *oneWayGroupAvailabilityPmMetric* - **Type:** *List of object*

Description: **oneWayGroupAvailabilityPmMetric** is a reference to zero or more instances of One Way Group Availability Performance Metric. Each reference contains a set of parameters and performance objective for the Performance Metric. If there are 0 instances then this Class of Service does not have an objective for One Way Group Availability. If there are multiple instances for this Class of Service then at least one of the parameters must be different between the instances.

Allowed values: List of [0...*] Unique Class: OneWayAvailabilityPmMetric

Class: OneWayFrameDelayPmMetric (**One Way Frame Delay**)

One Way Frame Delay Performance Metric consisting of 2 parameters, a list of Ordered End Point Pairs (referred to as S in MEF 10.4 and MEF 26.2) , a percentile (referred to as Pd in MEF 10.4 and MEF 26.2), and the One Way Frame Delay Objective for this Class of Service Name and these two parameters.

Property Name: *Frame Delay Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as S in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Unique Class: OrderedPair

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *Frame Delay Percentile*

Reference: MEF 10.4 sec. 8.8.2 and MEF 26.2 sec. 12.13.2 (Pd)

JSON Name: *oneWayFdPercentile* - **Type:** *object*

Description: A percentage in (0,100] for Frame Delay metric.

Allowed values: Type: Percentage

Validation Notes: This must be greater than 0.

Property Name: *Frame Delay Objective*

Reference: MEF 10.4 sec. 8.8.2 and MEF 26.2 sec. 12.13.2

JSON Name: *oneWayFdObjective* - **Type:** *object*

Description: The Performance Objective for this Performance Metric (this CoS and these 2 parameters). This is a unit of time greater than 0.

Allowed values: Class: TimeDuration

Class: OneWayMeanFrameDelayPmMetric (**One Way Mean Frame Delay**)

One Way Frame Mean Delay Performance Metric consisting of 1 parameter, a list of Ordered End Point Pairs (referred to as S in MEF 10.4 and MEF 26.2), and the One Way Mean Frame Delay Objective for this Class of Service Name and these Ordered End Point Pairs.

Property Name: *Mean Frame Delay Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as S in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Unique Class: OrderedPair

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *Mean Frame Delay Objective*

Reference: MEF 10.4 sec. 8.8.3 and MEF 26.2 sec. 12.13.3

JSON Name: *oneWayMfdObjective* - **Type:** *object*

Description: The Performance Objective for this Performance Metric (this CoS and these Ordered End Point Pairs). This is a unit of time >0.

Allowed values: Class: TimeDuration

Class: OneWayFrameDelayRangePmMetric (**One Way Frame Delay Range**)

One Way Frame Delay Range Performance Metric consisting of 2 parameters, a list of Ordered End Point Pairs (referred to as S in MEF 10.4 and MEF 26.2) , a percentile (referred to as Pr in MEF 10.4 and MEF 26.2), and the One Way Frame Delay Range Objective for this Class of Service Name and these two parameters.

Property Name: *Frame Delay Range Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as S in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Class: OrderedPair

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *Frame Delay Range Percentile*

Reference: MEF 10.4 sec. 8.8.4 and MEF 26.2 sec. 12.13.4

JSON Name: *oneWayFdrPecentile* - **Type:** *object*

Description: A percentage in (0,100] for Frame Delay Range metric.

Allowed values: Type: Percentage

Validation Notes: This must be greater than 0.

Property Name: *Frame Delay Range Objective*

Reference: MEF 10.4 sec. 8.8.4 and MEF 26.2 sec. 12.13.4

JSON Name: *oneWayFdrObjective* - **Type:** *object*

Description: The Performance Objective for this Performance Metric (this CoS and these 2 parameters). This is a unit of time >0.

Allowed values: Type: TimeDuration

Class: *OneWayInterFrameDelayVariationPmMetric* (***One Way InterFrame Delay Variation***)

One Way Frame Inter Frame Delay Variation Performance Metric consisting of 3 parameters, a list of Ordered End Point Pairs (referred to as S in MEF 10.4 and MEF 26.2), a time duration (referred to as delta-tau in MEF 10.4 and MEF 26.2), a percentile (referred to as Pv in MEF 10.4 and MEF 26.2), and the Inter Frame Delay Variation Objective for this Class of Service Name and these three parameters.

Property Name: *Interframe Delay Variation Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as S in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Class: OrderedPair

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *Time Duration*

Reference: MEF 10.4 sec. 8.8.5 and MEF 26.2 sec. 12.13.5

JSON Name: *timeDuration* - **Type:** *object*

Description: A time duration. This is the time difference between frames for which IFDV is measured. It is called delta-tau in MEF 10.4 and MEF 26.2

Allowed values: Class: TimeDuration

Property Name: *Interframe Delay Variation Percentile*

Reference: MEF 10.4 sec. 8.8.5 and MEF 26.2 sec. 12.13.5

JSON Name: *oneWayIfdvPencentile* - **Type:** *object*

Description: A percentage in (0,100] for Frame Delay metric.

Allowed values: Type: Percentage

Validation Notes: This must be greater than 0.

Property Name: *Interframe Delay Variation Objective*

Reference: MEF 10.4 sec. 8.8.5 and MEF 26.2 sec. 12.13.5

JSON Name: *oneWayIfdvObjective* - **Type:** *object*

Description: The Performance Objective for this Performance Metric (this CoS and these 3 parameters). This is a unit of time >0.

Allowed values: Class: TimeDuration

Class: *OneWayFrameLostRatioPmMetric* (***One Way Frame Loss Ratio***)

One Way Frame Loss Ratio Performance Metric consisting of 1 parameter, a list of Ordered End Point Pairs

(referred to as *S* in MEF 10.4 and MEF 26.2), and the One Way Frame Loss Ratio Objective for this Class of Service Name and these Ordered End Point Pairs.

Property Name: *Frame Loss Ratio Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as *S* in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Unique Class: *OrderedPair*

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *Frame Loss Ratio Objective*

Reference: MEF 10.4 sec. 8.8.6 and MEF 26.2 sec. 12.13.6

JSON Name: *oneWayFlrObjective* - **Type:** *object*

Description: The Performance Objective for this Performance Metric (this CoS and these Ordered End Point Pairs).

Allowed values: Type: Percentage

Class: *OneWayAvailabilityPmMetric* (**One Way Availability**)

*One Way Availability Performance Metric consisting of 1 parameter, a list of Ordered End Point Pairs (referred to as *S* in MEF 10.4 and MEF 26.2), and the One Way Availability Objective for this Class of Service Name and these Ordered End Point Pairs.*

Property Name: *Availability Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as *S* in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Unique Class: *OrderedPair*

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *Availability Objective*

Reference: MEF 10.4 sec. 8.8.7 and MEF 26.2 sec. 12.13.7

JSON Name: *oneWayAvailabilityObjective* - **Type:** *object*

Description: The PM Objective for this Performance Metric (this CoS and these Ordered End Point Pairs) expressed as a percentage.

Allowed values: Type: Percentage

Class: *OneWayHighLossIntervalPmMetric* (**One Way High Loss Intervals**)

*One Way High Loss Intervals Performance Metric consisting of 1 parameter, a list of Ordered End Point Pairs (referred to as *S* in MEF 10.4 and MEF 26.2), and the One Way High Loss Intervals Objective for this Class of Service Name and these Ordered End Point Pairs.*

Property Name: *HLI Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as S in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Unique Class: OrderedPair

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *HLI Objective*

Reference: MEF 10.4 sec. 8.8.8 and MEF 26.2 sec. 12.13.8

JSON Name: *oneWayHighLossIntervalsObjective* - **Type:** *integer*

Description: The PM Objective for this Performance Metric (this CoS and these Ordered End Point Pairs) expressed as a non-negative number.

Allowed values: Minimum: 0

Class: OneWayConsecutiveHighLossIntervalsPmMetric (**One Way Consecutive High Loss Intervals**)

One Way Frame Delay Range Performance Metric consisting of 2 parameters, a list of Ordered End Point Pairs (referred to as S in MEF 10.4 and MEF 26.2) , a number (referred to as p in MEF 10.4 and MEF 26.2), and the One Way Consecutive High Loss Intervals Objective for this Class of Service Name and these two parameters.

Property Name: *CHLI Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1 and MEF 26.2 sec. 12.13.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as S in MEF 10.4 and MEF 26.2) of ordered pairs of EVC or OVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Unique Class: OrderedPair

Validation Notes: Each EVC or OVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *CHLI Consecutive Number*

Reference: MEF 10.4 sec. 8.8.9 and MEF 26.2 sec. 12.13.9

JSON Name: *consecutiveNumberP* - **Type:** *integer*

Description: The number of high loss intervals that constitute a consecutive high loss interval.

Allowed values: Minimum: 1

Property Name: *CHLI Objective*

Reference: MEF 10.4 sec. 8.8.9 and MEF 26.2 sec. 12.13.9

JSON Name: *oneWayChliObjective* - **Type:** *integer*

Description: Performance Objective expressed as a non-negative integer.

Allowed values: Minimum: 1

Class: OneWayCompositePmMetric (**One Way Composite**)

One Way Composite Performance Metric for Subscriber Ethernet Services consisting of 7 parameters, a list of Ordered End Point Pairs (referred to as S in MEF 10.4) , a Composite Performance number (referred to as U in MEF 10.4), indicators about Composite Frame Loss, Composite Frame Delay, and Composite Frame Delay Variation (referred to as Wfl, Wfd, and Wfdv in MEF 10.4), Thresholds for Frame Delay and Delay Variation (referred to as DL and Jt in MEF 10.4) and the One Way Composite Objective for this Class of Service Name and these seven parameters. This Performance Metric is only applicable for Subscriber Ethernet Services, it is not defined for Operator Ethernet Services.

Property Name: *Composite Ordered Pairs*

Reference: MEF 10.4 sec. 8.8.1.1

JSON Name: *orderedPairList* - **Type:** *List of object*

Description: The set (referred to as S in MEF 10.4) of ordered pairs of EVC End Points over which this Performance Metric parameters and objective apply.

Allowed values: List of [1...*] Unique Class: OrderedPair

Validation Notes: Each EVC End Point in the pair must be one of the End Points in the service, they cannot be the same End Point, and at least one of them must be a *root* End Point.

Property Name: *Composite Performance Indicator Threshold*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *compositePerformanceIndicatorThreshold* - **Type:** *number*

Description: Composite Performance Indicator threshold which if exceeded suggests an unacceptable time interval.

Allowed values: Minimum: 0 Maximum: 1

Property Name: *Composite Frame Loss*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *compositeFrameLoss* - **Type:** *integer*

Description: Composite indicator for One-way Frame Loss equal to 0 or 1.

Allowed values: Minimum: 0 Maximum: 1

Property Name: *Composite Frame Delay*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *compositeFrameDelay* - **Type:** *integer*

Description: Composite indicator for One-way Frame Delay equal to 0 or 1.

Allowed values: Minimum: 0 Maximum: 1

Property Name: *Composite Frame Delay Variation*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *compositeFrameDelayVariation* - **Type:** *integer*

Description: Composite indicator for One-way Frame Delay Variation equal to 0 or 1.

Allowed values: Minimum: 0 Maximum: 1

Property Name: *FD Threshold*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *oneWayFdThreshold* - **Type:** *object*

Description: Composite One-way Frame Delay threshold in time units.

Allowed values: Class: TimeDuration

Property Name: *IFDV Threshold*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *oneWayIfdvThreshold* - **Type:** *object*

Description: One-way Frame Delay Variation threshold in time units.

Allowed values: Class: TimeDuration

Property Name: *Composite Objective*

Reference: MEF 10.4 sec. 8.8.10

JSON Name: *cpmObjective* - **Type:** *object*

Description: The PM Objective for this Performance Metric (this CoS and these 7 parameters) expressed as a percentage.

Allowed values: Type: Percentage

Class: OneWayGroupAvailabilityPmMetric (**One Way Group Availability**)

The One Way Group Availability Performance Metric has 2 parameters. The first parameter is a list of sets of Ordered End Point Pairs (referred to as G in MEF 10.4 and MEF 26.2). (Note that this is different than the other Performance Metrics which have a list of Ordered End Point Pairs). The second parameter is the number of sets that must be available (referred to as K in MEF 10.4 and MEF 26.2). The third element is the Performance Objective for the One Way Group Availability.

Property Name: GA Ordered Pairs

Reference: MEF 10.4 sec. 8.8.11 and MEF 26.2 sec. 12.13.10

JSON Name: setOfOrderedPairs - **Type:** List of object

Description: This is a list of lists of Ordered End Point Pairs.

Allowed values: List of [1...*] Unique Class: orderedPairList

Property Name: Minimum Number of Sets Available

Reference: MEF 10.4 sec. 8.8.11 and MEF 26.2 sec. 12.13.10

JSON Name: minimumNumberOfSetsAvailableK - **Type:** integer

Description: Specified number of sets of Ordered End Point Pairs available during characterized percentage of time of measurement.

Allowed values: Minimum: 1

Property Name: GA Objective

Reference: MEF 10.4 sec. 8.8.11 and MEF 26.2 sec. 12.13.10

JSON Name: oneWayGroupAvailabilityObjective - **Type:** object

Description: This is the Performance Objective for this Performance Metric expressed as a Percentage.

Allowed values: Type: Percentage

Class: OrderedPair (**Ordered Pair**)

Performance Metrics (except for Group Availability) are specified for a list of Ordered End Point Pairs. In other words a Frame Delay objective (for example) is specified from {A to B} and from {C to D}. This class defines one Ordered End Point Pair.

Property Name: From EVC/OVC End Point

JSON Name: fromCarrierEthernetServiceEndPoint - **Type:** string

Description: This is the EVC End Point ID for an EVC End Point in the service or OVC End Point ID for an OVC End Point in the service.

Allowed values: [Any String]

Property Name: To EVC/OVC End Point

JSON Name: toCarrierEthernetServiceEndPoint - **Type:** string

Description: This is the EVC End Point ID for an EVC End Point in the service or OVC End Point ID for an OVC End Point in the service.

Allowed values: [Any String]

Class: OrderedPairList (**Sets of Ordered Pairs**)

The Group Availability is specified for sets of Ordered End Point Pairs, e.g., $G1 = \langle \langle A, B \rangle, \langle A, C \rangle \rangle$ and $G2 = \langle \langle A, D \rangle, \langle A, E \rangle \rangle$. This class defines one set of Ordered End Point Pairs.

Property Name: List of Ordered Pairs

JSON Name: orderedPairList - **Type:** List of object

Allowed values: List of [1...*] Unique Class: OrderedPair

15.11 Standard Enums

Carrier Ethernet Enums

Schema File Name: carrierEthernetEnums

Includes classes:

EnabledDisabled (Enabled Disabled)
PcpValueAndDiscard (PCP Value and Discard Enum)
DeiValueAndDiscard (DEI and Discard Enum)
LinkAggType (LinkAgg Enum)
FrameColor (FrameColor Enum)
L2cpAddressSet (L2CP Address Set Enum)
MegLevel (MEG Level Enum)
AvailableMegLevel (Available MEG Level Enum)
PcpValue (PCP Value Enum)
TimeDurationUnits (Time Duration Units)
InformationRateUnits (Information Rate Units)
DataSizeUnits (Data Size Units)

Type: EnabledDisabled (**Enabled Disabled**)

Enumeration to indicate Enabled/Disabled state of an attribute

Property Name: Enabled Disabled Enum **Type:** enum

Allowed values: Enum: "ENABLED", "DISABLED"

Type: PcpValueAndDiscard (**PCP Value and Discard Enum**)

Property Name: PCP Value and Discard Enum **Type:** enum

Allowed values: Enum: "0", "1", "2", "3", "4", "5", "6", "7", "DISCARD"

Type: DeiValueAndDiscard (**DEI and Discard Enum**)

Property Name: DEI Value and Discard Enum **Type:** enum

Allowed values: Enum: "0", "1", "DISCARD"

Type: LinkAggType (**LinkAgg Enum**)

Type that defines the Link Aggregation types.

Property Name: Link Aggregation Enum **Type:** enum

Allowed values: Enum: "NONE", "2_LINK_ACTIVE_STANDBY", "ALL_ACTIVE", "OTHER"

Type: FrameColor (**FrameColor Enum**)

Property Name: *Frame Color Enum* **Type:** *enum*

Allowed values: Enum: "GREEN", "YELLOW"

Type: L2cpAddressSet (**L2CP Address Set Enum**)

Property Name: *L2CP Address Set Enum* **Type:** *enum*

Allowed values: Enum: "CTA", "CTB", "CTB2"

Type: MegLevel (**Meg Level Enum**)

Property Name: *Meg Level Enum* **Type:** *enum*

Allowed values: Enum: "0", "1", "2", "3", "4", "5", "6", "7", "NONE"

Type: AvailableMegLevel (**Available Meg Level Enum**)

Property Name: *Available Meg Level Enum* **Type:** *enum*

Allowed values: Enum: "0", "1", "2", "3", "4", "5", "6"

Type: PcpValue (**PCP Value Enum**)

Property Name: *PCP Value Enum* **Type:** *enum*

Allowed values: Enum: "0", "1", "2", "3", "4", "5", "6", "7"

Type: TimeDurationUnits (**Time Duration Units**)

Enum listing the units of measure for a Time Duration

Property Name: *Time Duration Units Enum* **Type:** *enum*

Allowed values: Enum: "NS", "US", "MS", "SEC", "MIN", "HOUR", "DAY", "WEEK", "MONTH", "YEAR"

Type: InformationRateUnits (**Information Rate Units**)

Enum of information rates (such as MBPS)

Property Name: *Information Rate Units Enum* **Type:** *enum*

Allowed values: Enum: "BPS", "KBPS", "MBPS", "GBPS", "TBPS", "PBPS", "EBPS", "ZBPS", "YBPS"

Type: DataSizeUnits (*Data Size Units*)



Property Name: *Data Size Units Enum* **Type:** *enum*

Description: Data size in multiples of bytes (e.g., BYTES or MBYTES)

Allowed values: Enum: "BYTES", "KBYTES", "MBYTES", "GBYTES", "TBYTES", "PBYTES", "EBYTES", "ZBYTES", "YBYTES"

15.12 Utility Classes

Utility Classes and Types

Schema File Name: carrierEthernetUtilityClasses

Includes classes:

MepLevelAndDirection (MEP Specification)
 SourceMacAddressLimit (SA Limit)
 AggLinkDepth (Link Depth)
 FrameDisposition (Frame Disposition)
 FrameDispEnum (Frame Disposition Enumeration)
 InformationRate (Information Rate)
 DataSize (Data Size)
 TimeDuration (Time Duration)
 Percentage (Percentage)

Class: MepLevelAndDirection (**MEP Specification**)

A 2-tuple that defines the MEG Level and MEP direction.

Property Name: MEG Level

JSON Name: level - **Type:** integer

Description: The MEG level

Allowed values: Minimum: 0 Maximum: 7

Property Name: MEP Direction

JSON Name: mepDirection - **Type:** enum

Description: Indicates whether this is an Up MEP or Down MEP

Allowed values: Enum: "UP", "DOWN"

Class: SourceMacAddressLimit (**SA Limit**)

This limits the number of source MAC addresses that can be used in ingress frame mapped to the End Point of all types over a time interval. It is a recommendation that each Ingress EI Frame with a source MAC address that would exceed the limit be discarded by the Carrier Ethernet Network.

Property Name: Number of Addresses

JSON Name: limit - **Type:** integer

Description: The number of MAC source addresses that will not subject an Ingress EI Frame to discard during the time interval.

Allowed values: Minimum: 1

Property Name: Time Interval

JSON Name: interval - **Type:** object

Description: The time interval in seconds over which the source address limit is evaluated

Allowed values: Class: TimeDuration

Class: AggLinkDepth (**Link Depth**)

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

Property Name: *vlanId*

JSON Name: *vlanID* - **Type:** *integer*

Description: The VLAN ID

Allowed values: Minimum: 1 Maximum: 4094

Property Name: *linkDepth*

JSON Name: *lagDepth* - **Type:** *integer*

Description: The number of Link Aggregation links available to the VLAN

Allowed values: Minimum: 1

Class: *FrameDisposition* (***Frame Disposition***)

A 3-tuple that indicates how Unicast, Multicast, and Broadcast Frames are delivered by the service. For each, the value can be UNCONDITIONAL, the frames are delivered without condition, CONDITIONAL, the frames are delivered based on conditions agreed to between buyer and seller (e.g., based on learned addresses), and DISCARD.

Property Name: *Unicast Frames*

JSON Name: *unicast* - **Type:** *object*

Allowed values: Type: *FrameDispEnum*

Property Name: *Multicast Frames*

JSON Name: *multicast* - **Type:** *object*

Allowed values: Type: *FrameDispEnum*

Property Name: *Broadcast Frames*

JSON Name: *broadcast* - **Type:** *object*

Allowed values: Type: *FrameDispEnum*

Type: *FrameDispEnum* (***Frame Disposition Enumeration***)

Property Name: *frameDispEnum* **Type:** *enum*

Allowed values: Enum: "DISCARD", "DELIVER_UNCONDITIONALLY", "DELIVER_CONDITIONALLY"

Class: *InformationRate* (***Information Rate***)

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

Property Name: *IR Value*

JSON Name: *irValue* - **Type:** *number*

Description: The value in the information rate. For example if the information rate is 70 kbps this element is 70.

Allowed values: Minimum: 0

Property Name: *IR Units*

JSON Name: *irUnits* - **Type:** *object*

Description: 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.

Allowed values: Type: InformationRateUnits

Class: DataSize (**Data Size**)

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

Property Name: *Data Size Value*

JSON Name: *dataSizeValue* - **Type:** *integer*

Description: The value in the data size. For example, if a burst size is 40 KBYTES, this element is 40.

Allowed values: [Any Integer]

Property Name: *Data Size Units*

JSON Name: *dataSizeUnits* - **Type:** *object*

Description: 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.

Allowed values: Type: DataSizeUnits

Class: TimeDuration (**Time Duration**)

This class is used to describe durations expressed as a 2-tuple, (value, units). The units are from nanoseconds to years.

Property Name: *Time Duration Value*

JSON Name: *timeDurationValue* - **Type:** *integer*

Description: The value of the duration. For example, if the duration is 20 ms, this element is 20.

Allowed values: [Any Integer]

Property Name: *Time Duration Units*

JSON Name: *timeDurationUnits* - **Type:** *object*

Description: The unit of measure in the duration. For example, if an interval is 2 ms, this element is MS.

Allowed values: Type: TimeDurationUnits

Type: Percentage (**Percentage**)

This is a number of percent - a floating point number between 0 and 100

Property Name: *Percentage* **Type:** *number*

Allowed values: Minimum: 0 Maximum: 100

16 Service Attributes Not Included

There are 8 Services Attributes from MEF 10.4 that are not included in the API. The two primary reasons for not including them are:

- They are part of the product-agnostic envelope (i.e., several Identifiers), and
- The Service Attribute has a single constant value for Subscriber Ethernet services defined in MEF 6.3 [7]. There is no benefit to including these in the API since the only possible use would be to validate that they are correct. There is no information to be gleaned if they are correct.

These Service Attributes are listed in the following table.

Group	Service Attribute	Discussion
EVC Service Attribute	EVC Identifier	Identifiers for Order Items are not needed since they are in the product-agnostic envelope.
EVC Service Attribute	EVC Type	EVC Type is not included, because it is implicit in the service type. For example, when ordering an E-TREE service, the EVC Type is known to be rooted multipoint and as such there is no value in specifying it.
EVC Service Attribute	List of EVC End Points	This is a list of EVC End Point IDs. This is not needed since the EVC End Points are included in the EVC definition or associated via product relationships.
EVC Service Attribute	EVC Group Membership	Out of scope for this release, because the Multiple EVC Service Level Specification Service Attribute is not currently part of MEF 7.4 [8].
EVC End Point Service Attributes	EVC End Point Ingress Bandwidth Profile	Bandwidth Profiles must be none as specified in MEF 6.3 [R3]
EVC End Point Service Attributes	EVC End Point Egress Bandwidth Profile	Bandwidth Profiles must be none as specified in MEF 6.3 [R4].
Subscriber UNI Service Attributes	Subscriber UNI Identifier	Identifiers for Order Items are not needed since they are in the product-agnostic envelope.
Subscriber UNI Service Attributes	Subscriber UNI Service Frame Format	Not needed, only a single value allowed: "802.3-2012"

Table 8 – Service Attributes Not Included in Schemas

17 References

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Appendix A Acknowledgements

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