MEF Standard

MEF 6.3

Subscriber Ethernet Services Definitions

November 2019

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1 List of Contributing Members

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

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2 Abstract

This document defines three Subscriber Ethernet Service constructs called Subscriber Ethernet Service Types and six Subscriber Ethernet Services with Service Attribute values as specified in MEF 10.4, "Subscriber Ethernet Services Attributes" [6] and in MEF 45.1, "Layer 2 Control Protocols in Ethernet Services" [11]. These Subscriber Ethernet Service Types are used to create Point-to-Point, Multipoint-to-Multipoint, and Rooted-Multipoint Ethernet Services that are either Port or VLAN based. This document supersedes and replaces MEF 6.2, "EVC Ethernet Services Definitions – Phase 3" [4].

In addition, an informative appendix is provided showing examples of some of the defined Subscriber Ethernet Services. This document also provides guidance on backwards compatibility to a Subscriber Ethernet Service as defined in MEF 6.2, "EVC Ethernet Services Definitions – Phase 3 [4].

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.

In addition, terms defined in MEF 10.4 [6], MEF 23.2 [8] MEF 23.2.1 [9], MEF 30.1 [10], and MEF 45.1 [11] are included in this document by reference and, hence, not repeated in table below.

Term	Definition	Reference
E-LAN Service Type	A Subscriber Ethernet Service Type that is based on a Multipoint-to-Multipoint EVC.	This document
E-Line Service Type	A Subscriber Ethernet Service Type that is based on a Point-to-Point EVC.	This document
EPL	Ethernet Private Line.	This document
EP-LAN	Ethernet Private LAN.	This document
EP-Tree	Ethernet Private Tree.	This document
Ethernet Private Line	A Port-based Service of E-Line Service Type that conforms to all the requirements described in Section 9.1.	This document
Ethernet Private LAN	A Port-based Service of E-LAN Service Type that conforms to all the requirements described in Section 9.3.	This document
Ethernet Private Tree	A Port-based Service of E-Tree Service Type that conforms to all the requirements described in Section 9.5.	This document
E-Tree Service Type	A Subscriber Ethernet Service Type that is based on a Rooted-Multipoint EVC.	This document
Ethernet Virtual Private Line	A VLAN-based Service of E-Line Service Type that conforms to all the requirements described in Section 9.2.	This document
Ethernet Virtual Private LAN	A VLAN-based Service of E-LAN Service Type that conforms to all the requirements described in Section 9.4.	This document
Ethernet Virtual Private Tree	A VLAN-based Service of E-Tree Service Type that conforms to all the requirements described in Section 9.6.	This document
EVPL	Ethernet Virtual Private Line.	This document
EVP-LAN	Ethernet Virtual Private LAN.	This document
EVP-Tree	Ethernet Virtual Private Tree.	This document
N/S	Not Specified	This document
FD	One-way Frame Delay as defined in Section 8.8.2 of MEF 10.4 [6]	This document
FLR	One-way Frame Loss Ratio as defined in Section 8.8.6 of MEF 10.4 [6]	This document
FDR	One-way Frame Delay Range as defined in Section 8.8.4 of MEF 10.4 [6]	This document
IFDV	One-way Inter Frame Delay Variation as defined in Section 8.8.5 of MEF 10.4 [6]	This document

Term	Definition	Reference
MFD	One-way Mean Frame Delay as defined in Section 8.8.3 of MEF 10.4 [6]	This document
Port-based Service	Any service with EVC EP Map Service Attribute value equal to *All* for each EVC EP in the EVC	This document
Subscriber Ethernet Service Type	A classification of services based on the value of EVC Type Service Attribute.	This document
VLAN-based Service	Any service with the EVC EP Map value equal to *UT/PT* or *List* for each EVC EP in the EVC	This document
VLAN	Virtual LAN	IEEE Std 802.1Q™-2018 [1]

Table 1: Terminology and Abbreviations

This document uses the same shortened terms as used in MEF 10.4, specifically Subscriber = Ethernet Subscriber, Service Provider = Ethernet Service Provider, UNI = Ethernet User Network Interface.

4 Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 (RFC 2119 [2], RFC 8174 [3]) 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**.**

A paragraph preceded by **[CRa]<** specifies a conditional mandatory requirement that **MUST** be followed if the condition(s) following the "<" have been met. For example, "**[CR1]<**[D38]" indicates that Conditional Mandatory Requirement 1 must be followed if Desirable Requirement 38 has been met. A paragraph preceded by **[CDb]<** specifies a Conditional Desirable Requirement that **SHOULD** be followed if the condition(s) following the "<" have been met. A paragraph preceded by **[COc]<** specifies a Conditional Optional Requirement that **MAY** be followed if the condition(s) following the "<" have been met.

5 Numerical Prefix Conventions

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

This document uses the Service Attribute values that are defined in MEF 10.4 “Subscriber Ethernet Services Attributes” [6] and applies them to define different Subscriber Ethernet Services.

The services defined in this document are based on the Service Attributes in MEF 10.4 [6] and therefore are somewhat different than the services defined in MEF 6.2 [4] which are based on the Service Attributes in MEF 10.3 [5]. For example, Ethernet Virtual Private Line (EVPL), as specified in this document, includes the Subscriber UNI Instantiation Service Attribute with values of *Physical* or *Virtual*, while a MEF 6.2 [4] EVPL service does not have such a Service Attribute. See Appendix B for information on the similarities and differences between MEF 6.3 Services and MEF 6.2 Services. See also Appendix C for key changes from MEF 6.2 [4].

As indicated in MEF 10.4 [6], the Subscriber Ethernet Services are modeled from the perspective of a Subscriber and the service is defined in terms of what is seen by the Subscriber Network (SN). Ethernet Services are used to provide connectivity between different parts of a Subscriber Network. A UNI, per MEF 10.4 [6], is used to interconnect the Subscriber Network (SN) to the Service Provider Network (SP Network) and instantiate services specified in this document. An Ethernet Service consists of the EVC and the corresponding EVC End Points, each located at a UNI, that are defined using the Service Attribute values agreed to between the SP and the Subscriber.

Within the context of a given EVC for the Ethernet Service, the Subscriber sees a single SP Network, and a single Service Provider. For example, an Ethernet Virtual Private LAN (EVP-LAN) service appears to the Subscriber as shown in Figure 1. This document takes the Subscriber’s point of view and therefore all requirements in this document are on the SP for a given service.

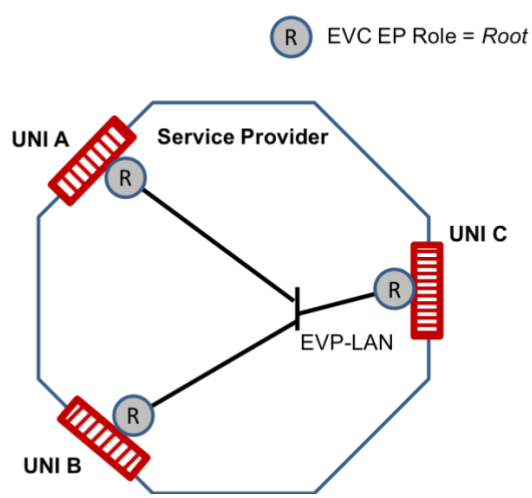

Figure 1: Subscriber’s View of EVP-LAN Service

This document defines Subscriber Ethernet Service Types and specifies constraints on the associated Service Attribute values for Point-to-Point, Multipoint-to-Multipoint, and Rooted-Multipoint Ethernet Services. A Subscriber Ethernet Service Type is a classification of services based on the value of the EVC Type Service Attribute.

This document also defines the requirements for several Ethernet Services that fall under each Subscriber Ethernet Service Type. These services are agnostic of the underlying network infrastructure within the Service Provider Network (SP Network) and might be supported over any combination of network technologies in SP Network.

6.1 "Support" in Normative Language

When the term "support" is used in a normative context in this document and the normative language applies to the Service Provider, it means that the Service Provider must/should/may be capable of meeting the requirement upon agreement between the Subscriber and Service Provider.

7 Subscriber Ethernet Service Type Framework

Using the set of Service Attributes from MEF 10.4 [6], this document defines three Subscriber Ethernet Service Type constructs, namely,

- Ethernet Line (E-Line) Service Type (refer to Section 8.1),
- Ethernet LAN (E-LAN) Service Type (refer to Section 8.2), and
- Ethernet Tree (E-Tree) Service Type (refer to Section 8.3).

The key differentiator between the Service Types is the value of the EVC Type Service Attribute (MEF 10.4 [6]) which determines the type of connectivity provided to the Subscriber. The Subscriber UNI, EVC EP and EVC Service Attribute values are normatively defined in MEF 10.4 [6]. In addition, the Service Attributes and requirements for handling of Layer 2 Control Protocols are covered in MEF 45.1 [11].

More than one Ethernet Service is defined for each of the three Subscriber Ethernet Service Types. These are differentiated by the method for service identification used at the UNIs. A Port-based Service is defined as a service with the EVC EP Map Service Attribute value equal to *All* for each EVC EP in the EVC. In Port-based Service, the C-Tag VLAN ID is not used in the mapping of Service Frames to the EVC EP. A VLAN-based Service is defined as a service with the EVC EP Map Service Attribute value equal to *UT/PT* or *List* for each EVC EP in the EVC. In 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 EP.

A VLAN Tagged UNI allows for multiple services to exist at that UNI with each service based on the *List* in the EVC EP Map value for that service. With an Untagged UNI or an All to One Bundled UNI, only one service exists at that UNI. See also Table 18 of MEF 10.4 [6] for allowed combinations of EVC EP Maps.

The services can be specified with multiple CoS Names and/or Envelopes at a UNI. In addition, the services can include multiple Bandwidth Profile Flows based on CoS Name within each Envelope when Token Share Service Attribute value is set to *Enabled*.

The relationship between Service Types and Port or VLAN based Services is shown in Table 3 below.

Service Type	Port-Based (EVC EP Maps = *All*) (All to One Bundled UNIs)	VLAN-Based (EP Maps = *UT/PT* or *List*) (Untagged or VLAN Tagged UNIs)
E-Line (Point-to-Point EVC)	Ethernet Private Line (EPL)	Ethernet Virtual Private Line (EVPL)
E-LAN (Multipoint-to-Multipoint EVC)	Ethernet Private LAN (EP-LAN)	Ethernet Virtual Private LAN (EVP-LAN)
E-Tree (Rooted-Multipoint EVC)	Ethernet Private Tree (EP-Tree)	Ethernet Virtual Private Tree (EVP-Tree)

Table 3: Ethernet Services

7.1 Common Constraints on Service Attribute Values

The Service Attribute values common to all services shown in Table 3 are grouped into separate tables for EVC (Section 7.2), Subscriber UNI (Section 7.3), and EVC EP (Section 7.4). The additional constraints, if any, with respect to definitions in MEF 10.4 [6] and MEF 45.1 [11] are specified. When a Service Attribute can take on any value as specified in MEF 10.4 [6] or MEF 45.1 [11] then this is indicated with 'No additional constraints".

[R1] The mandatory requirements in MEF 10.4 [6] and MEF 45.1 [11] **MUST** be met.

In addition, this document mandates and recommends constraints on Service Attribute values beyond those mandated and recommended in MEF 10.4 [6] and MEF 45.1 [11] for the services shown in Table 3.

Subsets of the Service Attributes from the common tables (EVC, Subscriber UNI, and EVC EP) can have different values for each service of a given Service Type. This is indicated in the common tables with 'See service specific Tables'. These subsets of attributes are described in Section 9 for the services shown in Table 3. The relationship of the tables (common versus service specific) is shown in Figure 2. As example, (EVP-Tree:22) refers to Table 22 for an EVP-Tree service.

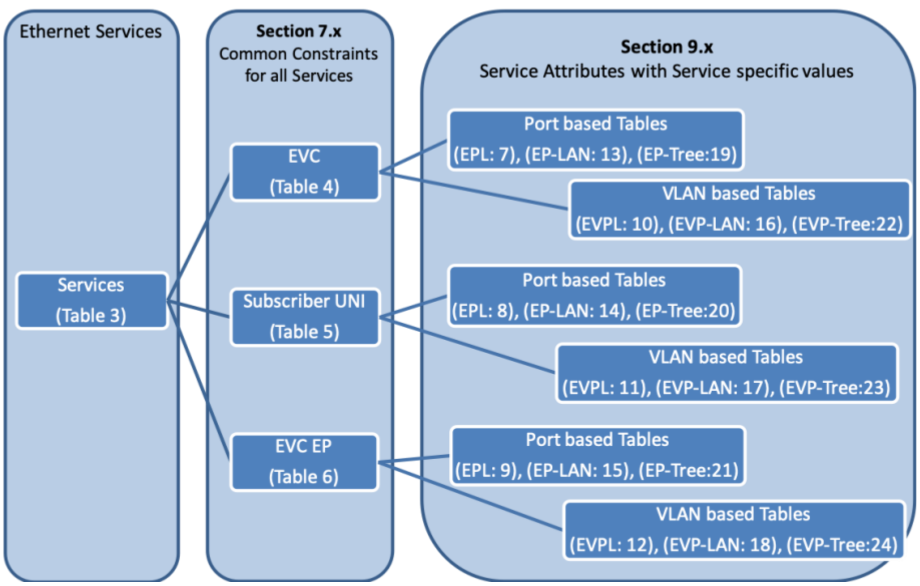

Figure 2: Structure of Service Attribute Tables

To get a complete picture of a given service, the tables in Section 7.2, 7.3, and 7.4 need to be combined with the the additional requirements in the corresponding tables for the service in Section 9. As an example, for EPL, the attributes listed in Section 9.1 have requirements that apply in addition to those in Section 7.2, 7.3, and 7.4. For a given service, the attributes are specified for EVC, each Subscriber UNI, and each EVC EP.

The Service Types are discussed in Section 8.

7.2 EVC Service Attributes

Table 4 below specifies constraints for each of the EVC Service Attribute values as defined in MEF 10.4 [6]. These constraints are common for all Subscriber Ethernet Service Types. The first column of this table identifies the EVC Service Attributes, as defined in MEF 10.4 [6]. The entries in the second column describe the possible values and third column specifies the requirements for the EVC.

When a Service Attribute can take on any value as specified in MEF 10.4 [6] then this is indicated with 'No additional constraints".

EVC Service Attribute	Values and Description	Requirement
EVC ID	A string as specified in Section 8.1 of MEF 10.4 [6]	No additional constraints
EVC List of EVC EPs	A list of EVC EP ID values as specified in Section 8.2 of MEF 10.4 [6]	See service specific Tables
EVC Type	***Point-to-Point*** or ***Multipoint-to-Multipoint*** or ***Rooted-Multipoint*** as specified in Section 8.3 of MEF 10.4 [6]	See service specific Tables
EVC Data Service Frame Disposition	A 3-tuple of the form **<*u, m, b*>** where each element is ***Discard*** or ***Deliver Unconditionally*** or ***Deliver Conditionally*** as specified in Section 8.4 of MEF 10.4 [6]	See service specific Tables
EVC C-Tag PCP Preservation	***Enabled*** or ***Disabled*** as specified in Section 8.5 of MEF 10.4 [6]	See service specific Tables
EVC C-Tag DEI Preservation	***Enabled*** or ***Disabled*** as specified in Section 8.6 of MEF 10.4 [6]	See service specific Tables
EVC List of Class of Service Names	A non-empty list of Class of Service Names as specified in Section 8.7 of MEF 10.4 [6]	**[D1]** For the services defined in this Standard, the Service Provider **SHOULD** support a value of the EVC List of Class of Service Names Service Attribute that contains at least 1 CoS Label defined in MEF 23.2 [8]. Note that MEF 23.2 has requirements related to CoS Labels.
EVC Service Level Specification	***None*** or 3-tuple **<*ts, T, CN*>** as specified in Section 8.8 of MEF 10.4 [6]	**[D2]** For the services defined in this Standard, the Service

EVC Service Attribute	Values and Description	Requirement
		Provider **SHOULD** support a value of the EVC Service Level Specification Service Attribute that is not ***None***. The EVC SLS for a CoS Label can include Performance Metrics for which MEF 23.2 [8] does not specify Performance Objectives. See service specific Tables
EVC Group Membership	***None*** or a non-empty list of 3-tuples of the form **<*ID, CoS_Name_G, SG*>** as specified in Section 8.9 of MEF 10.4 [6]	No additional constraints
EVC Maximum Service Frame Size	Integer at least 1522 as specified in Section 8.10 of MEF 10.4 [6] See also UNI Maximum Service Frame Size attribute in Table 5	**[D3]** For the services defined in this Standard, the value of the EVC Maximum Service Frame Size Service Attribute **SHOULD** be ≥ 2000 Bytes.
EVC Available MEG Level	***None*** or *integer* from ***0-7*** as specified in Section 8.11 of MEF 10.4 [6].	**[R2]** For the services defined in this Standard, the value of the EVC Available MEG Level Service Attribute **MUST** be an integer ≤ 6. [R2] means that the SP needs to reserve at least MEG levels 6 and 7 for use by the Subscriber. Note that if value of the EVC EP Subscriber MEG MIP Service Attribute is an integer in the range *0-7*, then the SP would have a MIP at the value of the EVC Available MEG Level Service Attribute or higher.

Table 4: EVC Service Attributes and Values for all Service Types

7.3 Subscriber UNI Service Attributes

Table 5 below specifies the constraints that apply to each of the Subscriber UNI Service Attributes defined in MEF 10.4 [6] and MEF 45.1 [11]. These constraints are common for all Subscriber Ethernet Service Types. The first column of this table identifies the Subscriber UNI Service Attributes, as defined in MEF 10.4 [6] or MEF 45.1 [11]. The entries in the second column describe the possible values and the third column includes any additional constraints. The requirements on the values of the Subscriber UNI Service Attributes apply regardless of the number of EVC EPs or the type of EVCs present on the UNI. These requirements allow for options for certain Subscriber UNI Service Attributes, e.g., Subscriber UNI List of Physical Links, Subscriber UNI Maximum Number of EVCs, and Subscriber UNI Layer 2 Control Protocol Peering. Note that such options might be different at each UNI in the EVC.

When a Service Attribute can take on any value as specified in MEF 10.4 [6] or MEF 45.1 [11] then this is indicated with 'No additional constraints'.

Subscriber UNI Service Attribute	Values and Description	Requirement
Subscriber UNI ID	A string as specified in Section 9.1 of MEF 10.4 [6]	No additional constraints
Subscriber UNI Instantiation	***Physical*** or ***Virtual*** as specified in Section 9.2 of MEF 10.4 [6]	No additional constraints
Subscriber UNI Virtual Frame Map	A map or ***Not Applicable*** as specified in Section 9.3 of MEF 10.4 [6]	No additional constraints
Subscriber UNI List of Physical Links	***Not Applicable*** or a non-empty list of 4-tuples of the form <***id, pl, fs, pt***> as specified in Section 9.4 of MEF 10.4 [6]	No additional constraints
Subscriber UNI Link Aggregation	***2-link Active/Standby, All Active, Other*** or ***Not Applicable*** as specified in Section 9.5 of MEF 10.4 [6] Additional requirements apply as per R13 of MEF 45.1 [11].	No additional constraints
Subscriber UNI Port Conversation ID to Aggregation Link Map	A map or ***Not Applicable*** as specified in Section 9.6 of MEF 10.4 [6]	No additional constraints
Subscriber UNI Service	***IEEE Std 802.3 – 2015*** as specified in Section 9.7 of MEF 10.4 [6]	No additional constraints

Subscriber UNI Service Attribute	Values and Description	Requirement
Frame Format		
Subscriber UNI Maximum Service Frame Size	Integer at least 1522 as specified in Section 9.8 of MEF 10.4 [6] Subscribers such as Mobile Operators might have a need to include additional encapsulation (MEF 22.3, [7]) in Service Frames sent across the UNI. Such use cases could benefit from a higher value of 2000 Bytes for the EVCs at the UNI. See also EVC Maximum Service Frame Size attribute in Table 4.	**[D4]** For the services defined in this Standard, the value of the Subscriber UNI Maximum Service Frame Size Service Attribute **SHOULD** be ≥ 2000 Bytes.
Subscriber UNI Maximum Number of EVC EPs	Integer ≥ 1 as specified in Section 9.9 of MEF 10.4 [6]	No additional constraints
Subscriber Maximum Number of C-Tag VLAN IDs per EVC EP	Integer ≥1 as specified in Section 9.10 of MEF 10.4 [6]	No additional constraints
Subscriber UNI Token Share	***Enabled*** or ***Disabled*** as specified in Section 9.11 of MEF 10.4 [6]	**[D5]** For the services defined in this Standard, the value of the Subscriber UNI Token Share Service Attribute **SHOULD** be ***Enabled***. [D5] allows for multiple BWP Flows from the same or different EVCs to be included in an Envelope.
Subscriber UNI Envelopes	***None*** or a non-empty list of ***<Envelope ID, CF^0 >*** pairs, as specified in Section 9.12 of MEF 10.4 [6]	No additional constraints

Subscriber UNI Service Attribute	Values and Description	Requirement
Subscriber UNI Link OAM	***Enabled*** or ***Disabled*** as specified in Section 9.13 of MEF 10.4 [6] Additional requirements apply as per R16 of MEF 45.1 [11].	No additional constraints
Subscriber UNI MEG	***Enabled*** or ***Disabled*** as specified in Section 9.14 of MEF 10.4 [6]	**[D6]** For the services defined in this Standard, the value of the Subscriber UNI MEG Service Attribute **SHOULD** be ***Enabled***.
Subscriber UNI LAG Link MEG	***Enabled*** or ***Disabled*** as specified in Section 9.15 of MEF 10.4 [6]	No additional constraints
Subscriber UNI L2CP Address Set	***CTB*** or ***CTB-2*** or ***CTA*** as specified in MEF 45.1 [11]	No additional constraints (from MEF 10.4 [6], MEF 45.1 [11]). See service specific Tables for informative text.
Subscriber UNI L2CP Peering	***None*** or list of ***{Destination Address, Protocol Identifier}*** or list of ***{Destination Address, Protocol Identifier, Link Identifier}*** to be Peered as specified in MEF 45.1 [11]	No additional constraints (from MEF 10.4 [6], MEF 45.1 [11])

Table 5: Subscriber UNI Service Attributes and Values for all Service Types

7.4 EVC EP Service Attributes

Table 6 below specifies the constraints that apply to each of the EVC EP Service Attribute values as defined in MEF 10.4 [6]. These constraints are common for all Subscriber Ethernet Service Types. The first column of this table identifies the Service Attributes, as defined in MEF 10.4 [6]. The entries in the second column decribe the possible values and the third column specifies the requirements for the EVC EP at the UNI. These requirements allow for options for certain attributes, e.g., Source MAC Address Limit, application of Ingress and Egress Bandwidth Profiles per Class of Service Name. Note that such options might be different at each EVC EP in the EVC.

When a Service Attribute can take on any value as specified in MEF 10.4 [6] then this is indicated with 'No additional constraints'.

EVC EP Service Attribute	Values and Description	Requirement
EVC EP ID	A string as specified in Section 10.1 of MEF 10.4 [6]	No additional constraints

EVC EP Service Attribute	Values and Description	Requirement
EVC EP UNI	Subscriber UNI ID as specified in Section 10.2 of MEF 10.4 [6]	No additional constraints
EVC EP Role	***Root*** or ***Leaf*** as specified in Section 10.3 of MEF 10.4 [6]	No additional constraints. See service specific Tables for informative text
EVC EP Map	***List, All,*** or ***UT/PT*** as specified in Section 10.4 of MEF 10.4 [6]	See service Specific Tables
EVC EP Ingress Class of Service Map	A 3-tuple of the form ***<F,M,P>*** as specified in Section 10.5 of MEF 10.4 [6] Where, - *F* is one of the values *EVC EP*, *C-Tag PCP*, or *DSCP*; - *M* is a map (whose form depends on *F*) that can be used to assign Class of Service Names to Service Frames, and - *P* is a map of Layer 2 Control Protocol types to Class of Service Names	**[D7]** For the services defined in this Standard, if the value of the EVC List of Class of Service Names Service Attribute has exactly one entry, the value of ***F*** in the EVC EP Ingress Class of Service Map Service Attribute **SHOULD** be ***EVC EP***. **[CR1]<[D1]** For the services defined in this Standard, if the value of ***F*** in the EVP EP Ingress Class of Service Map Service Attribute is ***C-Tag PCP*** or ***DSCP***, the value of ***M*** **MUST** be conformant with the mappings of PCP values or DSCP values (respectively) to CoS Labels specified in MEF 23.2 [8]. **[D8]** For the services defined in this Standard, the value of the EVC EP Ingress Class of Service Map Service Attribute **SHOULD** be such that all Ingress L2CP[1] Service Frames are mapped to the same CoS Name.

[1] See Section 7.6.1 of MEF 10.4 [6] and MEF 45.1 [11] for definition of L2CP Service Frame

EVC EP Service Attribute	Values and Description	Requirement
		[CD1]<[D8] For the services defined in this Standard, the value of the EVC EP Ingress Class of Service Map Service Attribute **SHOULD** be per [D8] of MEF 23.2 [8].
EVC EP Color Map	A pair of the form **<*F,M*>** as specified in Section 10.6 of MEF 10.4 [6] Where, - *F* is one of the values *EVC EP*, *C-Tag DEI*, *C-Tag PCP*, or *DSCP*; - *M* is a map (whose form depends on *F*) that can be used to assign Color to Service Frames,	**[CR2]<[D1]** For the services defined in this Standard, if the value of ***F*** in the EVP EP Color Map Service Attribute is ***C-Tag PCP*** or ***DSCP***, the value of ***M*** **MUST** be conformant with the mappings of PCP values or DSCP values (respectively) to Colors specified in MEF 23.2 [8]. **[D9]** For the services defined in this Standard, the value of the EVC EP Color Map Service Attribute **SHOULD** have F=C-Tag DEI.
EVC EP Egress Map	***None*** or a map as specified in Section 10.7 of MEF 10.4 [6]	No additional constraints
EVC EP Ingress Bandwidth Profile	***None*** or BWP Flow Parameters as specified in Section 10.8 of MEF 10.4 [6] This document uses the EVC EP Class of Service Name Ingress Bandwidth Profile.	**[R3]** For the services defined in this Standard, the value of the EVC EP Ingress Bandwidth Profile Service Attribute **MUST** be ***None***.

EVC EP Service Attribute	Values and Description	Requirement
EVC EP Class of Service Name Ingress Bandwidth Profile	***None*** or non-empty list of the form **<CoS Name, BWP Flow Parameters>** as defined in Section 10.9 of MEF 10.4 [6]	**[CD2]<[D8]** For the services defined in this Standard, the value of the EVC EP Class of Service Name Ingress Bandwidth Profile Service Attribute **SHOULD** be such that, for the CoS Name to which L2CP Frames are mapped, *CIRmax* > 0. **[D10]** For the services defined in this Standard that have >1 Bandwidth Profile Flows in a given Envelope, the value of the EVC EP Class of Service Name Ingress Bandwidth Profile Service Attribute **SHOULD** be conformant with one of the models specified in MEF 23.2.1 [9].
EVC EP Egress Bandwidth Profile	***None*** or the 3-tuple **<*CIR, CIRmax, ER*>** as specified in Section 10.10 of MEF 10.4 [6] This document uses the EVC EP Class of Service Name Egress Bandwidth Profile.	**[R4]** For the services defined in this Standard, the value of the EVC EP Egress Bandwidth Profile Service Attribute **MUST** be ***None***.
EVC EP Class of Service Name Egress Bandwidth Profile	***None*** or a non-empty list of the form **<CoS Name, CIR, CIRmax, ER>** as defined in Section 10.11 of MEF 10.4 [6]	See service specific Tables
EVC EP Source MAC Address Limit	***None*** or **<*N*, *τ*>** as specified in Section 10.12 of MEF 10.4 [6]	See service specific Tables
EVC EP Subscriber MEG MIP	***None*** or an integer in the range ***0-7*** as specified in Section 10.13 of MEF 10.4 [6]	**[D11]** For the services defined in this Standard, the Service Provider **SHOULD** support an integer as the value of the

EVC EP Service Attribute	Values and Description	Requirement
	When the value is not *None* for an EVC EP, the SP Network can process Loopback and/or Linktrace messages as per MEF 30.1 [10]	EVC EP Subscriber MEG MIP Service Attribute. See also R157 in MEF 10.4 [6]. See also Available MEG Level in Table 4 for values that can be used for Subscriber MEG Level(s).

Table 6: EVC EP Service Attributes and Values for all Service Types

8 Subscriber Ethernet Service Types

The following subsections define each of the three Subscriber Ethernet Service Types. Section 9 normatively defines the Ethernet Services.

8.1 Ethernet Line (E-Line) Service Type

Any Ethernet Service that has the EVC Type Service Attribute equal to *Point-to-Point* is classified as an Ethernet Line (E-Line) Service Type. E-Line Service Type is illustrated in Figure 3.

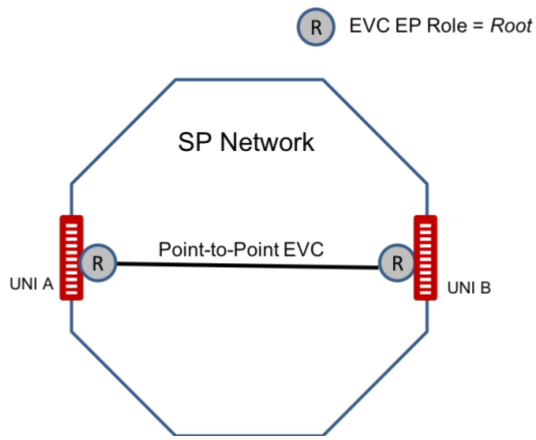

Figure 3: E-Line Service Type using Point-to-Point EVC

E-Line Service Type is the basis for a broad range of services based on a Point-to-Point EVC. In their simplest form, services of E-Line Service Type can provide symmetrical bandwidth for data with no performance assurances, e.g., best effort service between two 10Mb/s UNIs. In more sophisticated forms, services of E-Line Service Type can associate two UNIs with different line rates and can be defined with Performance Objectives such as FD, IFDV, FLR, and One-way Availability for a given Class of Service Name (CoS Name). Service Multiplexing might occur at one or both UNIs in the EVC. For example, more than one Point-to-Point EVC might be offered at one or both of the UNIs. One or more CoS Names might be associated with the service.

All Service Attributes and values can be found in Table 4, Table 5, and Table 6. However, some of the Service Attributes have values that are further constrained for the services of E-Line Service Type. See Section 9.1 for the EPL service and Section 9.2 for the EVPL service.

8.2 Ethernet LAN (E-LAN) Service Type

Any Ethernet Service that has the EVC Type Service Attribute equal to *Multipoint-to-Multipoint* is classified as an Ethernet LAN (E-LAN) Service Type.

E-LAN Service Type is illustrated in Figure 4 below.

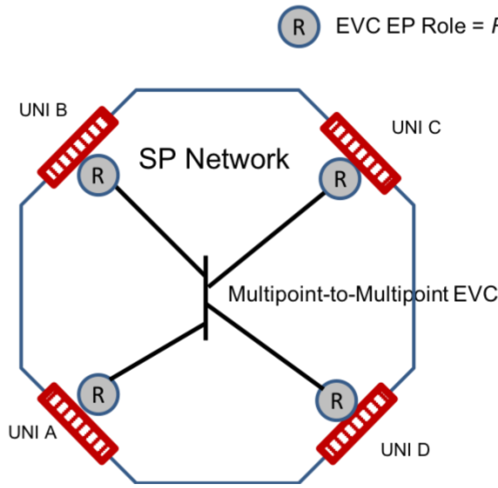

Figure 4: E-LAN Service Type using Multipoint-to-Multipoint EVC

E-LAN Service Type is the basis for a broad range of services. In their simplest form, services of E-LAN Service Type can provide a best effort service with no performance assurances between the UNIs. In more sophisticated forms, services of E-LAN Service Type might be defined with Performance Objectives such as FD, IFDV, FLR, and One-way Availability for a given CoS Name. One or more CoS Names might be associated with the service.

For E-LAN Service Type, Service Multiplexing might occur at none, one, or more than one of the UNIs in the EVC. For example, a service of E-LAN Service Type (Multipoint-to-Multipoint EVC) and a service of E-Line Service Type (Point-to-Point EVC) might be used with Service Multiplexing at the same UNI. In this example, the service of E-LAN Service Type might be used to interconnect other Subscriber sites while the service of E-Line Service Type is used to connect the Subscriber to a business partner such as a supplier for that Subscriber, with both services offered via Service Multiplexing at the same UNI.

All Service Attributes and values can be found in Table 4, Table 5, and Table 6. However, some of the Service Attributes have values that are further constrained for the services of E-LAN Service Type. See Section 9.3 for EP-LAN service and Section 9.4 for EVP-LAN service.

8.3 Ethernet Tree (E-Tree) Service Type

Any Ethernet Service that has the EVC Type Service Attribute equal to *Rooted-Multipoint* is classified as an Ethernet Tree (E-Tree) Service Type.

E-Tree Service Type with a single Root is illustrated in Figure 5.

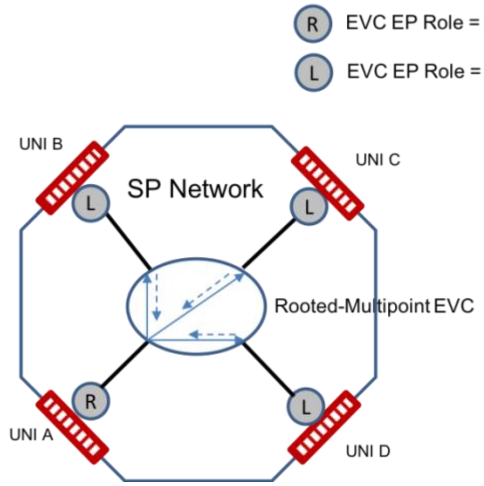

Figure 5: E-Tree Service Type using Rooted-Multipoint EVC

In their simplest form, services of E-Tree Service Type can provide a single Root EVC EP for multiple Leaf EVC EPs. Each Leaf EVC EP can exchange Data Service Frames (Unicast, Multicast, Broadcast) with only the Root EVC EP. A Service Frame sent from a UNI with Leaf EVC EP is not delivered to any other UNIs in the EVC that have Leaf EVC EPs. This service could be useful for Video over IP applications, such as multicast/broadcast packet video. One or more than one CoS Names might be associated with this service.

In more sophisticated forms, an E-Tree Service Type might support two or more Root EVC EPs. In this scenario, each Leaf EVC EP can exchange data only with the Root EVC EPs. As well, the Root EVC EPs can communicate with each other. In such a service, redundant access to Root EVC EPs can also be provided, effectively allowing for enhanced service reliability and flexibility. This service is depicted in Figure 6.

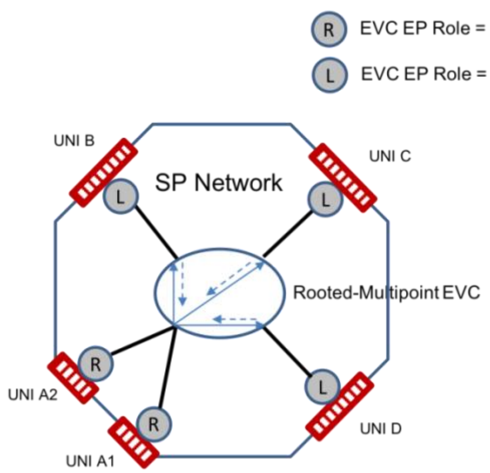

Figure 6: E-Tree Service Type using Multiple Roots

For services of E-Tree Service Type, Service Multiplexing might occur at none, one, or more than one of the UNIs in the EVC. For example, services of E-Tree Service Type and E-Line Service

Type might be used with Service Multiplexing at the same UNI. In this example, the service of aE-Tree Service Type can be used to support a specific application at the UNI, e.g., a Subscriber with access to redundant sites (multiple Roots), while the service of E-Line Service Type is used to connect to a supplier site with a Point-to-Point EVC.

All Service Attributes and values can be found in Table 4, Table 5, and Table 6. However, some of the Service Attributes have values that are further constrained for the services of E-Tree Service Type. See Section 9.5 for EP-Tree service and Section 9.6 for EVP-Tree Service.

9 Ethernet Service Definitions

An Ethernet Service is defined by specifying Service Attribute values for a given Subscriber Ethernet Service Type. This section defines the constraints to required Service Attribute values for the Ethernet Services specified in this document.

9.1 Ethernet Private Line Service

An Ethernet Private Line (EPL) service is a Port-based Service of E-Line Service Type that conforms to all the requirements described in this Section. EPL services are intended to be highly transparent, in the sense that Service Frames received at the ingress UNI are delivered at the egress UNI with as few modifications as possible. Some transparency requirements are specified in MEF 10.4 [6] including general Service Frame transparency (Section 7.7) and C-Tag VLAN ID preservation when the EVC EP Map Service Attribute has value of *All* (Sections 10.4.2 and 10.4.4). This document provides additional constraints that require Service Frames to have identical values for C-Tag PCP and C-Tag DEI at the ingress and egress UNIs.

Figure 3 in Section 8.1 shows the basic structure of an EPL service.

An EPL service does not allow Service Multiplexing, i.e., dedicated UNIs are used for the Service. Given the value per [R9] for the EVC EP Map Service Attribute for an EPL service, there is no need for coordination between the Subscriber and the Service Provider on the C-Tag VLAN ID values at each UNI because all the Service Frames are mapped to a single EVC EP at each UNI. Refer to Section 10.4 of MEF 10.4 [6] for more information on the EVC EP Map Service Attribute.

In addition to the requirements listed in Section 7, some of the Service Attributes are constrained with values specific to Ethernet Private Line.

Table 7 lists the EVC Service Attributes that have specific constraints for an EPL service.

EVC Service Attribute	Service Attribute values
EVC List of EPs	Given [R15] in Section 8.3.1 of MEF 10.4 [6], exactly two EVC EPs are allowed
EVC Type	**[R5]** For the EPL service, the value of the EVC Type Service Attribute **MUST** be ***Point-to-Point***.
EVC Data Service Frame Disposition	**[R6]** For the EPL service, the value of the EVC Type Service Attribute **MUST** be set to ***Deliver Unconditionally*** for each item in **<*u, m, b*>**.
EVC C-Tag PCP Preservation	**[R7]** For the EPL service, the value of the EVC C-Tag PCP Preservation Service Attribute **MUST** be ***Enabled***.
EVC C-Tag DEI Preservation	**[R8]** For the EPL service, the value of the EVC C-Tag DEI Preservation Service Attribute **MUST** be ***Enabled***.

EVC Service Attribute	Service Attribute values
EVC Service Level Specification	**[D12]** For the EPL service, for each objective specified in the EVC Service Level Specification Service Attribute for a Performance Metric that has a parameter *S*, the set *S* **SHOULD** include both ordered pairs of EVC End Points.

Table 7: EVC Service Attribute Values for the EPL Service

Table 8 lists the Subscriber UNI Service Attributes that have specific constraints for an EPL service.

Subscriber UNI Service Attribute	Service Attribute values
Subscriber UNI L2CP Address Set	Value of ***CTB*** or ***CTB-2*** per [R3] in MEF 45.1 [11]

Table 8: Subscriber UNI Service Attribute Values for the EPL Service

Table 9 lists the EVC EP Service Attributes that have specific constraints for an EPL service.

EVC EP Service Attribute	Service Attribute values
EVC EP Role	Given [R15] in Section 8.3.1 of MEF 10.4 [6], only the value of ***Root*** is allowed
EVC EP Map	**[R9]** For the EPL service, the value of the EVC EP Map Service Attribute **MUST** be ***All***.
EVC EP Egress Class of Service Name Bandwidth Profile	**[R10]** For the EPL service, the value of the EVC EP Egress Class of Service Name Bandwidth Profile Service Attribute **MUST** be ***None***[2].
EVC EP Source MAC Address Limit	**[R11]** For the EPL service, the value of the EVC EP Source MAC Address Limit Service Attribute **MUST** be ***None***.

Table 9: EVC EP Service Attribute Values for the EPL Service

[2] For EPL services, it is expected that an Ingress Bandwidth Profile will be applied at the ingress UNI such that traffic on the EVC is already controlled; therefore, there is no need to apply an EVC EP Egress Class of Service name Bandwidth Profile at the egress UNI.

9.2 Ethernet Virtual Private Line Service

An Ethernet Virtual Private Line (EVPL) service is a VLAN-based Service of E-Line Service Type that conforms to all the requirements described in this Section. An EVPL can be used to create services similar to the Ethernet Private Line (EPL) with some notable exceptions. An EVPL maps Service Frames at a UNI to an EVC EP based on the EVC EP Map Service Attribute value, i.e., either *list* or *UT/PT*. An additional difference compared to an EPL is that an EVPL will always filter some additional L2CP Service Frames with certain destination address as specified in MEF 45.1 [11].

It is not required to support more than one Ethernet Service at the UNI. With a UNI capable of Service Multiplexing, more than one Ethernet Service can be supported at the UNI whereas EPL does not allow this. EVPL is commonly used for connecting Subscriber hub and branch locations as illustrated in Appendix A.1.1 of MEF 10.4 [6].

When there is an instance of EVPL service at a UNI and there are instances of other EVCs at this UNI, the value of the EVC Type Service Attribute for the other EVCs can be *Point-to-Point* (see Figure 7), *Rooted-Multipoint* or *Multipoint-to-Multipoint* (see Figure 9). Figure 7 shows a typical use case of connecting to a hub enterprise location at UNI A with $EVPL_x$ from branch enterprise location at UNI B and with $EVPL_y$ from branch enterprise location at UNI C.

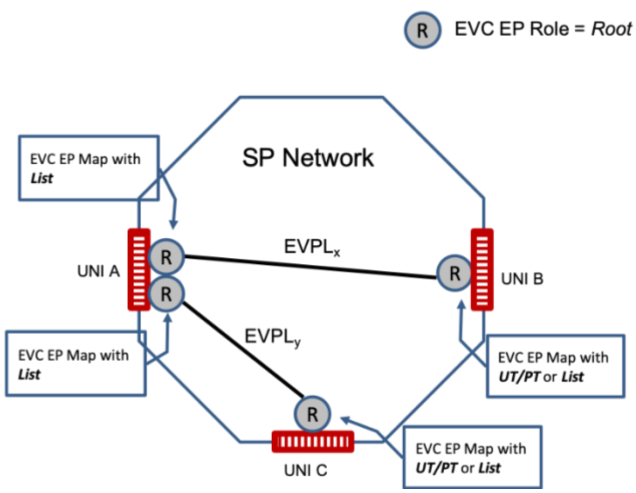

Figure 7: Typical Use Case of Multiple EVPL Services

Figure 8 shows the basic structure of EVPL service where there is a single instance of EVPL at each UNI.

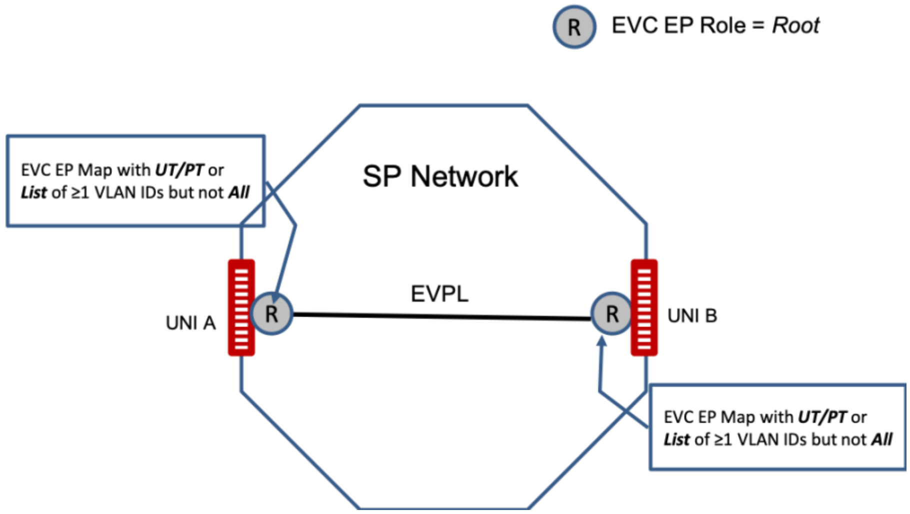

Figure 8: Ethernet Virtual Private Line Service

In addition to the requirements listed in Section 7, some of the Service Attributes are constrained with values specific to Ethernet Virtual Private Line. When a Service Attribute can take on any value as specified in MEF 10.4 [6] then this is indicated with 'No additional constraints'.

Table 10 lists the EVC Service Attributes that have specific constraints for an EVPL service.

EVC Service Attribute	Service Attribute values
EVC List of EVC EPs	Given [R15] in Section 8.3.1 of MEF 10.4 [6], exactly two EVC EPs are allowed
EVC Type	**[R12]** For the EVPL service, the value of the EVC Type Service Attribute **MUST** be ***Point-to-Point***.
EVC Data Service Frame Disposition	**[D13]** For the EVPL service, the value of the EVC Data Service Frame Disposition Service Attribute **SHOULD** be set to ***Deliver Unconditionally*** for each item in **3-tuple <*u, m, b*>**.
EVC C-Tag PCP Preservation	No additional constraints
EVC C-Tag DEI Preservation	No additional constraints
EVC Service Level Specification	**[D14]** For the EVPL service, for each objective specified in the EVC Service Level Specification Service Attribute for a Performance Metric that has a parameter *S*, the set *S* **SHOULD** include both ordered pairs of EVC End Points.

Table 10: EVC Service Attribute Values for the EVPL Service

Table 11 lists the Subscriber UNI Service Attributes that have specific constraints for an EVPL service.

Subscriber UNI Service Attribute	Service Attribute values
Subscriber UNI L2CP Address Set	Value of ***CTA*** as per [R1] specified in MEF 45.1 [11]

Table 11: Subscriber UNI Service Attribute Values for EVPL Service

Table 12 lists the EVC EP Service Attributes that have specific constraints for an EVPL service.

EVC EP Service Attribute	Service Attribute values
EVC EP Role	Given [R15] in Section 8.3.1 of MEF 10.4 [6], only the value of ***Root*** is allowed
EVC EP Map	**[R13]** For the EVPL service, the value of the EVC EP Map Service Attribute **MUST** be ***UT/PT*** or ***List***.
EVC EP Egress Class of Service Name Bandwidth Profile	No additional constraints When there is more than one EVC EP at the UNI, use of an Egress Bandwidth Profile may be helpful to the Subscriber (e.g., avoid buffer overflow in Subscriber's equipment).
EVC EP Source MAC Address Limit	**[CR3]< [D13]** For the EVPL service, the value of the EVC EP Source MAC Address Limit Service Attribute **MUST** be ***None***.

Table 12: EVC EP Service Attribute Values for EVPL Service

9.3 Ethernet Private LAN Service

An Ethernet Private LAN (EP-LAN) service is a Port-based Service of E-LAN Service Type that conforms to all the requirements described in this Section. An EP-LAN service enables Subscribers with multiple sites to interconnect them so that all sites appear to be on the same Local Area Network (LAN) and have the same performance and access to resources such as servers and storage. An EP-LAN service is a highly transparent service that connects multiple UNIs.

Since an EP-LAN service has an EVP EP Map Service Attribute value of *All* at each EVC EP (i.e., all the UNIs are All to one Bundled UNIs), C-Tag VLAN ID values are preserved as Service Frames flow across the EVC (per [R118] of MEF 10.4 [6]). A key advantage of this approach is that the Subscriber can configure C-Tag VLAN IDs across the sites without any need to coordinate with the Service Provider. In addition, EP-LAN services have C-Tag PCP and C-Tag DEI preservation enabled.

Figure 4 shows the Multipoint-to-Multipoint EVC Type used for an EP-LAN service. Each UNI associated by the EVC has exactly one EVC EP.

In addition to the requirements listed in Section 7, some of the Service Attributes are constrained with values specific to EP-LAN. When a Service Attribute can take on any value as specified in MEF 10.4 [6] then this is indicated with ‘No additional constraints’.

Table **13** lists the EVC Service Attributes that have specific constraints for an EP-LAN service.

EVC Service Attribute	Service Attribute values
EVC List of EVC EPs	No additional constraints
EVC Type	**[R14]** For the EP-LAN service, the value of the EVC Type Service Attribute **MUST** be ***Multipoint-to-Multipoint***.
EVC Data Service Frame Disposition	**[D15]** For the EP-LAN service, the value of the EVC Data Service Frame Disposition Service Attribute **SHOULD** be ***Deliver Conditionally*** for ***u*** in 3-tuple <***u,m,b***> with the condition that the delivery of Unicast Service Frames is subject to the dynamic learning and filtering process as described in IEEE Std 802.1Q-2018 [1] for Independent and Shared VLAN learning bridges. [D15] does not preclude other conditions to be applied. **[D16]** For the EP-LAN service, the value of the EVC Data Service Frame Disposition Service Attribute **SHOULD** be ***Deliver Unconditionally*** for ***b*** in the 3-tuple <***u,m, b***>. No additional constraints for ***m*** in <***u,m,b***> [3]
EVC C-Tag PCP Preservation	**[R15]** For the EP-LAN service, the value of the EVC C-Tag PCP Preservation Service Attribute **MUST** be ***Enabled***.
EVC C-Tag DEI Preservation	**[R16]** For the EP-LAN service, the value of the EVC C-Tag DEI Preservation Service Attribute **MUST** be ***Enabled***.
EVC Service Level Specification	No additional constraints

Table 13**: EVC Service Attribute Values for the EP-LAN Service**

Table 14 lists the Subscriber UNI Service Attributes that have specific constraints for an EP-LAN service.

[3] For a Multipoint EVC, an ingress frame at a given UNI with a multicast MAC DA, or the broadcast MAC DA, would be forwarded to all egress UNIs in the EVC. This behavior supports the expectation of basic deployments. Conditional delivery might be used in some cases; such conditions might include multicast pruning on egress or ingress rate limiting of multicast and broadcast frames.

Subscriber UNI Service Attribute	Service Attribute values
Subscriber UNI L2CP Address Set	Value of ***CTB*** per [R2] in MEF 45.1 [11]

Table 14: Subscriber UNI Service Attribute Values for the EP-LAN Service

Table 15 lists the EVC EP Service Attributes that have specific constraints for an EP-LAN service.

EVC EP Service Attribute	Service Attribute values
EVC EP Role	Given [R16] in Section 8.3.2 of MEF 10.4 [6], only the value of ***Root*** is allowed
EVC EP Map	**[R17]** For the EP-LAN service, the value of the EVC EP Map Service Attribute **MUST** be ***All***.
EVC EP Class of Service Name Egress Bandwidth Profile	No additional constraints
EVC Source MAC Address Limit	No additional constraints

Table 15: EVC EP Service Attribute Values for the EP-LAN Service

9.4 Ethernet Virtual Private LAN Service

An Ethernet Virtual Private LAN (EVP-LAN) service is a VLAN-based Service of E-LAN Service Type that conforms to all the requirements described in this Section. Some Subscribers desire a service of E-LAN Service Type to connect their UNIs in a network, while at the same time accessing other services from one or more of those UNIs. An example of such a UNI is a Subscriber site that wants to access a public or private IP service from a UNI that is also used for a service of E-LAN Service Type among the Subscriber's several locations. Ethernet Virtual Private LAN (EVP-LAN) service is specified in this subsection to address this need.

For an EVP-LAN service, the EVC EP Map Service Attribute with a value of *List* can be used at the UNIs in the Multipoint-to-Multipoint EVC. Figure 9 below shows the basic structure of EVP-LAN service. In this example, the Subscriber uses an EVP-LAN service (solid black line for the EVC), associating UNIs A, B, C and D, for providing multipoint connectivity, and an EVPL service (dashed red line for the EVC), associating UNI B and UNI E, for accessing other service from UNI E. UNI B is a VLAN Tagged UNI that supports more than one EVC EP. UNIs A, C and D can be VLAN Tagged UNIs or Untagged UNIs. See also Table 18 in section 10.4.4 of MEF 10.4 [6] for allowed mixing of EVC EP Map Service Attribute values. The EVC Types for other EVCs, at such a UNI, can be *Point-to-Point*, *Rooted-Multipoint* or *Multipoint-to-Multipoint*.

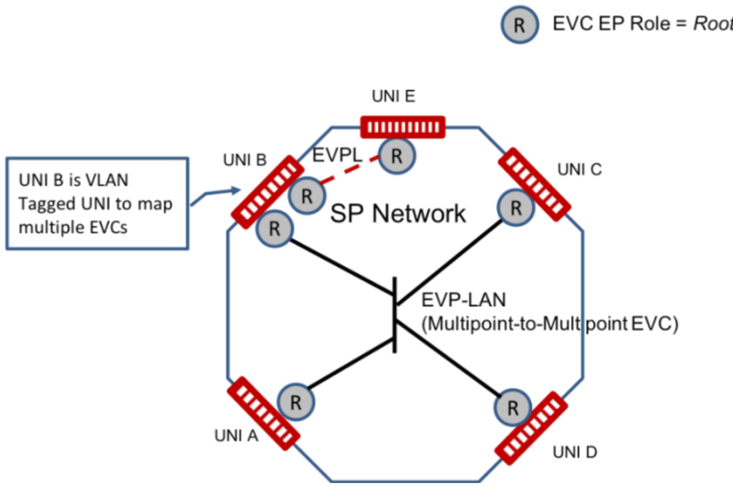

Figure 9: Ethernet Virtual Private LAN (EVP-LAN) Service

In addition to the requirements listed in Section 7, some of the Service Attributes are constrained with values specific to EVP-LAN. When a Service Attribute can take on any value as specified in MEF 10.4 [6] then this is indicated with ‘No additional constraints’.

Table 16 lists the EVC Service Attributes that have specific constraints for an EVP-LAN service.

EVC Service Attribute	Service Attribute values
EVC List of EVC EPs	No additional constraints.
EVC Type	**[R18]** For the EVP-LAN service, the value of the EVC Type Service Attribute **MUST** be ***Multipoint-to-Multipoint***.
EVC Data Service Frame Disposition	**[D17]** For the EVP-LAN service, the value of the EVC Data Service Frame Disposition Service Attribute **SHOULD** be ***Deliver Conditionally*** for ***u*** in 3-tuple <***u,m,b***> with the condition that the delivery of Unicast Service Frames is subject to the dynamic learning and filtering process as described in IEEE Std 802.1Q-2018 [1] for Independent and Shared VLAN learning bridges. [D17] does not preclude other conditions to be applied. **[D18]** For the EVP-LAN service, the value of the EVC Data Service Frame Disposition Service Attribute **SHOULD** be ***Deliver Unconditionally*** for ***b*** in the 3 tuple <***u,b,m***>. No additional constraints for ***m*** in <***u,m,b***>
EVC C-Tag PCP Preservation	No additional constraints
EVC C-Tag DEI Preservation	No additional constraints

EVC Service Attribute	Service Attribute values
EVC Service Level Specification	No additional constraints

Table 16: EVC Service Attribute Values for the EVP-LAN Service

Table 17 lists the Subscriber UNI Service Attributes that have specific constraints for an EVP-LAN service.

Subscriber UNI Service Attribute	Service Attribute values
Subscriber UNI L2CP Address Set	Value of ***CTA*** per [R1] in MEF 45.1 [11]

Table 17: Subscriber UNI Service Attribute Values for the EVP-LAN Service

Table 18 lists the EVC Service Attributes that have specific constraints for an EVP-LAN service.

EVC EP Service Attribute	Service Attribute values
EVC EP Role	Given [R16] in Section 8.3.2 of MEF 10.4 [6], only the value of ***Root*** is allowed
EVC EP Map	**[R19]** For the EVP-LAN service, the value of the EVC EP Map Service Attribute **MUST** be ***UT/PT*** or ***List***.
EVC EP Egress Class of Service Name Bandwidth Profile	No additional constraints
EVC EP Source MAC Address Limit	No additional constraints

Table 18: EVC EP Service Attribute values for the EVP-LAN Service

9.5 Ethernet Private Tree Service

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

The EP-Tree service is specified to provide preservation of the C-Tag VLAN ID and to not filter some Layer 2 Control Protocols. A key advantage of this approach is that the Subscriber can configure VLANs across the sites without any need to coordinate with the Service Provider. Each UNI is an All to One Bundled UNI. In addition, EP-Tree supports C-Tag PCP and C-Tag DEI preservation.

Figure 5 shows the Rooted-Multipoint EVC Type used for an EP-Tree service. Each UNI associated by the EVC has one EVC EP.

In addition to the requirements listed in Section 7, some of the Service Attributes are constrained with values specific to Ethernet Private Tree. When a Service Attribute can take on any value as specified in MEF 10.4 [6] then this is indicated with 'No additional constraints'.

Table 19 lists the EVC Service Attributes that have specific constraints for an EP-Tree service.

EVC Service Attribute	Service Attribute values
EVC List of EVC EPs	**[R20]** For the EP-Tree service, the Service Provider **MUST** support a value of the EVC List of EVC EPs Service Attribute that contains ***at least 2*** Leaf EVC EPs. [R19] of MEF 10.4 [6] has support for at least 1 Leaf EVC EP. [R20] strengthens this by requiring support for at least two Leaf EVC EPs. Note that the Subscriber, with the agreement of the SP, could start with two Root EVC EPs and zero Leaf EVC EPs in the service and subsequently add Leaf EVC EPs to this service.
EVC Type	**[R21]** For the EP-Tree service, the value of the EVC Type Service Attribute **MUST** be ***Rooted-Multipoint***.
EVC Data Service Frame Delivery	**[D19]** For the EP-Tree service, the value of the EVC Data Service Frame Delivery Service Attribute **SHOULD** be ***Deliver Conditionally*** [4] for ***u*** in the 3-tuple <***u,m,b***> with the condition that the delivery of Unicast Service Frames is subject to the dynamic learning and filtering process as described in IEEE Std 802.1Q-2011 [1] for Independent and Shared VLAN learning bridges. [D19] does not preclude other conditions to be applied. **[D20]** For the EP-Tree service, the value of the EVC Data Service Frame Delivery Service Attribute **SHOULD** be ***Deliver Unconditionally*** for ***b*** in 3-tuple <***u,b,m***>. No additional constraints for ***m*** in <***u,m,b***> from Table 4 of Section 7.2[5]

[4] For a Rooted Multipoint EVC, forwarding constraints involving roots and leaves, as specified in MEF 10.4 [6], apply to all frame types – unicast, multicast and broadcast.

[5] For a Rooted Multipoint EVC, an ingress frame at a given UNI with a multicast MAC DA, or the broadcast MAC DA, would be forwarded to all egress UNIs in the EVC with the constraints imposed related to Roots and Leaves for Deliver Unconditionally per Section 8.4 of MEF 10.4 [6]. This behavior supports the expectation of basic deployments. Conditional delivery can be used in some cases; such conditions can include multicast pruning on egress or ingress rate limiting of multicast and broadcast frames, or other conditions

EVC Service Attribute	Service Attribute values
EVC C-Tag PCP Preservation	**[R22]** For the EP-Tree service, the value of the EVC C-Tag PCP Preservation Service Attribute **MUST** be ***Enabled***.
EVC C-Tag DEI Preservation	**[R23]** For the EP-Tree service, the value of the EVC C-Tag DEI Preservation Service Attribute **MUST** be ***Enabled***.
EVC Service Level Specification	No additional constraints

Table 19: EVC Service Attribute Values for the EP-Tree Service

Table 20 lists the Subscriber UNI Service Attributes that have specific constraints for an EP-Tree service.

Subscriber UNI Service Attribute	Service Attribute values
Subscriber UNI L2CP Address Set	Value of ***CTB*** per [R2] in MEF 45.1 [11]

Table 20: Subscriber UNI Service Attribute Values for the EP-Tree Service

Table 21 lists the EVC EP Service Attributes that have specific constraints for an EP-Tree service.

EVC EP Service Attribute	Service Attribute values
EVC EP Role	No additional constraints
EVC EP Map	**[R24]** For the EP-Tree service, the value of the EVC EP Map Service Attribute **MUST** be ***All***.
EVC EP Egress Class of Service Name Bandwidth Profile	No additional constraints
EVC EP Source MAC Address Limit	No additional constraints

Table 21: EVC EP Service Attribute Values for the EP-Tree Service

9.6 Ethernet Virtual Private Tree Service

An Ethernet Virtual Private Tree (EVP-Tree) Service is defined as a VLAN-based Service of E-Tree Service Type that conforms to all the requirements described in this Section. Some Subscribers desire access to certain applications or content services from well-defined access points within their own (or an external) network. In this case it is necessary to interconnect the participating UNIs in a Rooted-Multipoint connection to the well-defined access (or root) points. For such cases, the EVP-Tree Service can be used. Some of the UNIs can be VLAN Tagged UNIs and support other services, e.g., EVPL or EVP-LAN. The EVC Types for other EVCs, at such a UNI, can be *Point-to-Point, Multipoint-to-Multipoint* or *Rooted-Multipoint*.

An EVC EP for an EVP-Tree service can have an EVC EP Map of *List* , i.e., the EVC EP can be at a VLAN-Tagged UNI. Figure 10 shows the basic structure of EVP-Tree Service. In this example, a Subscriber has EVP-LAN service (dashed red line for the EVC) providing data connectivity among three UNIs (A, B, D), while using EVP-Tree Service (solid black line for the EVC) for providing video broadcast from a video hub location at UNI A to UNIs B, C and D. EVC EPs at UNIs B and D have different EVC EP Roles dependng on EVC Type.

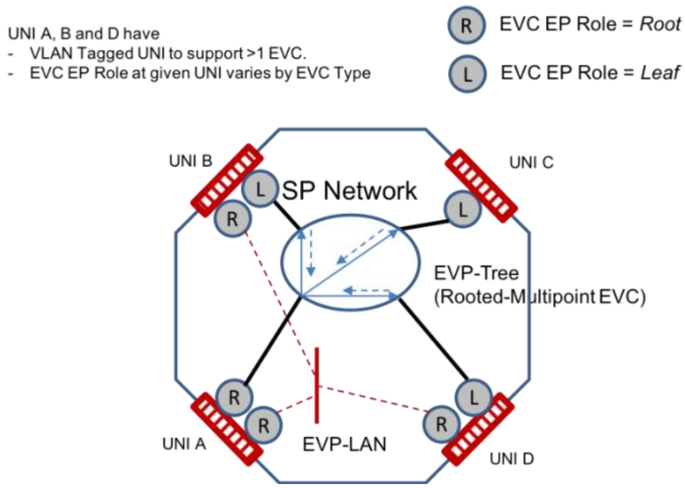

Figure 10: Ethernet Virtual Private Tree (EVP-Tree) Service

In addition to the requirements listed in Section 7, some of the Service Attributes are constrained with values specific to Ethernet Virtual Private Tree. When a Service Attribute can take on any value as specified in MEF 10.4 [6] then this is indicated with 'No additional constraints'.

Table 22 lists the EVC Service Attributes that have specific constraints for an EVP-Tree Service.

EVC Service Attribute	Service Attribute values
EVC List of EVC EPs	**[R25]** For the EVP-Tree Service, the Service Provider **MUST** support a value of the EVC List of EVC EPs Service Attribute that contains **at least *2*** EVC EPs with Role of ***Leaf***. [R19] of MEF 10.4 [6] has support for at least one Leaf EVC EP. [R25] strengthens this by requiring support for at least two Leaf EVC EPs. Note that the Subscriber, with the agreement of the SP, could start with two Root EVC EPs and zero Leaf EVC EPs in the service and subsequently add Leaf EVC EPs to this service.
EVC Type	**[R26]** For the EVP-Tree Service, the value of the EVC Type Service Attribute **MUST** be ***Rooted-Multipoint***.

EVC Service Attribute	Service Attribute values
EVC Data Service Frame Disposition	**[D21]** For the EVP-Tree Service, the value of the EVC Data Service Frame Disposition Service Attribute **SHOULD** be ***Deliver Conditionally***[4] for ***u*** in 3-tuple <***u,m,b***> with the condition that the delivery of Unicast Service Frames is subject to the dynamic learning and filtering process as described in IEEE Std 802.1Q-2011 [1] for Independent and Shared VLAN learning bridges. [D21] does not preclude other conditions to be applied. **[D22]** For the EVP-Tree Service, the value of the EVC Data Service Frame Disposition Service Attribute **SHOULD** be ***Deliver Unconditionally*** for ***b*** in 3-tuple <***u,m,b***>. No additional constraints for ***m*** in <***u,m,b***>
EVC C-Tag PCP Preservation	No additional constraints
EVC C-Tag DEI Preservation	No additional constraints
EVC Service Level Specification	No additional constraints

Table 22: EVC Service Attribute Values for the EVP-Tree Service

Table 23 lists the Subscriber UNI Service Attributes that have specific constraints for an EVP-Tree Service.

Subscriber UNI Service Attribute	Service Attribute values
Subscriber UNI L2CP Address Set	Value of ***CTA*** per [R1] in MEF 45.1 [11]

Table 23: Subscriber UNI Service Attribute Values for the EVP-Tree Service

Table 24 lists the EVC EP Service Attributes that have specific constraints for an EVP-Tree Service.

EVC EP Service Attribute	Service Attribute values
EVC EP Role	No additional constraints
EVC EP Map	**[R27]** For the EVP-Tree Service, the value of the EVC EP Map Service Attribute **MUST** be value of ***UT/PT*** or ***List***.
EVC EP Egress Class of Service Name Bandwidth Profile	No additional constraints
EVC EP Source MAC Address Limit	No additional constraints

Table 24: EVC EP Service Attribute Values for the EVP-Tree Service

10 References

[1] IEEE Std 802.1Q™ – 2018, “Bridges and Bridged Networks”, May 2018

[2] IETF RFC 2119, “Key words for use in RFCs to Indicate Requirement Levels”, March 1997

[3] IETF RFC 8174, “Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words”, May 2017

[4] MEF 6.2, “EVC Ethernet Services Definitions - Phase 3”, August 2014

[5] MEF 10.3, “Ethernet Services Attributes Phase 3”, October 2013

[6] MEF 10.4, “Subscriber Ethernet Service Attributes”, December 2018

[7] MEF 22.3, “Transport Services for Mobile Networks”, January 2018

[8] MEF 23.2, “Carrier Ethernet Class of Service – Phase 3”, August 2016

[9] MEF 23.2.1, “Models for Bandwidth Profiles with Token Sharing”, January 2017

[10] MEF 30.1, “Service OAM Fault Management Implementation Agreement: Phase 2”, April 2013

[11] MEF 45.1, “Layer 2 Control Protocols in Ethernet Services”, December 2018.

Appendix A Practical Examples of Ethernet Services (Informative)

This appendix provides service instance examples of E-Line, E-LAN, and E-Tree Service Types defined in Section 8. These service examples are assumed to be offered by a hypothetical Service Provider, ACME, offering a portfolio of Ethernet Services.

Table 25 and Table 26 combine to define an example of the EVC SLS Service Attribute offered by ACME. The list of Performance Metrics for the EVC SLS Service Attribute might include a subset of Performance Metrics defined in MEF 10.4 [6]. For simplicity, the more complex Performance Metrics, e.g., One Way Group Availability ($\widehat{GA}$) are not included. For simplicity, it is assumed that the values shown below apply to all Ethernet Services in the examples, i.e., EPL, EVP-LAN, EP-Tree and EVP-Tree Services. In actuality, Service Providers might offer different CoS Names and associated performance attribute objectives for the three Service Types. Also, since the Performance Objective values have wide variance among Service Providers, actual numbers are not used for the Performance Objective values in the example. However, when a SP offers MEF CoS Labels, then the parameters and Performance Objectives are as specified in MEF 23.2 [8].

Table 25 and Table 26 are used as a reference for Ethernet Services in each of the examples in the following subsections.

Parameters	Parameter Value
ts, (date and time to start SLS)	1/1/2020, 0h:0m:0s
T, (time duration)	1 month
CN	[<Krypton, 1sec, 0.1, 5, PM-Krypton>, <Argon, 1sec, 0.1, 5, PM-Argon>, <Neon, 1sec, 0.1, 5, PM-Neon>] Note: See Table 26 for PM-Krypton, PM-Argon, and PM-Neon

Table 25: EVC SLS Value

Example: Ethernet Services (offered by the ACME Service Provider)				
Performance Metrics in List	**PM Parameters**	**PM-Krypton**	**PM-Argon**	**PM-Neon**
One Way Frame Delay (FD)	Subset of ordered EVC EP pairs (S)	All	All	All
	FD Performance Objective, ($\hat{d}$)	X ms	Y ms (Y>X)	Z ms (Z>Y)
	Percentile (Pd)	99.9%	99%	95%
Inter Frame Delay Variation (IFDV)	Subset of ordered EVC EP pairs (S)	All	N/S	N/S
	IFDV Performance Objective, ($\widehat{dv}$)	Q ms	N/S	N/S
	Percentile (Pv)	99.9%	N/S	N/S
	Frame pair selector interval ($\Delta\tau$)	1 s	N/S	N/S
One-way Frame Loss Ratio (FLR)	Subset of ordered EVC EP pairs (S)	All	All	All
	FLR Performance Objective, ($\widehat{FLR}$)	A%	B% (B>A)	C% (C>B)
One-way Availability (A)	Subset of ordered EVC EP pairs (S)	All	All	All
	Availability Performance Objective, ($\hat{A}$)	α%	β% (β< α)	γ% (γ< β)

Table 26: PM lists for CoS Offering

In Table 26, the value 'All' in the 'Subset of ordered EVC EP pairs' entries, means all possible ordered pairs of EVC EPs specified in MEF 10.4 [6] for that EVC Type. For example, in an E-Tree Service Type, all ordered pairs where at least one EVC EP in each pair has the Role of *Root* are included in the offering. The reader is directed to MEF 10.4 [6] for precise definitions of the SLS Service Attribute.

A.1 Example: Transport-oriented EPL Service for Private Data Networking

A popular application of transport-oriented (or circuit-like) EPL services is to provide an interconnect service between routing or switching equipment in an enterprise's private data network. This need might arise when a Subscriber wishes to manage its own networking infrastructure, and desires a transport service that emulates as close as possible to a dedicated circuit for Service Frames, including associated management and control traffic. In such ascenario, the Service Provider provides point-to-point interconnect service between two designated UNIs and allocates transport resources (capacity) according to the desired circuit rate (typically the UNI port speed). In this example, the Subscriber is getting full port bandwidth and thus the service does not have an Ingress Bandwidth Profile. Additionally, in order to allow larger frames, this service allows 9000 Bytes for the value of the EVC Maximum Service Frame Size and the Subscriber UNI Maximum Service Frame Service Attributes.

The Service architecture is illustrated in Figure 11 below. The red dash represents the EVC instance that realizes the EPL service.

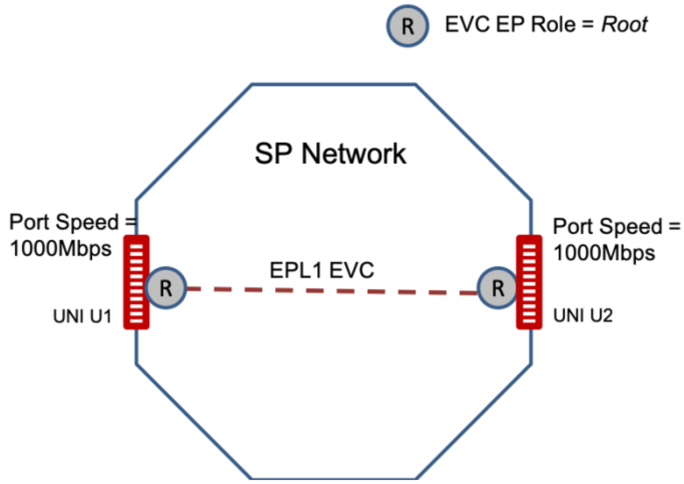

Figure 11: Transport-Oriented Private Data Network Using the EPL Service

The traffic pattern is that the Subscriber data, management and control frames are sent from UNI to UNI over a symmetric path. Routing/switching equipment on the Subscriber side might send their own control messages without interference from the SP Network. See MEF 45.1 [11] for requirements on handling Layer 2 Control Protocols for EPL service.

In the case where the Subscriber wishes to have redundancy, a back-up EVC can be used with some redundancy protocol to ensure that only one of the EVCs is active at any time. Alternatively, two similar EPL services can be instantiated between Sites A and B and allow for Subscriber Network port protection (e.g., by running LACP over the two EPL's to achieve a LAG between the SN equipment at the two Subscriber sites) by requiring the L2CP Address Set attribute for both EPL services set to CTB-2 per MEF 45.1 [11].

For monitoring the EVC, the Subscriber could use Service OAM at the Subscriber MEG [10] level, as seen by the Subscriber Network, with or without the SP Network supporting the Subscriber MEG MIP.

Table 27 provides the EVC Service Attribute values that satisfy the example.

EVC Service Attribute	EVC_1
EVC Type	*Point-to-Point*
EVC ID	EPL1
EVC List of EVC EPs	{U1_EPL1, U2_EPL1}
EVC Data Service Frame Disposition	< u= *Deliver Unconditionally*, m= *Deliver Unconditionally*, b=*Deliver Unconditionally* >
EVC C-Tag PCP Preservation	*Enabled*
EVC C-Tag DEI Preservation	*Enabled*
EVC List of Class of Service Names	{Krypton}
EVC Service Level Specification	Per Table 25 with CN for Krypton
EVC Group Membership	*None*
EVC Maximum Service Frame Size	9000
EVC Available MEG Level	0

Table 27: EVC Service Attribute Values for Private Data Network Using EPL Service

Table 28 provides the UNI Service Attribute values that satisfy the example.

Subscriber UNI Service Attribute	UNI 1	UNI 2
Subscriber UNI ID	U1	U2
Subscriber UNI Instantiation	*Physical*	*Physical*
Subscriber UNI Virtual Frame Map	*Not Applicable*	*Not Applicable*
Subscriber UNI List of Physical Links	{U1-L1, 1000BASE-SX, Disabled, Disabled}	{U2-L1, 1000BASE-LX, Disabled, Disabled}
Subscriber UNI Link Aggregation	*Not Applicable*	*Not Applicable*
Subscriber UNI Port Conversation ID to Aggregation Link Map	*Not Applicable*	*Not Applicable*
Subscriber UNI Service Frame Format	IEEE Std 802.3 - 2015	IEEE Std 802.3 - 2015
Subscriber UNI Maximum Service Frame Size	9000	9000
Subscriber UNI Maximum Number of EVC EPs[6]	5	5
Subscriber UNI Maximum Number of C-Tag VLAN IDs per EVC EP[6]	4094	4094
Subscriber UNI Token Share	*Disabled*	*Disabled*
Subscriber UNI Envelopes	*None* None since no bandwidth profiles	*None* None since no bandwidth profiles
Subscriber UNI Link OAM	*Disabled*	*Disabled*
Subscriber UNI MEG	*Disabled*	*Disabled*
Subscriber UNI LAG Link MEG	*Disabled*	*Disabled*
Subscriber UNI L2CP Address Set	*CTB-2*	*CTB-2*
Subscriber UNI L2CP Peering	{} Empty list since no protocols are Peered	{} Empty list since no protocols are Peered

Table 28: Subscriber UNI Service Attribute Values for Private Data Network Using EPL Service

Table 29 provides the EVC EP Service Attribute values that satisfy the example.

[6] Example of a Service Attribute that is for capability attribute (see Section 7.3 in MEF 10.4 [6]) and is thus shown with a value of 5. The value of this capability Service Attribute has no impact on the behavior of the service in this example

EVC EP Service Attribute	EVC EP at UNI 1	EVC EP at UNI 2
EVC EP ID	U1_EPL1	U2_EPL1
EVC EP UNI	U1	U2
EVC EP Role	*Root*	*Root*
EVC EP Map	*All*	*All*
EVC EP Ingress Class of Service Map	F = *EVC EP* M = {U1_EPL1→ Krypton} P = {}	F = *EVC EP* M = {U2_EPL1→ Krypton} P = {}
EVC EP Color Map	F = *EVC EP* M = {U1_EPL1→ Green}	F = *EVC EP* M = {U2_EPL1→Green}
EVC EP Egress Map	*None*	*None*
EVC EP Ingress Bandwidth Profile	*None*	*None*
EVC EP Class of Service Name Ingress Bandwidth Profile	*None*	*None*
EVC EP Egress Bandwidth Profile	*None*	*None*
EVC EP Class of Service Name Egress Bandwidth Profile	*None*	*None*
EVC EP Source MAC Address Limit	*None*	*None*
EVC EP Subscriber MEG MIP	*Disabled*	*Disabled*

Table 29: EVC EP Service Attribute Values for Private Data Network Using EPL Service

A.2 Example: Packet-oriented EPL Service for Public Data Networking

A popular application of packet-oriented (or statistical) EPL services is to provide an interconnect service between routing or switching equipment in an enterprise via a public data networking service. This need arises when a Subscriber wishes to interconnect multiple sites but does not wish to manage the intermediate datacom facilities. In such scenario, the Service Provider provides point-to-point interconnect services between 2 designated UNIs and allocates transport resources according to the anticipated traffic volume between the sites (typically less than the UNI port speed).

Since the Subscriber does not wish to manage its own packet network infrastructure there could be additional requirements at the UNI for L2CP Service Frames. The service interfaces at the UNIs might operate at different Port Speeds, and the Ingress Bandwidth Profile at each UNI might also be different. Non-essential traffic can be forwarded according to resource availability (i.e., statistical multiplexing).

The service architecture is illustrated in Figure 12 below. The red dash represents the EVC instance that realizes the EPL service.

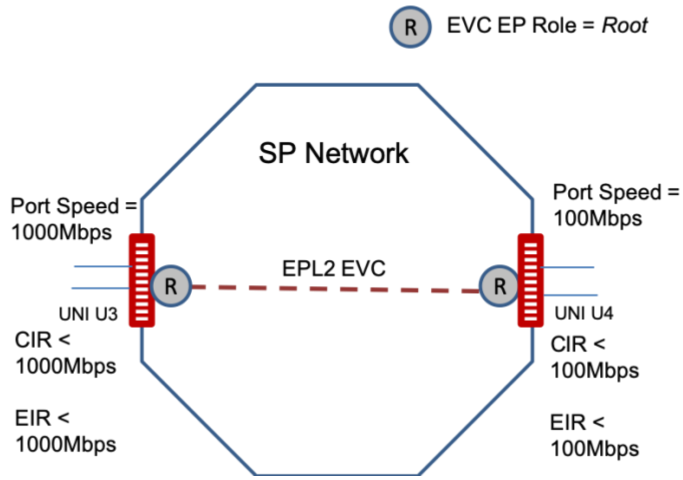

Figure 12: Packet-Oriented Public Data Network Interconnect Using the EPL Service.

The traffic pattern is such that the Subscriber data, management and control frames are sent from UNI to UNI with different CoS Names. Different levels of performance are applicable depending on the traffic type (indicated via C-Tag PCP). Also, in order to allow additional frame encapsulation, the service allows a value of 2000 Bytes for the EVC Maximum Service Frame Size and the Subscriber UNI Maximum Service Frame Size Service Attributes.

In the case where the Subscriber wishes to have redundancy, a back-up EVC can be used with some redundancy protocol to ensure that only one of the EVCs is active at any time. The UNI can also be protected via link aggregation. For this case the UNI attribute values that would satisfy the example are depicted in Table 31.

This example also shows how Service Attributes like the EVC EP Subscriber MEG MIP Service Attribute and EVC EP Class of Service Ingress Bandwidth Profile Service Attribute with token sharing are used. The EVC EP Subscriber MEG MIP Service Attribute is used to offer a MIP for the EVC EP at the UNI. While, for example, the MIP might be offered at some or all EVC EPs in the EVC, this example assumes that Subscriber prefers to have the MIP enabled at both EVC EPs for the EPL service.

To illustrate token sharing, this example defines two Ingress Bandwidth Profile Flows in an Envelope. Further, the excess tokens are allowed to be shared from higher rank Ingress Bandwidth Profile Flow to lower rank Ingress Bandwidth Profile Flow. With CF^0=0 and CF^i=0 for i=1 to 2, this example is similar to the 'Uncoupled Bandwidth Sharing' example described in Appendix D.3.2 of MEF 10.4 [6] except for the number of Bandwidth Profile Flows in the example described here.

Figure 13 shows two Bandwidth Profile Flows at U3 of Figure 12 (same at U4 for this example) mapped based on CoS Name Krypton and Argon. The configuration for the Bandwidth Profile, described in Table **32** for EVC EP Service Attributes, is as follows:

- Envelope ID is U3_EPL2 with Rank 1 for lower priority and Rank 2 for higher priority Ingress Bandwidth Profile Flows

- Overflows of Green tokens are not converted to Yellow tokens: CF^0=0, CF^i = 0 for i=1,2
- The EVC would allow total Green traffic up to CIR=25Mb/s and total Yellow traffic up to EIR=50Mb/s
- Ingress Bandwidth Profile Flow with Rank 2 is allowed a maximum of CIR^2_{max}=20Mb/s and EIR^2_{max}=0. Given that EBS^2=0 all the Yellow tokens overflow to the Ingress Bandwidth Profile Flow with Rank 1.
- Ingress Bandwidth Profile Flow with Rank 1 is allowed to use tokens up to CIR^1_{max}=20Mb/s, if available due to overflow, and EIR^1_{max} =50Mb/s. Note that CIR^1=5Mb/s so this flow cannot be starved of green tokens.

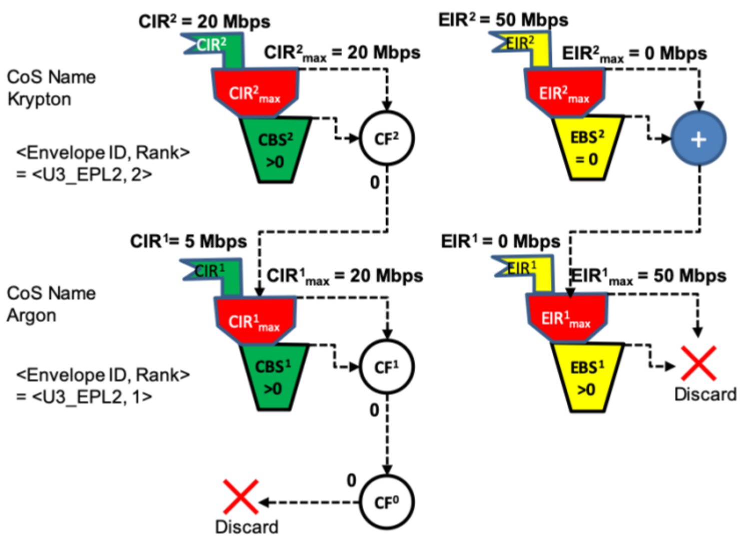

Figure 13: EPL Service with Token Sharing Enabled (shown at EVC EP U3)

Table 30 provides the EVC Service Attribute values that satisfy the example.

EVC Service Attribute	EVC_1
EVC Type	*Point-to-Point*
EVC ID	EPL2
EVC List of EVC EPs	{U3_EPL2, U4_EPL2}
EVC Data Service Frame Disposition	< u=*Deliver Unconditionally*, m=*Deliver Unconditionally*, b=*Deliver Unconditionally* >
EVC C-Tag PCP Preservation	*Enabled*
EVC C-Tag DEI Preservation	*Enabled*
EVC List of Class of Service Names	{Krypton, Argon}
EVC Service Level Specification	Per Table 25 with CN for Krypton and Argon
EVC Group Membership	*None*
EVC Maximum Service Frame Size	2000
EVC Available MEG Level	6

Table 30: EVC Service Attribute Values for Public Data Networking Using EPL Service

Table 31 provides the UNI Service Attribute values that satisfy the example.

Subscriber UNI Service Attribute	UNI 3	UNI 4
Subscriber UNI ID	U3	U4
Subscriber UNI Instantiation	*Physical*	*Physical*
Subscriber UNI Virtual Frame Map	*None*	None

Subscriber UNI list of Physical Links	{
	<U3-L1, 1000BASE-SX, *Disabled*, *Disabled*>,
	<U3-L2, 1000BASE-LX, *Disabled*, *Disabled*>
	}
		{
		<U4-L1, 100BASE-T4, *Disabled*, *Disabled*>,
		<U4-L2, 100BASE-TX, *Disabled*, *Disabled*>
		}

Subscriber UNI Link Aggregation	*All Active*	*All Active*
Subscriber UNI Port Conversation ID to Aggregation Link Map	[< {0 -2047}→ [1,2], {2048-4094}→[2,1] >]	[< {0 -2047}→ [1,2], {2048-4094}→[2,1] >]
Subscriber UNI Service Frame Format	IEEE Std 802.3 - 2015	IEEE Std 802.3 - 2015
Subscriber UNI Maximum Service Frame Size	2000	2000
Subscriber UNI Maximum Number of EVC EPs	1	1
Subscriber UNI Maximum Number of C-Tag VLAN IDs per EVC EP	4094	4094
Subscriber UNI Token Share	*Enabled*	*Enabled*
Subscriber UNI Envelopes	< U3_EPL2, 0>	< U4_EPL2, 0>
Subscriber UNI Link OAM	*Disabled*	*Disabled*
Subscriber UNI MEG	*Enabled*	*Enabled*
Subscriber UNI LAG Link MEG	*Disabled*	*Disabled*
UNI L2CP Address Set	*CTB*	*CTB*
UNI L2CP Peering	{LACP/LAMP}	{LACP/LAMP}

Table 31: Subscriber UNI Service Attribute Values for the Public Data Networking Using EPL Service

Table **32** provides the EVC EP Service Attribute values that satisfy the example.

EVC EP Service Attribute	EVC EP at UNI 3	EVC EP at UNI 4
EVC EP ID	U3_EPL2	U4_EPL2
EVC EP UNI	U3	U4
EVC EP Role	*Root*	*Root*
EVC EP Map	*All*	*All*

EVC EP Ingress Class of Service Map	F = *C-Tag PCP*
	M =
	{
	5→Krypton, 3→Argon, (0,2-4,6,7)→Discard
	}
	P =
	{
	(Note1), Krypton
	}
	
	Note1: Every protocol type used by Subscriber is mapped to Krypton
		F = *C-Tag PCP*
		M =
		{
		5→Krypton, 3→Argon, (0,2-4,6,7→Discard
		}
		P =
		{
		(Note 1), Krypton
		}
		
		Note1: Every protocol type used by Subscriber is mapped to Krypton

EVC EP Color Map	F = *C-Tag DEI* M = {0→Green, 1→Yellow}	F = *C-Tag DEI* M = {0→Green, 1→Yellow}
EVC EP Egress Map	None	None
EVC EP Ingress Bandwidth Profile	None	None

EVC EP Service Attribute	EVC EP at UNI 3	EVC EP at UNI 4
EVC EP Class of Service Name Ingress Bandwidth Profile	< CoS Name= Krypton, CIR=20Mb/s, CIR_{max}= 20Mb/s, CBS=16000B, EIR=50Mb/s, EIR_{max}=0Mb/s, EBS=0, CM=color blind, CF=0, Envelope ID=U3_EPL2, Rank=2 > < CoS Name= Argon CIR= 5Mb/s, CIR_{max}= 20Mb/s, CBS=16000B, EIR= 0Mb/s, EIR_{max}= 50Mb/s, EBS= 16000B, CM= color blind, CF= 0, Envelope ID= U3_EPL2, Rank= 1 >	< CoS Name= Krypton, CIR=20Mb/s, CIR_{max}= 20Mb/s, CBS= 16000B, EIR=50Mb/s, EIR_{max}=0Mb/s, EBS=0, CM=color blind, CF=0, Envelope ID=U4_EPL2, Rank=2 > < CoS Name= Argon CIR= 5Mb/s, CIR_{max}= 20Mb/s, CBS= 16000B, EIR= 0Mb/s, EIR_{max}= 50Mb/s, EBS= 16000B, CM=color blind, CF= 0, Envelope ID= U4_EPL2, Rank= 1 >
EVC EP Egress Bandwidth Profile Per EVC	*None*	*None*
EVC EP Class of Service Name Egress Bandwidth Profile	*None*	*None*
EVC EP Source MAC Address Limit	*None*	*None*
EVC EP Subscriber MEG MIP	*Enabled*	*Enabled*

Table 32: EVC EP Service Attribute Values for Public Data Networking Using EPL Service

A.3 Example: Ethernet Private Tree (EP-Tree) Service for Video Broadcast

One example of using the EP-Tree service is for a video broadcast application. In this scenario, we assume that a video broadcaster, as Subscriber, gets the EP-Tree service from a Service Provider to deliver a video service to its video customers. The EP-Tree service associates Root EVC EPs at video headend locations with Leaf EVC EPs at video customer locations.

The video distribution service might offer multiple broadcast channels. In the case where all channels are to be delivered to each of the video customers, this service is mostly uni-directional (no or minimal signaling traffic from Leaf to Root). In this mode, more efficient service delivery is possible compared to E-Line Service Type. Additionally, in the case when each video customer (connected to a Leaf EVC EP) needs just a subset of the available channels, then this might be configured via a standard multicast protocol. This example does not describe the use of multicast protocol to restrict the membership of a video customer to a specific channel group.

The service architecture is illustrated in Figure 14 below. The Root EVC EPs and the Leaf EVC EPs for this EVC are identified as per the legend.

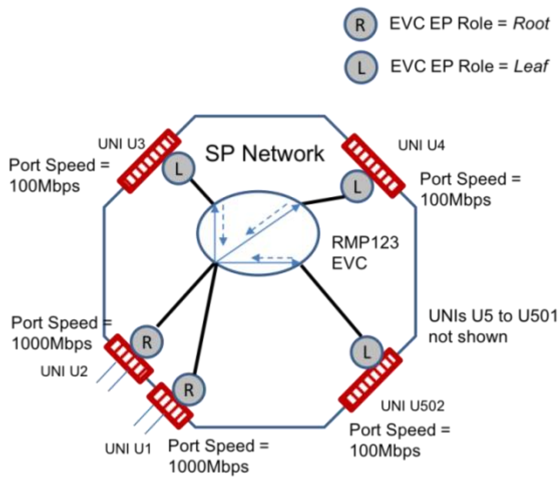

Figure 14: Video Broadcast Delivery Using the EP-Tree Service

The majority of the traffic is the video content that is sent from the video head-end towards the receiving video customer. Each such video customer sends a small amount of control messages to the video head-end.

In the case where the video broadcaster (Subscriber) wishes to have redundancy, two Root EVC EPs might be used with some redundancy protocol ensuring that only one of them transmits data into the EVC at a given time. Additionally, U1 and U2 use Link Aggregation as shown with two links in Figure 14.

Table 33 provides the EVC Service Attribute values that satisfy the example.

EVC Service Attribute	EVC
EVC ID	RMP123
EVC List of EVC EPs	{U1_RMP123, U2_RMP123/.../U502_RMP123}
EVC Type	*Rooted-Multipoint*
EVC Data Service Frame Disposition	< u=*Deliver Conditionally*: only deliver content subscribed to on a given Leaf EVC EP, m=*Deliver Conditionally*: only deliver content subscribed to on a given Leaf EVC EP, b=*Deliver Unconditionally* >
EVC C-Tag PCP Preservation	*Enabled*
EVC C-Tag DEI Preservation	*Enabled*
EVC List of Class of Service Names	Krypton
EVC Service Level Specification (for all ordered UNI pairs where at least one UNI in each pair is of Type Root).	Per Table 25 with CN for Krypton
EVC Group Membership	*None*
EVC Maximum Service Frame Size	2000
EVC Available MEG Level	0

Table 33: EVC Service Attribute Values for Video Broadcast Using EP-Tree Service

Table 34 provides the Subscriber UNI Service Attribute values that satisfy the example.

Subscriber UNI Service Attribute	UNIs (UNIs 1 & 2) with Root EVC EPs	UNIs (UNIs 3 → 502) with Leaf EVC EPs
Subscriber UNI ID	U1, U2	Ux Note: Ux = U3 → U502
Subscriber UNI Instantiation	*Physical*	*Physical*
Subscriber UNI Virtual Frame Map	*Not Applicable*	*Not Applicable*

Subscriber UNI List of Physical Links	For U1:
	{
	<U1-L1, 1000BASE-LX, *Disabled, Disabled*>
	<U1-L2, 1000BASE-LX, *Disabled, Disabled*>
	}
	For U2:
	{
	<U2-L1, 1000BASE-LX, *Disabled, Disabled*>
	<U2-L2, 1000BASE-LX, *Disabled, Disabled*>
	}
		{
		<Ux-L1, 100BASE-LX, *Disabled, Disabled*>
		}
		
		Note: Ux = U3 → U502

Subscriber UNI Link Aggregation	*2-Link Active/Standby*	*Not Applicable*
Subscriber UNI Port Conversation ID to Aggregation Link Map	*Not Applicable*	*Not Applicable*
Subscriber UNI Service Frame Format	IEEE Std 802.3 - 2015	IEEE Std 802.3 - 2015
Subscriber UNI Maximum Service Frame Size	2000	2000
Subscriber UNI Maximum Number of EVC EPs	1	1
Subscriber UNI Maximum Number of C-Tag VLAN IDs per EVC EP	4094	4094
Subscriber UNI Token Share	*Disabled*	Disabled
Subscriber UNI Envelopes	*None*	<ENV1-RMP123, 0>
Subscriber UNI Link OAM	*Enabled*	*Enabled*
Subscriber UNI MEG	*Disabled*	*Disabled*
Subscriber UNI LAG Link MEG	*Disabled*	*Disabled*
Subscriber UNI L2CP Address Set	*CTB*	*CTB*
Subscriber UNI L2CP Peering	{LACP/LAMP, Link OAM}	{Link OAM}

Table 34: Subscriber UNI Service Attribute Values for Video Broadcast Using EP-Tree Service

Table 35 provides the EVC EP Service Attribute values that satisfy the example.

EVC EP Service Attribute	Root EVC EPs (at UNIs 1 & 2)	Leaf EVC EPs (at UNIs 3 → 502)
EVC EP ID	U1_RMP123, U2_RMP123	U3_RMP123, ... U502_RMP123
EVC EP UNI	U1, U2	U3 → U502
EVC EP Role	*Root*	*Leaf*
EVC EP Map	*All*	*All*
EVC EP Ingress Class of Service Map	F = *EVC EP* M = {Ux_RMP123→Krypton} P= {} Note: Ux = U1 → U2	F = *EVC EP* M = {Ux_RMP123→Krypton} P= {} Note: Ux= U3 → U502
EVC EP Color Map	F = *EVC EP* M = <Ux_RMP123→Green> Note: Ux is U1 →U2	F = *EVC EP* M = <Ux_RMP123→Green> Note: Ux is U3 →U502
EVC EP Egress Map	*None*	*None*
EVC EP Ingress Bandwidth Profile	*None*	*None*
EVC EP Class of Service name Ingress Bandwidth Profile	*None*[7]	< CoS Name = Krypton CIR=1Mb/s, CIR_{max}=1Mb/s, CBS=12176B, EIR=0, EIR_{max}=1Mb/s, EBS=0, CM=color blind, CF=0 Envelope = ENV1-RMP123 Rank=1 >
EVC EP Egress Bandwidth Profile	None	None
EVC EP Class of Service Name Egress Bandwidth Profile	None	None
EVC EP Source MAC Address Limit	None	None
EVC EP Subscriber MEG MIP	Disabled	Disabled

Table 35: EVC EP Service Attribute Values for Video Broadcast Using EP-Tree Service

A.4 Example: Distance Learning (EVP-Tree) and Business Data (EVP-LAN)

In this example, we build an E-Tree Service Type and combine it with an E-LAN Service Type. All Subscriber locations are connected with two EVCs: EVP-LAN service is used for a business data application, and EVP-Tree Service is used for a distance learning application, which is based on IP video.

[7] Video source might be considered trusted and constant bit rate.

Since the same UNIs are used for both services, Service Multiplexing is required at each UNI, and separate Ingress Bandwidth Profiles are needed to ensure that the services do not adversely affect each other. For the EVP-LAN service, Bundling is required to ensure C- Tag VLAN ID transparency in the range indicated in Table **38**. For the EVP-Tree service, Bundling is not required since only one C-Tag VLAN ID is mapped to that EVC.

Figure 15 below shows this example. The EVC EPs at UNIs U1 and U2 for both EVCs are Root EVC EPs. The Leaf EPs at UNIs U3-U50 are for the RMP333 EVC and the Root EVC EPs at UNIs U3-U50 are for the MP111 EVC. Each EVC has a single Class of Service with Neon for MP111 and Krypton for RMP333.

This example also shows the use of attributes like Subscriber MEG MIP. For example, a Subscriber MEG MIP can be offered on one EVC but not offered on another EVC at the same UNI. Additionally, UNI 1 and UNI 2 use Link Aggregation as shown with two links in Figure 15.

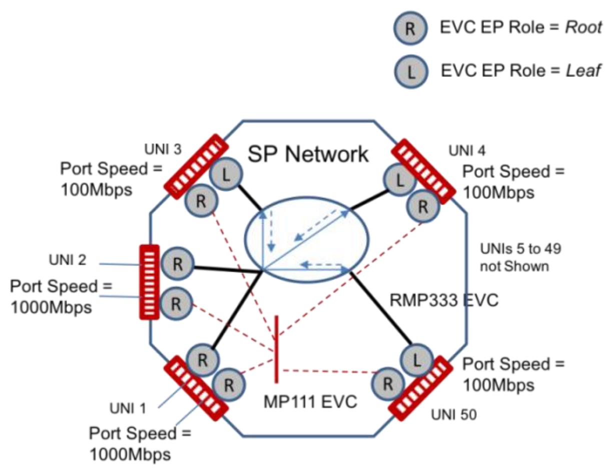

Figure 15: Distance Learning and Business Data Using EVP-LAN and EVP-Tree Services

The EVC Service Attribute values that would satisfy the example are shown in Table 36 below for each of the EVCs in this example.

EVC Service Attribute	EVC 1	EVC 2
EVC Type	*Multipoint-to-Multipoint*	*Rooted-Multipoint*
EVC ID	MP111	RMP333

EVC List of EVC EPs	{
	<U1_MP111>,
	/…/
	<U50_MP111>
	}
		{
		<U1_RMP333>,
		/…/
		<U50_RMP333>
		}

EVC Data Service Frame Disposition	< u = *Deliver Conditionally*: for known Destination MAC Addresses only to destination UNI and subject to dynamic learning and filtering process as described in IEEE Std 802.1Q-2011 [1]; m = *Deliver Unconditionally* b = *Deliver Unconditionally*	< u = *Deliver Conditionally*: for known Destination MAC Addresses only to destination UNI and subject to dynamic learning and filtering process as described in IEEE Std 802.1Q-2011 [1]; m = *Deliver Conditionally*: only deliver content subscribed to on a given Leaf UNI b = *Deliver Unconditionally*
EVC C-Tag PCP Preservation	*Disabled*	*Disabled*
EVC C-Tag DEI Preservation	*Disabled*	*Disabled*
EVC List of Class of Service Names	Neon	Krypton
EVC Service Level Specification	See Table 25 with CN for Neon (for all ordered UNI pairs)	See Table 25 with CN for Krypton (for all ordered UNI pairs where at least one UNI in each pair is of Type Root)
EVC Group Membership	*None*	*None*
EVC Maximum Service Frame Size	2000	2000
EVC Available MEG Level	6	6

Table 36: EVC Service Attribute Values for Distance Learning, Business Data Services

Table 37 provides the UNI Service Attribute values that would satisfy the example.

Subscriber UNI Service Attribute	UNIs 1 & 2	UNIs 3 → 50
Subscriber UNI ID	U1, U2	U3 → U50
Subscriber UNI Instantiation	*Physical*	*Physical*
Subscriber UNI Virtual Frame Map	*Not Applicable*	*Not Applicable*

Subscriber UNI List of Physical Links	For U1:
	{
	<U1-L1, 1000BASE-LX, *Disabled*, *Disabled*>
	<U1-L2, 1000BASE-LX, *Disabled*, *Disabled*>
	}
	For U2:
	{
	<U2-L1, 1000BASE-LX, *Disabled*, *Disabled*>
	<U2-L2, 1000BASE-LX, *Disabled*, *Disabled*>
	}
		For U3 → U50:
		{
		<Ux-L1, 100BASE-TX, *Disabled*, *Disabled*>
		}
		
		Note: Ux = U3 → U50

Subscriber UNI Link Aggregation	*All Active*	*Not Applicable*
Subscriber UNI Port Conversation ID to Aggregation Link Map	< {4094, (1, 2)} {1-4, (1)} {5-9, (2)} {all others, (no links)} >	*Not Applicable*
Subscriber UNI Service Frame Format	IEEE Std 802.3 - 2015	IEEE Std 802.3 - 2015
Subscriber UNI Maximum Service Frame Size	2000	2000
Subscriber UNI Maximum Number of EVC EPs	10	5
Subscriber UNI Maximum Number of C-Tag VLAN IDs per EVC EP	20	20
Subscriber UNI Token Share	*Disabled*	*Disabled*

Subscriber UNI Service Attribute	UNIs 1 & 2	UNIs 3 → 50
Subscriber UNI Envelopes	U1: <I-Env-Neon1,0>,<I-Env-Krypton1,0> U1: <E-Env-Neon1,0>,<E-Env-Krypton1,0> U2: <I-Env-Neon2,0>,<I-Env-Krypton2,0> U2: <E-Env-Neon2,0>,<E-Env-Krypton2,0>	Ux: <I-Env-NeonX,0>,<I-Env-KryptonX,0> Ux: <E-Env-NeonX,0>,<E-Env-KryptonX,0> (X = 3, 4, …, 50)
Subscriber UNI Link OAM	*Disabled*	*Disabled*
Subscriber UNI MEG	*Enabled*	*Enabled*
Subscriber UNI LAG Link MEG	*Disabled*	*Disabled*
Subscriber UNI L2CP Address Set	*CTA*	*CTA*
Subscriber UNI L2CP Peering	{LACP/LAMP}	{} Empty set since no protocols are Peered

Table 37: Subscriber UNI Service Attribute Values for Distance Learning, Business Data Services

The EVC EP Service Attribute values that satisfy the example are shown in Table **38** below. For table simplicity, only UNI 1 and UNI 50 are shown. The values for Service Attributes are similar for UNI 1 and 2. In addition, the value of the Service Attributes are similar for UNI x, x= 3,4,...,50.

EVC EP Service Attribute		EVC Eps at UNIs 1 & 2 (Values shown for UNI1)		EVC Eps at UNIs 3-50 (Values shown for UNI50)	
		EVC_1 MP111	EVC_2 RMP333	EVC_1 MP111	EVC_2 RMP333
EVC EP ID		U1_MP111	U1_RMP333	U50_MP111	U50_RMP333
EVC EP UNI		U1	U1	U50	U50
EVC EP Role		Root	Root	Root	Leaf
EVC EP Map		{1-9}	{4094}	{1-9}	{4094}

EVC EP Ingress Class of Service Map		F = EVC EP
		M =
		{
		U1_MP111→ Neon
		}
		P= {}
			F = EVC EP
			M =
			{
			U1_RMP333 →Krypton
			}
			P= {}
				F = EVC EP
				M =
				{
				U50_MP111→ Neon
				}
				P= {}
					F = EVC EP
					M =
					{
					U50_RMP333 → Krypton
					}
					P= {}

EVC EP Color Map		F=*C-Tag DEI*, M= {<0,Green>, <1,Yellow>}		F=*C-Tag DEI*, M={<0,Green>, <1,Yellow>}	
EVC EP Egress Map		<Neon,Green> → <3,0> <Neon, Yellow> → <3,1>	<Krypton, Green> → <5,0> <Krypton, Yellow> → <5,1>	<Neon, Green> → <3,0> <Neon, Yellow> → <3,1>	<Krypton, Green> → <5,0> <Krypton, Yellow> → <5,1>
EVC EP Ingress Bandwidth Profile		None		None	
EVC EP Class of Service Name Ingress Bandwidth Profile (Note: <CoS Name, 10-tuple> is shown as rows for clarity)	CoS Name	Neon	Krypton	Neon	Krypton
	CIR (Mb/s)	20	10	20	1
	CIRmax (Mb/s)	20	10	20	1
	CBS (B)	70000	70000	70000	70000
	EIR (Mb/s)	20	0	20	0
	EIRmax (Mb/s)	20	0	20	0
	EBS (B)	70000	0	100000	0
	CM	Color Blind	Color Blind	Color Blind	Color Blind
	CF	0	0	0	0
	Envelope ID	I-Env-Neon1	I-Env-Krypton1	I-Env-Neon50	I-Env-Krypton50
	Rank	1	1	1	1
EVC EP Egress Bandwidth Profile		None		None	
EVC EP Class of Service	CoS Name	Neon	Krypton	Neon	Krypton

<table>
<tr><th colspan="2" rowspan="2">EVC EP Service Attribute</th><th colspan="2">EVC Eps at UNIs 1 & 2
(Values shown for UNI1)</th><th colspan="2">EVC Eps at UNIs 3-50
(Values shown for UNI50)</th></tr>
<tr><th>EVC_1
MP111</th><th>EVC_2
RMP333</th><th>EVC_1
MP111</th><th>EVC_2
RMP333</th></tr>
<tr><td rowspan="4">Name Egress Bandwidth Profile

(Note: <CoS Name, 3-tuple> is shown as rows for clarity)</td><td>CIR[1] (Mb/s)</td><td>20</td><td>10</td><td>20</td><td>10</td></tr>
<tr><td>CIR[1]max (Mb/s)</td><td>40</td><td>10</td><td>40</td><td>10</td></tr>
<tr><td>Envelope ID</td><td>E-Env-Neon1</td><td>E-Env-Krypton1</td><td>E-Env-Neon50</td><td>E-Env-Krypton50</td></tr>
<tr><td>Rank</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td colspan="2">EVC EP Source MAC Address Limit</td><td>None</td><td>None</td><td>None</td><td>N=5
τ=24 hrs</td></tr>
<tr><td colspan="2">EVC EP Subscriber MEG MIP</td><td>6</td><td>None</td><td>6</td><td>None</td></tr>
</table>

Table 38: EVC EP Service Attribute Values for Distance Learning, Business Data Services

Appendix B Backwards Compatibility to MEF 6.2 Service (Informative)

Appendix B.1 provides guidance on achieving MEF 6.2 service behaviors by using appropriate values for the Service Attributes in a MEF 6.3 service. Additionally, Appendix B.2 identifies backwards compatibility gaps that can result in not achieving certain MEF 6.2 service behaviors.

B.1 Backwards Compatibility

MEF 6.3 Services use Service Attributes and values specified in MEF 10.4 [6] and MEF 45.1 [11] with additional constraints specified for some of the Service Attribute values as described in Sections 7 and 9 of this document. This section provides guidance on identifying the values that can be set for a MEF 6.3 service such that the Subscriber sees similar behavior as for a MEF 6.2 [4] Service.

Table 39, Table 40, and Table 41 below describe how to set the Service Attribute values for services, as defined in this document, to achieve the required behavior of services, as defined in MEF 6.2 [4]. The tables do not include recommended values per MEF 6.2. The first column lists the Service Attributes used in this document (from MEF 10.4 [6]). The second column is for Port-based Services. The third column is for VLAN-based Services. When value is different per service, the specific value is provided. When any of the values specified by MEF 10.4 are allowed, then "*Any value*" is the entry.

A shaded row indicates new Service Attribute and/or with new values specified in MEF 10.4.

EVC Service Attribute per MEF 10.4	Values for MEF 6.2 Port-based Services	Values for MEF 6.2 VLAN-based Services
EVC ID	*Any value*	*Any value*
EVC List of EVC EPs	*List with* EPL: *two EVC EP ID values* EP-LAN: ≥ *two EVC EP ID values* EP-Tree: ≥ *two EVC EP ID values*	*List with* EVPL: *two EVC EP ID values* EVP-LAN: ≥ *two EVC EP ID values* EVP-Tree: ≥ *two EVC EP ID values*
EVC Type	EPL*: Point-to-Point* EP-LAN: *Multipoint-to-Multipoint* EP-Tree: *Rooted-Multipoint*	EVPL: *Point-to-Point* EVP-LAN: *Multipoint-to-Multipoint* EVP-Tree: *Rooted-Multipoint*
EVC Data Service Frame Disposition	*For u, m and b:* EPL: *Deliver Unconditionally* EP-LAN: *Any value* EP-Tree: *Any value*	*For u, m and b:* *Any value*
EVC C-Tag PCP Preservation	*Enabled*	*Any value*
EVC C-Tag DEI Preservation	*Enabled*	*Any value*
EVC List of Class of Service Names	*Any value*	*Any value*
EVC Service Level Specification	*Any value*	*Any value*

EVC Service Attribute per MEF 10.4	Values for MEF 6.2 Port-based Services	Values for MEF 6.2 VLAN-based Services
EVC Group Membership	*Any value*	*Any value*
EVC Maximum Service Frame Size	*≥ 1522 Bytes*	*≥ 1522 Bytes*
EVC Available MEG Level	*Integer* ≤ 6	*Integer* ≤ 6

Table 39: EVC Service Attribute Values for MEF 6.2 Services

Subscriber UNI Service Attribute	Values for MEF 6.2 Port-based Services	Values for MEF 6.2 VLAN-based Services
Subscriber UNI ID	*Any value*	*Any value*
Subscriber UNI Instantiation	*Physical*	*Physical*
Subscriber UNI Virtual Frame Map	*Not Applicable*	*Not Applicable*
Subscriber UNI List of Physical Links	*Any value* for *id*, *fs*, *pt* *pl:* physical layer restricted per MEF 6.2	*Any value* for *id*, *fs*, *pt* *pl:* physical layer restricted per MEF 6.2
Subscriber UNI Link Aggregation	*2-link Aggregation*, *Other* or *Not Applicable* Note: All-Active was not yet specified for MEF 6.2.	*2-link Aggregation*, *Other* or *Not Applicable*> Note: All-Active was not yet specified for MEF 6.2.
Subscriber UNI Port Conversation ID to Aggregation Link Map	*Not Applicable*	*Not Applicable*
Subscriber UNI Service Frame Format	*MAC Frame format per IEEE 802.3-2015, clause 3*	*MAC Frame format per IEEE 802.3-2015, clause 3*
Subscriber UNI Maximum Service Frame Size	*≥ 1522 Bytes*	*≥ 1522 Bytes*
Subscriber UNI Maximum Number of EVC EPs	*1*	*Integer ≥1*
Subscriber Maximum Number of C-Tag VLAN IDs per EVC EP	*Any value*	*Any value*
Subscriber UNI Token Share	*Any value*	*Any value*
Subscriber UNI Envelopes	*Any value*	*Any value*
Subscriber UNI Link OAM	*Any value*	*Any value*

Subscriber UNI Service Attribute	**Values for MEF 6.2 Port-based Services**	**Values for MEF 6.2 VLAN-based Services**
Subscriber UNI MEG	*Any value*	*Any value*
Subscriber UNI LAG Link MEG	*Any value*	*Any value*
Subscriber UNI L2CP Address Set	EPL: *CTB or CTB2* EP-LAN: *CTB* EP-Tree: *CTB* See MEF 45.1 for details	*CTA* See MEF 45.1 for details
Subscriber UNI L2CP Peering	*Any value* See MEF 45.1 for details	*Any value* See MEF 45.1 for details

Table 40: Subscriber UNI Service Attribute Values for MEF 6.2 Services

EVC EP Service Attribute	**Values for MEF 6.2 Port-based Services**	**Values for MEF 6.2 VLAN-based Services**
EVC EP ID	*Any value*	*Any value*
EVC EP UNI	*Any value*	*Any value*
EVC EP Role	EPL: *Root* EP-LAN: *Root* EP-Tree: *Root or Leaf*	EVPL: *Root* EVP-LAN: *Root* EVP-Tree: *Root or Leaf*
EVC EP Map	*All*	*List or UT/PT* See B.2.1 for a gap discussion related to CE-VLAN ID to EVC Map
EVC EP Ingress Class of Service Map	*Any value*	*Any value*
EVC EP Color Map	*Any value*	*Any value*
EVC EP Egress Map	*None*	*None*
EVC EP Ingress Bandwidth Profile	*None*	*None*
EVC EP Egress Bandwidth Profile	*None*	*None*

EVC EP Service Attribute	Values for MEF 6.2 Port-based Services	Values for MEF 6.2 VLAN-based Services
EVC EP Class of Service Name Ingress Bandwidth Profile	*None or non-empty list <CoS Name, BWP Flow Parameters>* When *non-empty list*, additional constraints need to apply to align with the MEF 6.2 service definition: a) *F = 0* b) When single BWP Flow is in an Envelope, set (per section 12.3 of MEF 10.4): $CIR_{max} \geq$ CIR and $EIR_{max} \geq$ EIR + CF*CIR. Note that the combination of a) and b) above reduces to the BWP algorithm of MEF 10.2, which is required in MEF 6.2 for single BWP Flow in an Envelope.	*None or non-empty list <CoS Name, BWP Flow Parameters>* When *non-empty list*, additional constraints need to apply to align with the MEF 6.2 service definition: a) *F = 0* b) When single BWP Flow is in an Envelope, set (per section 12.3 of MEF 10.4): $CIR_{max} \geq$ CIR and $EIR_{max} \geq$ EIR + CF*CIR. Note that the combination of a) and b) above reduces to the BWP algorithm of MEF 10.2, which is required in MEF 6.2 for single BWP Flow in an Envelope.
EVC EP Class of Service Name Egress Bandwidth Profile	EPL: *None* EP-LAN: *None* or *non-empty list <CoS Name, CIR, CIRmax, ER>* EP-Tree: *None* or *non-empty list <CoS Name, CIR, CIRmax, ER>* When non-empty list, an additional constraint for y needs to apply to align with the MEF 6.2 service definition: When single BWP Flow in an Envelope, set $CIR_{max} \geq$ CIR (per section 12.3 of MEF 10.4). See Section B.2.2 for gap discussion related to Egress Bandwidth Profile parameters See Section B.2.3 for gap discussion related to Egress Bandwidth Profile per Egress Equivalence Class	*None* or *non-empty list <CoS Name, CIR, CIRmax, ER>* When non-empty list, an additional constraint for y needs to apply to align with the MEF 6.2 service definition: When single BWP Flow in an Envelope, set $CIR_{max} \geq$ CIR (per section 12.3 of MEF 10.4). See Section B.2.2 for gap discussion related to Egress Bandwidth Profile parameters See Section B.2.3 for gap discussion related to Egress Bandwidth Profile per Egress Equivalence Class
EVC EP Source MAC Address Limit	EPL: *None* EP-LAN: *Any value* EP-Tree: *Any value*	EVPL: *None* when EVC Data Service Frame Disposition Service Attribute has a value set to *Deliver Unconditionally* for each item in 3-tuple *<u,m,b>* EVP-LAN: *Any value* EVP-Tree: *Any value*

EVC EP Service Attribute	Values for MEF 6.2 Port-based Services	Values for MEF 6.2 VLAN-based Services
EVC EP Subscriber MEG MIP	*Any value* Behavior of a MEF 6.2 Service with value *Enabled* can be obtained by setting value of service attribute to an integer in range <0-7>	*Any value* Behavior of a MEF 6.2 Service with value *Enabled* can be obtained by setting value of service attribute to an integer in range <0-7>

Table 41: EVC EP Service Attribute Values for MEF 6.2 Services

B.2 Backward Compatibility Gaps

In revising MEF 10.3 [5] to develop MEF 10.4 [6] certain simplifications were made. As a result, some service behaviors allowed by MEF 10.3 [5] are not possible with MEF 10.4 [6]. These simplifications result in backward compatibility gaps between the services defined in MEF 6.2 [4] and services defined in this Standard. These backward compatibility gaps are explained in the following sections.

B.2.1 Backward Compatibility Gap in Mapping Service Frames to EVCs

In MEF 10.3 [5] the CE-VLAN ID/EVC Map Service Attribute controls the mapping of Service Frames to EVCs based on the content of the C-Tag VLAN ID or its absence. The value of this Service Attribute is a list of one or more CE-VLAN ID values where $\{1,2,\dots,4095\}$ is the set of possible CE-VLAN ID values. In addition the CE-VLAN ID for Untagged and Priority Tagged Service Frames is defined as integer in the range 1,2,…,4094. An example of the value of the CE-VLAN ID/EVC Map Service Attribute is shown in Table 42 where the asterisk indicates the value of the CE-VLAN ID for Untagged and Priority Tagged Service Frames.

CE-VLAN ID	EVC
47	EVC_1
1343	EVC_2
17*	EVC_3

Table 42: CE-VLAN ID/EVC Map Example per MEF 10.3 [5]

In this example Untagged Service Frames, Priority Tagged Service Frames, and C-Tagged Service Frames with VLAN ID = 17 are all mapped to EVC_3. All other Service Frames are not mapped to EVC_3.

In MEF 10.4 [6] the CE-VLAN ID/EVC Map Service Attribute and the CE-VLAN ID for Untagged and Priority Tagged Service Frames Service Attribute are removed and replaced by the EVC EP Map Service Attribute whose value is one of *List*, *All*, or *UT/PT*. Table 43 summarizes how the value of the EVC EP Map Service Attribute controls mapping of Service Frames to EVC EPs (and thus to EVCs).

EVC EP Map Value	Service Frame Type Mapping (Section 7.4 of MEF 10.4 [6])		
	VLAN Tagged	**Priority Tagged**	**Untagged**
List	Mapped if the C-Tag VLAN ID value is in the list	Not Mapped	Not Mapped
All	Mapped	Mapped	Mapped
UT/TP	Not Mapped	Mapped	Mapped

Table 43: Mapping of Service Frames to EVC EPs via the EVC EP Map Service Attribute

Per [R13], [R19], and [R27], for a VLAN-based Service, the value of the EVC EP Map Service Attribute is mandated to be either *List* or *UT/PT*. Consequently, it is impossible for an VLAN-based Service defined in this Standard to have the mapping behavior like that in Table 42 for EVC_3.

Mappings of the form in Table 42 were included in MEF 10.3 [5] and earlier versions to accommodate an SN that attaches to the UNI with a shared media network and a mix of devices that are compatible and not compatible with IEEE Std 802.1Q – 2018 [1]. Such SN configurations are no longer important in the industry. Consequently, the EVC EP Map Service Attribute does not support this SN configuration.

B.2.2 Backward Compatibility Gap in Egress Bandwidth Profile Flow Parameters

In MEF 6.2 [4], when an Egress Bandwidth Profile for a Bandwidth Profile Flow is specified, the value for the parameters $\langle CIR, CIR_{max}, CBS, EIR, EIR_{max}, EBS, CF, CM, ER\rangle$ are agreed to by the Subscriber and the Service Provider. In this Standard, when an Egress Bandwidth Profile for a Bandwidth Profile Flow is specified, per MEF 10.4 [6], only the value for the parameters $\langle CIR, CIR_{max}, ER\rangle$ are agreed to by the Subscriber and the Service Provider. The value for the Bandwidth Profile Flow parameters $\langle CBS, EIR, EIR_{max}, EBS, CF, CM\rangle$ are set by the Service Provider. Consequently a MEF 6.2 [4] service will not comply with this Standard unless the Service Provider happens to choose the value for the parameters $\langle CBS, EIR, EIR_{max}, EBS, CF, CM\rangle$ that were agreed to for the MEF 6.2 [4] service.

As an example, consider a MEF 6.2 [4] service that has an Egress Bandwidth Profile Flow with $EIR = 150\ Mbps$. If the Service Provider choses $EIR = 125\ Mbps$ for this Bandwidth Profile Flow, this MEF 6.2 [4] service is not a service definable via this Standard.

B.2.3 Backward Compatibility Gap in Egress Bandwidth Profile Flow Specification

In MEF 6.2 [4], a Bandwidth Profile Flow specified in the value of an Egress Bandwidth Profile per Egress Equivalence Class Identifier Service Attribute is based on the Egress Equivalence Class assigned to each Service Frame. In this Standard, per MEF 10.4 [6], a Bandwidth Profile Flow specified in the value of an EVC EP Class of Service Name Egress Bandwidth Profile Service Attribute is based on the given Class of Service Name assigned to each Ingress Service Frame. Since it is possible to specify more Egress Equivalence Classes than the number of Class of Service Names, it is possible to have a MEF 6.2 [4] service that does not comply with this Standard.

As an example, consider a service with the value of EVC EP Ingress Class of Service Map Service Attribute, the value of the EVC EP Color Map Service Attribute and the resulting Egress Bandwidth Profile Flows shown in Table 44, where the EVC EP Class of Service Name Egress

Bandwidth Profile Service Attribute is used. In this service there are at most four Egress Bandwidth Profile Flows.

C-Tag PCP Value	Class of Service Name	Color	Egress Bandwidth Profile Flow per Class of Service Name
0	Coal	Green	BWPF1
1	Coal	Yellow	BWPF1
2	Bauxite	Green	BWPF2
3	Bauxite	Yellow	BWPF2
4	Sapphire	Green	BWPF3
5	Sapphire	Yellow	BWPF3
6	Diamond	Green	BWPF4
7	Diamond	Yellow	BWPF4

Table 44: Example Egress Bandwidth Profile Flows per MEF 10.4 [6]

Table 45 shows an example of the value for the Egress Equivalence Class Identifier Service Attribute in MEF 10.3 [5] and the Egress Bandwidth Profile Flows per Egress Equivalence Class for a service similar to the one described above. In this case, there can be up to eight Egress Bandwidth Profile Flows.

C-Tag PCP Value	Egress Equivalence Class	Egress Bandwidth Profile Flow per Egress Equivalence Class
0	Mercury	EEC1
1	Venus	EEC2
2	Earth	EEC3
3	Mars	EEC4
4	Jupiter	EEC5
5	Saturn	EEC6
6	Uranus	EEC7
7	Neptune	EEC8

Table 45: Example Egress Bandwidth Profile Flows per MEF 10.3 [5]

Because there are more Egress Equivalence Classes than Class of Service Names, a MEF 6.2 [4] service using the Egress Equivalence Classes in Table 45 is not a service definable via this Standard.

The intent of Egress Equivalence Classes in MEF 10.3 [5] was to allow the grouping of multiple Class of Service Names into a single Egress Bandwidth Profile Flow. A typical example of when such a grouping is useful is a Multipoint-to-Multipoint EVC with three Class of Service Names but only one Class of Service Name is used at a given UNI in the EVC. Grouping the two unused Class of Service Names into a single Egress Bandwidth Profile Flow allows the amount of egress traffic for the combination of these two Class of Service Names to be throttled at the given UNI. The EVC EP Egress Map Service Attribute introduced in MEF 10.4 [6] handles such a grouping in a simpler way and thus it replaced the concept of the Egress Equivalence Class.

In a MEF 6.2 [4] service with a value for the Egress Equivalence Class that cannot be represented in MEF 6.3, the behavior of the Egress Bandwidth Profile was not deterministic. The inability to represent such services in MEF 6.3 is therefore not expected to have an impact.

Appendix C Changes from MEF 6.2 (Informative)

Most technical changes are based on revised or new attributes in MEF 10.4 [6] and MEF 45.1 [11]. In addition, suitable requirements have been included based on material in other MEF specifications such as MEF 23.2 [8].

MEF 6.2 Section	MEF 6.3 Section	Key Changes from MEF 6.2
All	All	• Updated Figures to align with MEF 10.4 style
2. Abstract	2. Abstract	• Alignment with MEF 10.4 and MEF 45.1 • Superseding MEF 6.2
3. Terminology	3. Terminology	• Additional terms
4. Scope		• Removed section • moved changes to new Appendix
7. Introduction	6. Introduction	• Included Section 6.1 for "Support" in normative text

8. Ethernet Service Definition Framework	7. Ethernet Service Definition Framework	• Defined Port-based and VLAN-based Services
		• Updated Table 3 for Service Types and services
		• Updated Figure 2 for relationship between common and service specific Tables
		• Removed definition of Token Share Service Attribute and [R2], [D1], and [R3] from MEF 6.2 since these have been included in MEF 10.4
		• Updated list of Service Attributes, values, and constraints for EVC, UNI and EVC EP per MEF 10.4, MEF 45.1 and MEF 23.2
		• Constraints for EVC Service Attributes:
		  ○ EVC List of Class of Service Names: [D1] of MEF 6.3 is for [D7] in MEF 6.2
		  ○ EVC Service Level Specification: [D13] in MEF 6.2 rephrased as [D2] in MEF 6.3. Removed [D14] in MEF 6.2
		  ○ EVC Maximum Service Frame Size: increase to 2000B
		  ○ EVC Available MEG Level: [R18] in MEF 6.2 is now [R2] in MEF 6.3
		• Constraints for Subscriber UNI Service Attributes:
		  ○ Subscriber UNI Maximum Service Frame Size: increase to 2000B
		  ○ Subscriber UNI Token Share: new [D6]
		  ○ Subscriber UNI Envelopes: Removed [R4] and [R5] from MEF 6.2
		  ○ Subscriber UNI Link OAM: Removed [D3] from MEF 6.2
		• Constraints for EVC EP Service Attributes:

MEF 6.2 Section	MEF 6.3 Section	Key Changes from MEF 6.2
		○ EVC EP Class of Service Map: [D9] from MEF 6.2 is removed because it is in MEF 10.4, and [CD1] in MEF 6.2 has been removed because it is not needed ○ EVC EP Color Map: new [CR2]< and [D9] ○ EVC EP Class of Service Name Ingress Bandwidth Profile: Removed [R10] to [R13] from MEF 6.2. New [CD2]< in MEF 6.3 only for L2CP frames ○ EVC EP Class of Service Name Egress Bandwidth Profile: Removed [R14] to [R17] from MEF 6.2. ○ EVC EP Subscriber MEG MIP: Removed O1 from MEF 6.2, Updated [D12] from MEF 6.2 as [D11] in MEF 6.3, Replaced [R18] in MEF 6.2 with [R2] in MEF 6.3
9. Ethernet Service Types	8. Subscriber Ethernet Service Types	(No key changes to list)
10. Service Definitions	9. Ethernet Service Definitions	• Updated list of Service Attributes, values, and constraints for EVC, UNI and EVC EP per MEF 10.4, MEF 45.1 and MEF 23.2 • Additional requirements when new Service Attributes, e.g., EVC C-Tag DEI Preservation
11. References	10. References	• Updated Reference list
Appendix	Appendix	• Updated Appendix A has new EVC SLS table, updated examples. • Updated Appendix B has backwards compatibility to MEF 6.2 • Appendix C from MEF 6.2 has been removed • New Appendix C included with changes compared to MEF 6.2

Table 46: Key Changes from MEF 6.2 [4]