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ITU-T G.8011.1/Y.1307.1

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TELECOMMUNICATION
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Recommendation ITU-T G.8011.1/Y.1307.1

Ethernet private line service

Summary

Recommendation ITU-T G.8011.1/Y.1307.1 defines the service attributes and parameters for carrying Ethernet characteristic information over dedicated bandwidth, point-to-point connections, provided by SDH, PDH, ETY, ETH, ATM, MPLS or OTH server layer networks. This type of service is referred to as Ethernet private line (EPL) service. This Recommendation is based on the Ethernet service framework as defined in Recommendation ITU-T G.8011/Y.1307.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Ethernet, Ethernet service, private line.

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FOREWORD

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Ethernet private line service

1 Scope

This Recommendation defines the service attributes and parameters for carrying Ethernet characteristic information over dedicated-bandwidth, point-to-point connections, provided by SDH, ATM, MPLS, PDH, ETY or OTH server layer networks. This type of services is referred to as Ethernet private line (EPL) service. This Recommendation is based on the Ethernet service framework as defined in [ITU-T G.8011] and is aligned with the EPL specified in [MEF 6.1].

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.707] Recommendation ITU-T G.707/Y.1322 (2007), *Network node interface for the synchronous digital hierarchy (SDH)*.

[ITU-T G.709] Recommendation ITU-T G.709/Y.1331 (2012), *Interfaces for the Optical Transport Network (OTN)*.

[ITU-T G.805] Recommendation ITU-T G.805 (2000), *Generic functional architecture of transport networks*.

[ITU-T G.809] Recommendation ITU-T G.809 (2003), *Functional architecture of connectionless layer networks*.

[ITU-T G.7043] Recommendation ITU-T G.7043/Y.1343 (2004), *Virtual concatenation of plesiochronous digital hierarchy (PDH) signals*.

[ITU-T G.8001] Recommendation ITU-T G.8001/Y.1354 (2013), *Terms and definitions for Ethernet frames over transport*.

[ITU-T G.8010] Recommendation ITU-T G.8010/Y.1306 (2004), *Architecture of Ethernet layer networks*.

[ITU-T G.8011] Recommendation ITU-T G.8011/Y.1307 (2012), *Ethernet service characteristics*.

[ITU-T G.8012] Recommendation ITU-T G.8012/Y.1308 (2004), *Ethernet UNI and Ethernet NNI*.

[ITU-T G.8012.1] Recommendation ITU-T G.8012.1/Y.1308.1 (2012), *Interfaces for the Ethernet transport network*.

[ITU-T G.8013] Recommendation ITU-T G.8013/Y.1731 (2013), *OAM functions and mechanisms for Ethernet based networks*.

[ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (2012), *Characteristics of Ethernet transport network equipment functional blocks*.

[ITU-T G.8021.1] Recommendation ITU-T G.8021.1/Y.1341.1 (2012), Types and *characteristics of Ethernet transportation network equipment*.

[IEEE 802.3] IEEE 802.3-2012, *IEEE Standard for Ethernet.*

[IEEE 802.1Q] IEEE 802.1Q-2011, *IEEE Standard for Local and metropolitan area networks – Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks*.

[MEF 6.1] MEF 6.1 (2008), *Ethernet Services Definitions – Phase 2*.

[MEF 6.1.1] MEF 6.1.1 (2012), *Layer 2 Control Protocol Handling Amendment to MEF 6.1*.

[MEF 10.2] MEF 10.2 (2009), *Ethernet Services Attributes – Phase 2*.

[MEF 12.1] The Metro Ethernet Forum MEF (2010), *Carrier Ethernet Network Architecture Framework Part 2: Ethernet Services Layer – Basic Elements*.

[MEF 26.1] The Metro Ethernet Forum MEF (2012), *External Network Network Interface (ENNI) – Phase 2*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 access link: [ITU-T G.8001].

3.1.2 customer: [ITU-T G.8001].

3.1.3 ENNI: [MEF 26.1].

3.1.4 EPL type 1: [ITU-T G.8001.

3.1.5 EPL type 2: [ITU-T G.8001].

3.1.6 ETH link: See clause 6.6 of [ITU-T G.8010].

3.1.7 Ethernet service: [ITU-T G.8001].

3.1.8 Ethernet service instance: [ITU-T G.8001].

3.1.9 Ety-NNI: [ITU-T G.8001].

3.1.10 Ety-UNI: [ITU-T G.8001].

3.1.11 flow point: [ITU-T G.809].

3.1.12 flow termination: [ITU-T G.809].

3.1.13 link connection: [ITU-T G.805].

3.1.14 service frame: [MEF 10.2].

3.1.15 subnetwork: [ITU-T G.805].

3.1.16 subnetwork connection: [ITU-T G.805].

3.1.17 termination flow point: [ITU-T G.809].

3.1.18 traffic conditioning function: [ITU-T G.8001].

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ATM Asynchronous Transfer Mode
CBR Constant Bit Rate
CBS Committed Burst Size
CI Characteristic Information
CIR Committed Information Rate
CO-PS Connection-Oriented Packet Switched
CoS Class of Service
EC Ethernet Connection
EIR Excess Information Rate
ENNI Ethernet NNI
EPL Ethernet Private Line
ETH Ethernet MAC layer network
ETH_CI Ethernet MAC Characteristic Information
ETY Ethernet physical layer network
ETYn Ethernet physical layer network of order *n*
Ety-NNI Ethernet over Transport NNI
Ety-UNI Ethernet UNI
EVC Ethernet Virtual Connection
GFP Generic Framing Procedure
LCAS Link Capacity Adjustment Scheme
MAC Media Access Control
MEF Metro Ethernet Forum
MEG Maintenance Entity Group
MEP Maintenance End Point
MIP Maintenance Intermediate Point
MPLS Multi-Protocol Label Switching
MTU Maximum Transmission Unit
NNI Network to Network Interface
OAM Operations, Administration, Maintenance
OTH Optical Transport Hierarchy
OTN Optical Transport Network
PDH Plesiochronous Digital Hierarchy
PHY Physical device
SDH Synchronous Digital Hierarchy
UNI User Network Interface

5 Conventions

In this Recommendation the Ethernet connection (EC) is functionally equivalent to the EC defined in [MEF 12.1]. The EC is used to describe the network underlying the Ethernet private line (EPL) service. To describe the EPL service, this Recommendation uses the term Ethernet virtual connection (EVC) as equivalent to the EVC as defined in [MEF 10.2].

6 Ethernet private lines

This Recommendation defines an Ethernet private line (EPL) service. This definition is based on the Ethernet transport architecture described in [ITU-T G.8010]. Unlike the original version of this Recommendation, the base Ethernet services attributes and their definitions are imported from [MEF 10.2] and the base definitions for EPL are imported from [MEF 6.1] to ensure alignment. This Recommendation adds further explanation to some of these attributes, to clearly show the relationship with [ITU-T G.8010]. In addition, several ITU-T specific attributes are defined to provide a superset definition.

6.1 Description

An EPL service is a point-to-point service between two demarcation points, as illustrated in Figure 6-1. The service is provided over connection oriented server layer networks with a committed information rate (CIR). Note that if a CO-PS server layer is used, traffic management is required to ensure that the CIR is maintained. The level of transparency of an EPL can be either:

Type 1 – Frame-based characteristic information (see example in Annex A);

Type 2 – Character-based characteristic information.

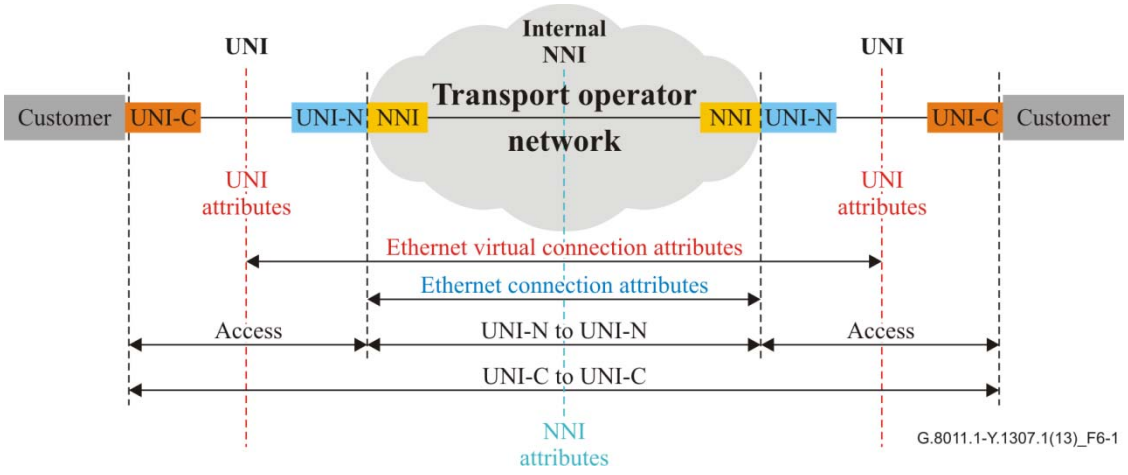

Figure 6-1 – Ethernet private line

6.1.1 EPL type 1

The generic method to support the transport of Ethernet MAC frames (ETH service) between two Ethernet UNIs is to terminate the Ethernet physical section layer (ETY), extract the Ethernet MAC frames (ETH_CI), and transport them over the SDH, PDH, ETY, ETH, ATM, MPLS or OTH network. This is referred to as EPL type 1 and described below. An example of EPL type 1 is shown in Annex A.

In addition, EPL type 1 can be further subdivided into Option 1 and Option 2 based on the handling of Layer 2 control protocols. Option 1 reflects the current IEEE standards, while Option 2 follows MEF 6.1 process requirements that do not align with current IEEE standards. Both options are now defined in [MEF 6.1.1].

6.1.2 EPL type 2

A second type of service with lower latency characteristics is defined for the 8B/10B encoded 1 Gbit/s Ethernet interface signal and the 10 Gbit/s Ethernet interface signal. The line code information of the symbol stream (ETC_CI) within the interface signal is transported through the transport network, instead of the Ethernet MAC frames. In the case of 1 Gbit/s Ethernet, the symbols are transcoded prior to transmission. This is referred to as EPL type 2.

6.2 EPL type 1 service architecture

The components used to support an EPL type 1 service are shown in Figure 6-1:

– the Ety-UNIs (UNI-N, UNI-C);

– the Ety-NNI;

– the Ethernet virtual connection;

– the access link.

The EPL type 1 service uses an Ety-UNI and is supported over Ethernet-over-PDH, Ethernet-over-SDH and Ethernet-over-OTH Ety-NNIs. EPL type 1 service can also use Ethernet-over-ATM with CIR and Ethernet-over-MPLS with CIR NNIs. The UNI and NNI are specified in [ITU-T G.8012] and [ITU-T G.8012.1].

Figure 6-2 shows the basic architecture of the EPL type 1 service. The ETY layer is terminated at the UNI-N and the ETH frames are forwarded over a single ETH_FP to the server layer.

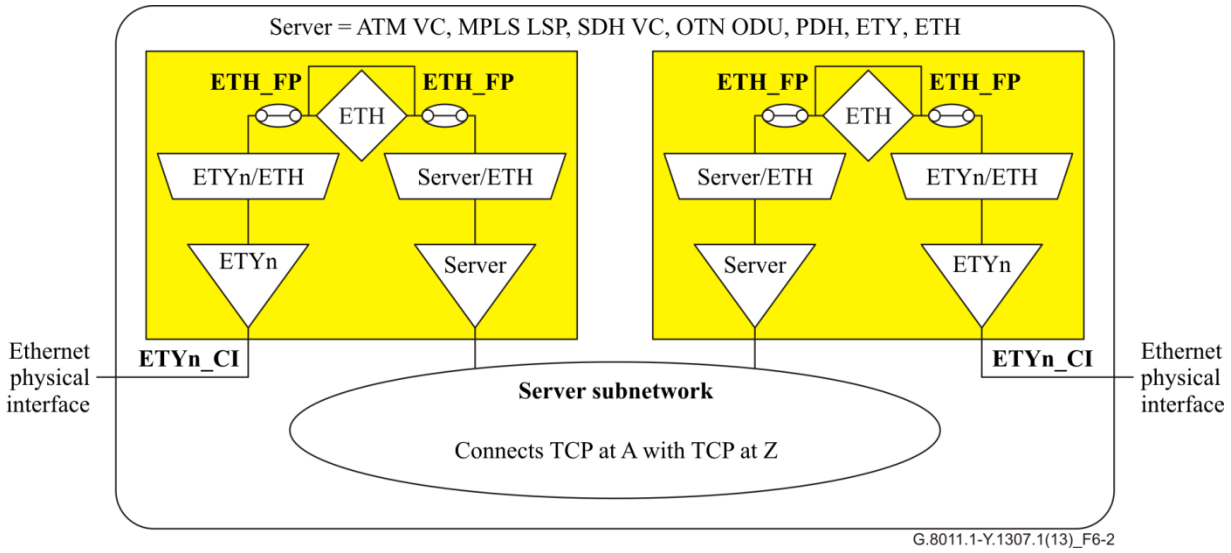

Figure 6-2 – Ethernet private line type 1 architecture

6.3 EPL type 2 service architecture

The EPL type 2 service is essentially an ETY layer service and does not process the Ethernet MAC frames (ETH layer). As a result, many service attributes defined in [ITU-T G.8011] do not apply to this service.

6.3.1 1 Gbit/s EPL type 2 service

Figure 6-3 shows the architectural model of this service. The Ethernet coding sublayer is terminated and the decoded signal is mapped into a VC-4-7v using GFP-T mapping.

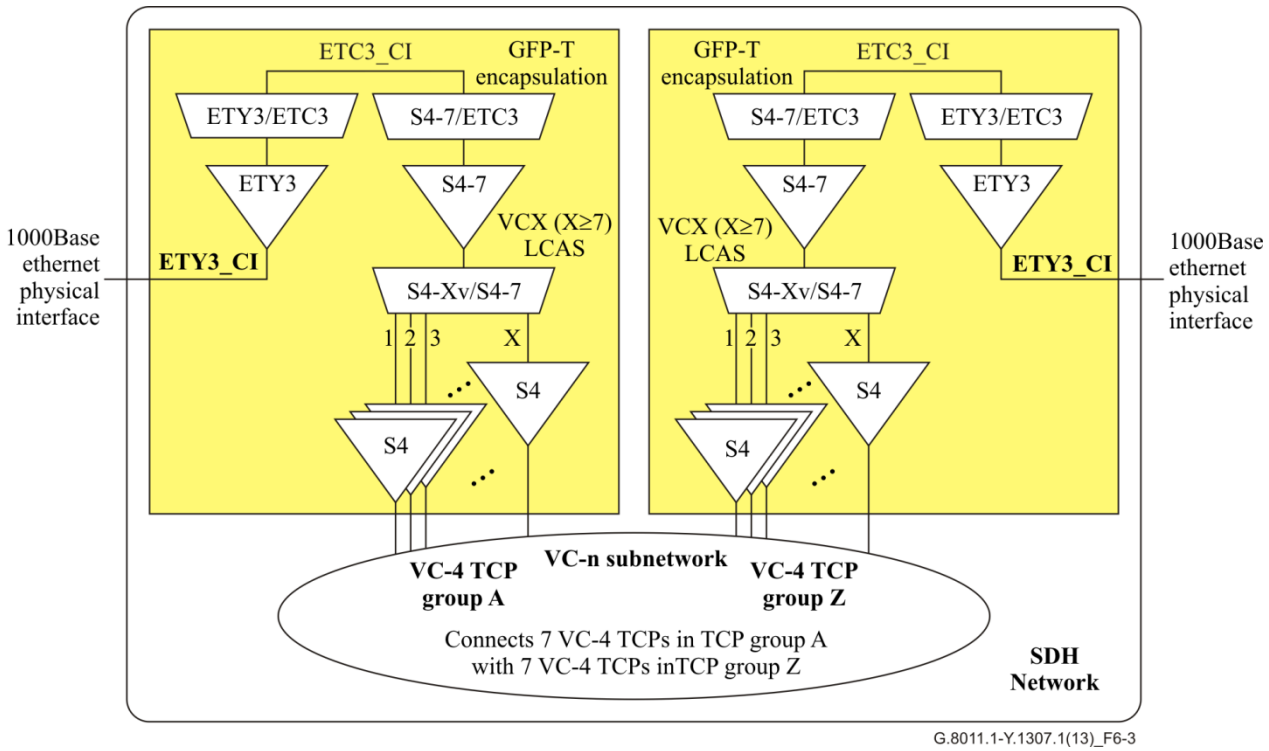

Figure 6-3 – EPL type 2 architecture for a 1 Gbit/s Ethernet signal

6.3.2 10 Gbit/s EPL type 2 service

The 10GBASE-W signal is basically a STM-64 with a VC-4-64c and the Ethernet MAC mapped into the VC-4-64c using a 64B/66B coding.

NOTE 1 – The transport and path overhead used by the 10GBASE-W is compatible with that specified in [ITU-T G.707], however, the 10GBASE-W signal uses only a subset of this overhead.

The 10GBASE-W signal is specified to use a clock accuracy of ±20 ppm. With this client signal accuracy, the 10GBASE-W binary signal can be transported as a CBR10G signal via an OTH network as specified in [ITU-T G.709] (Figure 6-4). ODU2 path monitoring is deployed to assess the quality of service. The functional architecture is shown in Figure 6-4.

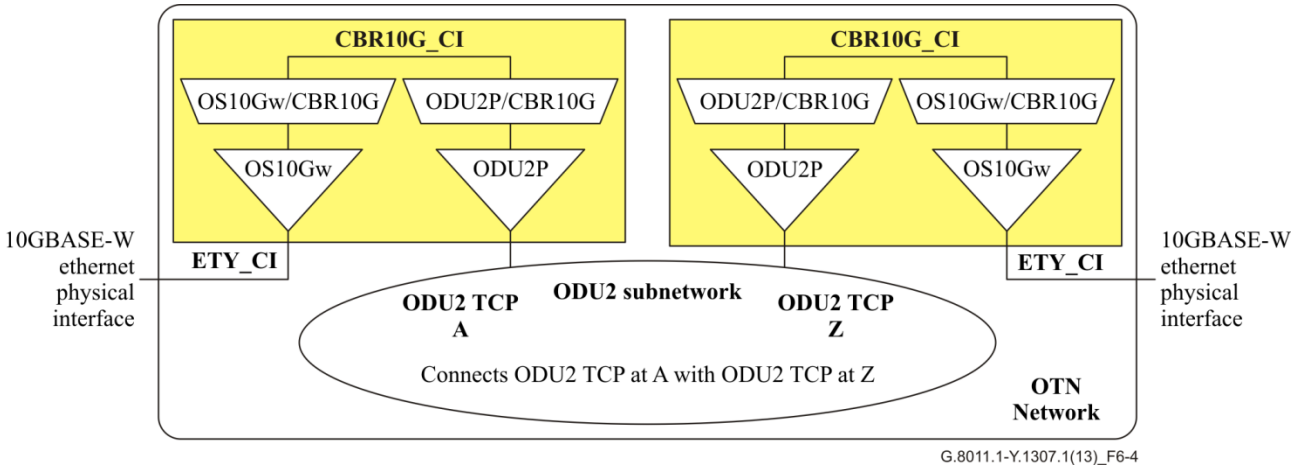

Figure 6-4 – Ethernet private line architecture for the case of an OTH network (10G WAN case)

The VC-4-64c of the 10 GbE WAN signal can also be transported over a SDH network in case the clock requirements are met (see Appendix XII of [ITU-T G.707]). VC-4-64c tandem connection

monitoring can be deployed to assess the quality of service. The functional architecture is shown in Figure 6-5.

NOTE 2 – If interface signal clock accuracy is ±20 ppm, the 10GBASE-W signal can be transported through an SDH network, but excessive pointer adjustments may occur.

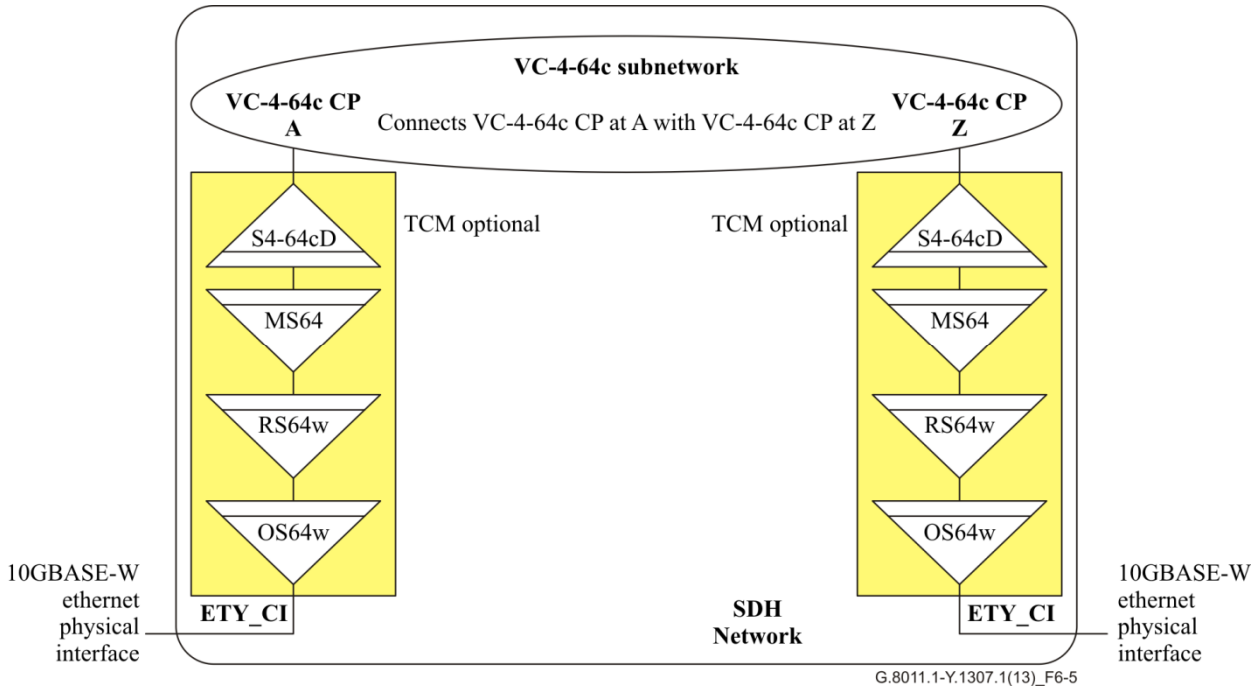

Figure 6-5 – Ethernet private line architecture for the case of an SDH network (10GBASE-W signal's clock accuracy complies with the SDH clock accuracy requirements)

7 Ethernet virtual connection (EVC) attributes for EPL

This clause describes the Ethernet virtual connection (EVC) attributes that pertain to EPL. The EVC attributes for the two EPL types, and the attributes common to both types, are summarized in the following clauses.

7.1 Ethernet virtual connection (EVC) attributes for EPL type 1

The EVC service attributes that apply to EPL type 1 are shown in Table 7-1. The Ethernet virtual connection (EVC) service attributes are the same as the EVC attributes defined in [MEF 6.1] Table 12, as amended in [MEF 6.1.1].

Table 7-1 – EVC service attributes and parameters for EPL type 1

EVC service attribute	Service attribute parameters and values
EVC type	**MUST** by point-to-point
EVC ID	An arbitrary string, unique across the MEN, for the EVC supporting the service instance
UNI list	**MUST** list the two UNIs associated with the EVC. The UNI type **MUST** be Root for each UNI
Maximum number of UNIs	**MUST** be 2
EVC MTU size	**MUST** be 2000 ≥ Integer ≥ 1522 (See Note)
CE-VLAN ID preservation	**MUST** be Yes

Table 7-1 – EVC service attributes and parameters for EPL type 1

EVC service attribute	Service attribute parameters and values
CE-VLAN CoS preservation	**MUST** be Yes
Unicast service frame delivery	**MUST** Deliver Unconditionally
Multicast service frame delivery	**MUST** Deliver Unconditionally
Broadcast service frame delivery	**MUST** Deliver Unconditionally
Layer 2 control protocols processing (only applies for L2CPs passed to the EVC)	**MUST** specify in accordance with sections 8.1.1 (Option 1) and 8.3 (Option 2) of [MEF 6.1.1]. See clause 7.1.1 of this Recommendation for a summary of Options 1 and 2
EVC performance	At least one CoS is **REQUIRED**. **MUST** specify CoS ID, per section 6.8 of [MEF 10.2]. **MUST** list values for each of the following attributes {Frame Delay, Frame Delay Variation, Frame Loss Ratio and Availability} for each CoS, where Not Specified (N/S) is an acceptable value
NOTE – The upper bound of 2000 bytes for EVC MTU size is not indicated in [MEF 10.2]. It only applies for transport server layers that impose this restriction (e.g., 802.3 PHYs per [IEEE 802.3]).	

7.1.1 Layer 2 control protocol processing for EPL type 1

There are two L2CP requirement options defined in [MEF 6.1.1]. Option 1 (section 8.1.1 of [MEF 6.1.1]) is similar in functionality to the original MEF EPL definition and Option 2 (section 8.3 of [MEF 6.1.1]) is similar to the definition in a previous version of this Recommendation (2004). Option 2 does not align with the current IEEE 1588 or 802.1 standards. The requirements in [MEF 6.1.1] specify whether L2 control frames may be discarded, peered or tunnelled, and whether this is done for all UNIs or on a per-UNI basis. Option 1 does not require or support tunnelling L2 control frames. In contrast, most L2 control frames with Option 2 must or should be tunnelled.

7.2 Ethernet virtual connection (EVC) attributes for EPL type 2

The EVC service attributes that apply to EPL type 2 are shown in Table 7-2, and the EPL type 2 UNI service attributes are summarized in Table 7-3.

Table 7-2 – EPL type 2 EVC service attributes

EVC service attribute	Service attribute parameters and values
EVC type	**MUST** be point-to-point
EVC ID	An arbitrary string, unique across the MEN, for the EVC supporting the service instance
UNI list	**MUST** list the two UNIs associated with the EVC. The UNI type **MUST** be Root for each UNI
Maximum number of UNIs	**2**
EVC MTU size	**MUST** be 2000 ≥ Integer ≥ 1522
CE-VLAN ID preservation	**N/A**
CE-VLAN CoS preservation	**N/A**
Unicast service frame delivery	**N/A**
Multicast service frame delivery	**N/A**
Broadcast service frame delivery	**N/A**

Table 7-2 – EPL type 2 EVC service attributes

EVC service attribute	Service attribute parameters and values
Layer 2 control protocols processing	**N/A**
Service performance	**N/A**
Ingress bandwidth profile per EVC	**N/A**
Egress bandwidth profile per EVC	**N/A**
Link type	Dedicated
Survivability	Server specific
NOTE – The upper bound of 2000 bytes for EVC MTU size is not indicated in [MEF 10.2]. It only applies for transport server layers that impose this restriction (e.g., 802.3 PHYs per [IEEE 802.3]).	

Table 7-3 – EPL type 2 UNI service attributes

	UNI service attribute	Service attribute parameters and values
ETY	Physical medium	IEEE 802.3-2008 PHY per [ITU-T G.8012]
	Speed	1 Gbit/s, or 10 Gbit/s
	Mode	**MUST** be full duplex

The service is at the full rate of the specific Ethernet physical signal. Subrate services are not supported.

7.3 Ethernet connection (EC) attributes for both EPL types

The EC attributes that apply to both EPL types are shown in Table 7-4.

Table 7-4 – EC service attributes

EC service attribute	Service attribute parameters and values
Link type	Dedicated
Survivability	None; server specific

7.3.1 Link type

This type of link is referred to as dedicated as defined in clause 7.2.1.1 of [ITU-T G.8011].

7.3.2 Survivability

The transport network can provide survivability for the EPL. The survivability alternatives for the ETH link are, for example:

– no protection;

– protection by means of SDH or OTH or ATM or MPLS or Ethernet protection schemes;

– restoration by means of SDH or OTH or ATM or MPLS or Ethernet restoration schemes.

See clause 7.2.2 of [ITU-T G.8011] for the specific protection options. The applicability of survivability by means of LCAS (in which the ETH link operates at reduced bandwidth during the defect condition) is for further study.

8 EPL type 1 UNI attributes

8.1 ETH_UNI attributes

This clause describes service UNI attributes that modify the behaviour of a particular instance of an Ethernet service at the demarc of the UNI to characterize the service. There is a UNI defined at each of the ETH and ETY layers. The base set of EVPL UNI attributes is the same as the UNI attributes defined in [MEF 6.1] Tables 10 and 11, as amended in [MEF 6.1.1]. These are summarized in Tables 8-1 and 8-2.

Table 8-1 – EPL type 1 UNI service attributes

	UNI service attribute	Service attribute parameters and values
ETH	UNI identifier	Arbitrary text string to identify the UNI
	MAC layer	IEEE 802.3 [IEEE 802.3]
	UNI MTU size	**MUST** be 2000 ≥ Integer ≥ 1522
	Service multiplexing	**MUST** be No
	Bundling	**MUST** be No
	All to one bundling	**MUST** be Yes
	CE-VLAN ID for untagged and priority tagged service frames	All untagged and priority tagged service frames at the UNI **MUST** map to the same EVC as is used for all other service frames
	Maximum number of EVCs	**MUST** be 1
	Ingress bandwidth profile per UNI	**MUST NOT** specify
	Egress bandwidth profile per UNI	**MUST NOT** specify
	Layer 2 control protocol processing	**MUST** specify in accordance with sections 8.1.1 (Option 1) and 8.3 (Option 2) of [MEF 6.1.1]. See clause 7.1.1 of this Recommendation regarding Options 1 and 2
	UNI EVC ID	A string formed by the concatenation of the UNI ID and the EVC ID
	CE-VLAN ID/EVC map	All service frames at the UNI **MUST** map to a single point-to-point EVC
	Ingress bandwidth profile per EVC	**OPTIONAL**. If supported, **MUST** specify <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be combined with any other type of ingress bandwidth profile
	Ingress bandwidth profile per CoS ID	**OPTIONAL**. If supported, **MUST** specify CoS ID per [MEF 10.1], section 6.8, and **MUST** specify <CIR, CBS, EIR, EBS, CM, CF> for each CoS. **MUST NOT** be combined with any other type of ingress bandwidth profile
	Egress bandwidth profile per EVC	**MUST NOT** specify
	Egress bandwidth profile per CoS ID	**MUST NOT** specify
ETY	Physical medium	IEEE 802.3-2005 PHY per [ITU-T G.8012]
	Speed	10 Mbit/s, 100 Mbit/s, 10/100 Mbit/s auto-negotiation, 10/100/1000 Mbit/s auto-negotiation, 1 Gbit/s, or 10 Gbit/s
	Mode	**MUST** be full duplex

9 EPL type 1 NNI attributes

9.1 ETH_NNI attributes

The base set of EVPL ENNI attributes is the same as the ENNI attributes defined in [MEF 26.1] Table 2 and they are summarized in Table 9-1.

Table 9-1 – NNI service attributes

	ENNI service attribute	Service attribute parameters and values	MEF 26.1 reference
ETH	Operator ENNI identifier	A string that is unique across the Operator MEN	7.1.1
	Frame format	Frame formats as specified in section 7.1.3 of [MEF 26.1]	7.1.3
	Number of links	An integer with value 1 or 2	7.1.4
	Protection mechanism	Link aggregation, none, or other	7.1.5
	ENNI maximum transmission unit size	An integer number of bytes greater than or equal to 1526	7.1.6
	End-point map	A table with rows of the form <S-VLAN ID value, End Point Identifier, End Point Type>	7.1.7
	Maximum number of OVCs	An integer greater than or equal to 1	7.1.8
	Maximum number of OVC End-points per OVC	An integer greater than or equal to 1	7.1.9
ETY	Physical layer	One of the PHYs listed in [R5] of [MEF 26.1]	7.1.2
	Server layer	SDH, PDH, OTH, ETY, ATM, MPLS, ETH	

10 Connectivity monitoring

Connectivity monitoring can either be proactive (sublayer monitoring, inherent monitoring) or on-demand, using [ITU-T G.8013]. In some network implementations, the connectivity monitoring can rely on the server layer connectivity monitoring (inherent monitoring). It is also optional to perform no monitoring.

For EPL, connectivity monitoring is achieved via Ethernet OAM mechanisms defined in [ITU-T G.8013] [IEEE 802.1Q], and is optional. If specified, the MEG levels at the customer service layer are:

1) Tunnelled.
2) Tunnelled with UNI-N MIP.
3) Peered at UNI-N.
4) Blocked at UNI-N.

Specifically, it will be blocked at the UNI-N if there is an up MEP at an equal or higher level, or a down MEP at a higher level.

Annex A

EPL type 1 network models

(This annex forms an integral part of this Recommendation.)

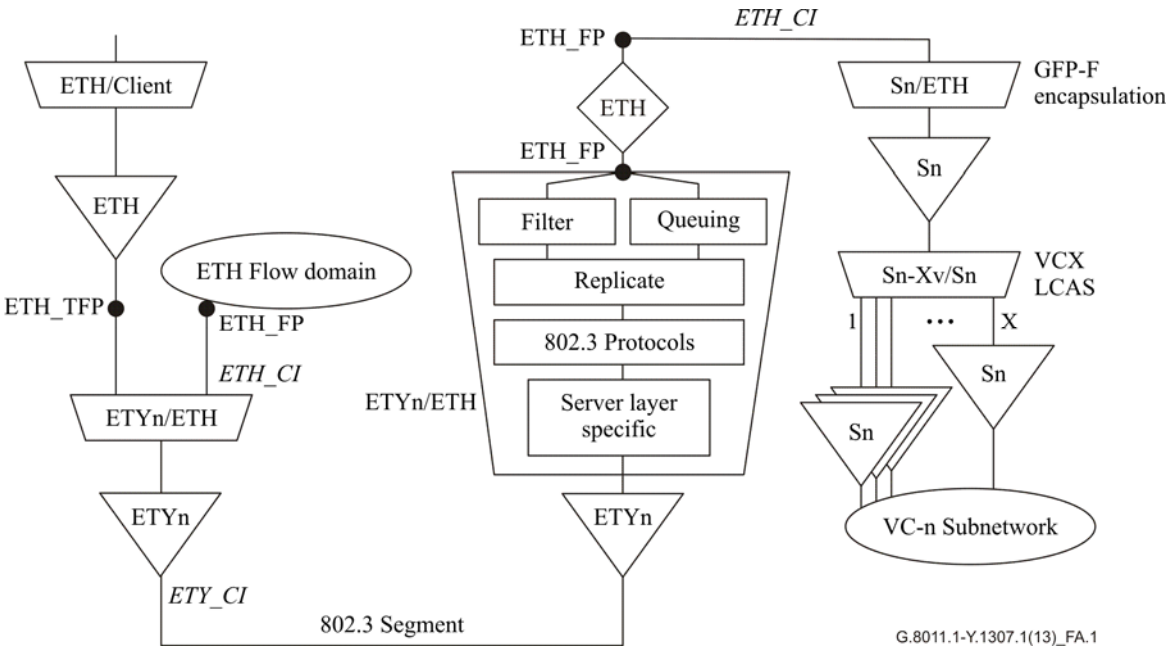

Figure A.1 – EPL access link with type 1 mapping into SDH

An ITU-T G.8010 model of an EPL type 1 is provided in Figure A.1. It shows:

– the adaptation of a MAC client to the ETH layer;
– the ETH trail termination (TT) function;
– an ETH flow domain;
– the adaptation of ETH_CI to the ETY layer;
– the ETY TT function;
– an 802.3 access link to a provider edge device;
– the corresponding ETY TT function;
– the ETY/ETH adaptation function (including the component functions);
– a traffic conditioning (TC) function;
– the adaptation of ETH_CI into an SDH path via GFP-F encapsulation;
– the trail termination functions of a VC-n subnetwork;
– the adaptation into virtually concatenated and LCAS controllable VC-ns;
– a VC-n subnetwork.

Note that the replicate and filter blocks shown in Figure A.1 may be null functions for an EPL.

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