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ITU-T G.8011.2/Y.1307.2

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TELECOMMUNICATION
STANDARDIZATION SECTOR
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Recommendation ITU-T G.8011.2/Y.1307.2

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Recommendation ITU-T G.8011.2/Y.1307.2

Ethernet virtual private line service

Summary

Recommendation ITU-T G.8011.2/Y.1307.2 defines the service attributes and parameters for carrying Ethernet characteristic information over shared bandwidth, point-to-point connections provided by synchronous digital hierarchy (SDH), plesiochronous digital hierarchy (PDH), asynchronous transfer mode (ATM), multi-protocol label switching (MPLS), optical transport hierarchy (OTH), Ethernet MAC layer network (ETH) or Ethernet PHY layer network (ETY) server layer networks. This type of service is referred to as Ethernet virtual private line (EVPL) 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*
1.0	ITU-T G.8011.2/Y.1307.2	2005-09-22	15	11.1002/1000/8531-en
2.0	ITU-T G.8011.2/Y.1307.2	2009-01-13	15	11.1002/1000/9657-en
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Keywords

Ethernet, Ethernet service, virtual private line.

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FOREWORD

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1 Scope

This Recommendation defines the service attributes and parameters for carrying Ethernet characteristic information over shared-bandwidth, point-to-point connections provided by SDH, ATM, MPLS, PDH, ETY, OTH, ETH or ETY server layer networks. This type of service is referred to as Ethernet virtual private line (EVPL) service. This Recommendation is based on the Ethernet service framework as defined in [ITU-T G.8011] and [MEF 10.2], and is aligned with the EVPL 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.809] Recommendation ITU-T G.809 (2003), *Functional architecture of connectionless layer networks*.

[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.8011.1] Recommendation ITU-T G.8011.1/Y.1307.1 (2013), *Ethernet private line service.*

[ITU-T G.8012] Recommendation ITU-T G.8012/Y.1308 (2007), *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.8021.1] Recommendation ITU-T G.8021.1/Y.1341.1 (2012), *Types and characteristics of Ethernet transport network equipment*.

[IEEE 802.1AX] IEEE 802.1AX-2008, *IEEE Standard for Local and metropolitan area networks – Link Aggregation*.

[IEEE 802.1D] IEEE 802.1D-2004, *IEEE Standard for local and metropolitan area networks – Media Access Control (MAC) Bridges*.

[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*.

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

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

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

[MEF 10.2] The Metro Ethernet Forum MEF (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.*

[MEF 30] The Metro Ethernet Forum MEF (2012), *Service OAM Fault Management Implementation Agreement.*

[MEF 35] The Metro Ethernet Forum MEF (2012), *Service OAM Performance Monitoring Implementation Agreement.*

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

3.1.5 Ethernet connection (EC): [ITU-T G.8001].

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

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

3.1.8 Ethernet virtual connection (EVC): [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 EVPL type 1: [ITU-T G.8001].

3.1.12 EVPL type 2: [ITU-T G.8001].

3.1.13 EVPL type 3: [ITU-T G.8001].

3.1.14 operator virtual connection (OVC): [MEF 26.1].

3.1.15 OVC end point: [MEF 26.1].

3.1.16 subnetwork: See clause 6.3.2 of [ITU-T G.800].

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ATM Asynchronous Transfer Mode

CBS Committed Burst Size

CI Characteristic Information

CIR Committed Information Rate

CL-PS Connectionless Packet Switched

CO-CS Connection Oriented Circuit Switched

CO-PS Connection Oriented Packet Switched

EC Ethernet Connection

EIR Excess Information Rate

EPL Ethernet Private Line

ETH Ethernet MAC layer network

ETH_CI Ethernet MAC Characteristic Information

ETY Ethernet PHY layer network

EVC Ethernet Virtual Connection

MAC Media Access Control

MEF Metro Ethernet Forum

MPLS Multi-Protocol Label Switching

NNI Network-to-Network Interface

OAM Operations, Administration, Maintenance

OTH Optical Transport Hierarchy

OTN Optical Transport Network

OVC Operator Virtual Connection

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 EVPL service, this Recommendation uses the term Ethernet virtual connection (EVC) as equivalent to the EVC as defined in [MEF 10.2].

In this Recommendation, the term 'shared server layer' is equivalent to a server layer that is supporting Ethernet links with an ITU-T G.8011 Ethernet connection link type attribute of shared.

6 Ethernet virtual private lines

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

6.1 Description

An EVPL service is a point-to-point service between two demarcation points as illustrated in Figure 6-1. The service is provided over connection-oriented or connectionless server layer networks. The service has a committed information rate (CIR), committed burst size (CBS), excess information rate (EIR) and excess burst size (EBS). Note that if a CO-PS or CL-PS server layer is used, traffic management is required to ensure that the CIR and EIR are maintained.

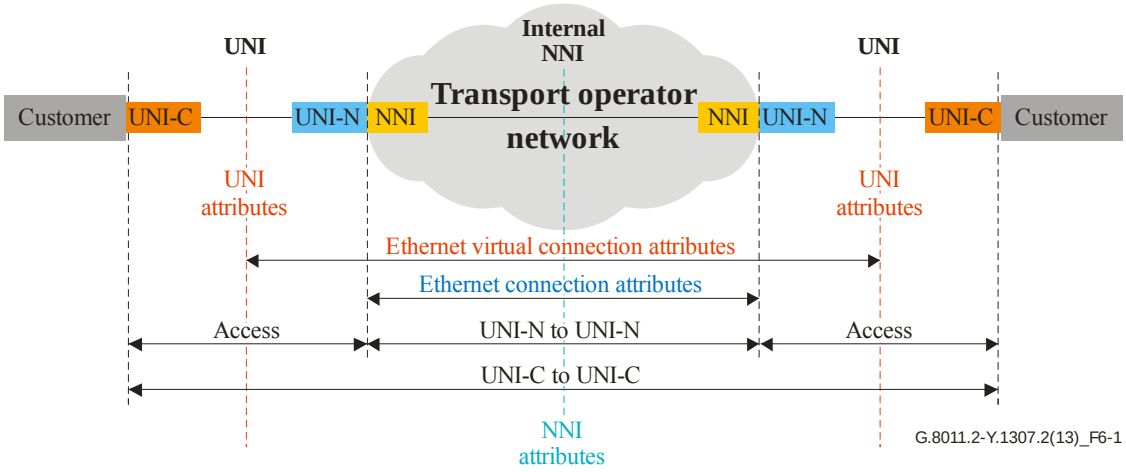

Figure 6-1 – Ethernet virtual private line

The [ITU-T G.8010] maintenance entities (ME) listed in Table 6-1 of [ITU-T G.8011] are shown at the bottom of Figure 6-1 and apply to EVPL. Additional details on the use of these for management of Ethernet services are described in [ITU-T G.8013].

6.2 EVPL service architecture

There are three types of EVPL described in this clause:

- EVPL type 1 (multiplexed access with dedicated server layer);
- EVPL type 2 (shared server layer with dedicated access);
- EVPL type 3 (shared server layer with multiplexed access).

These types are based on a combination of [ITU-T G.8011] attributes as shown in Table 6-1 below. The subtypes shown in the following clauses are degenerate cases of the base type.

Table 6-1 – EVPL types

Type	Shared server layer	Multiplexed access
EVPL type 1	N	Y
EVPL type 2	Y	N
EVPL type 3	Y	Y
EPL (see [ITU-T G.8011.1])	N	N

The components used to support an EVPL service shown in the figures of this clause are:

– the Ety-UNIs (UNI-N, UNI-C);

– the Ety-NNI;

– the Ethernet virtual connection;

– the access link.

The EVPL service uses an Ethernet UNI and is supported over Ethernet NNIs. EVPL type 1 service can specifically be supported over Ethernet-over-PDH, Ethernet-over-SDH, and Ethernet-over-OTH NNIs. EVPL type 1 service may also be supported over Ethernet-over-ATM with CIR and Ethernet-over-MPLS with CIR NNIs. EVPL type 2 and type 3 services can be supported over Ety-NNI in addition to those indicated for type 1. EVPL type 2 service may also be supported over Ethernet-over-ATM, Ethernet-over-Ethernet, and Ethernet-over-MPLS with CIR, EIR, CBS and EBS NNIs. The UNI and NNI are specified in [ITU-T G.8012] and [ITU-T G.8012.1].

6.2.1 EVPL type 1

Figure 6-2 shows the basic architecture of the EVPL type 1 service. The ETY layer is terminated at the UNI-N and the multiplexed ETH frames are forwarded over single ETH_FPs to the dedicated server layer. The UNI uses the VLAN tag for multiplexing at the demarcation point[1]. Multiplexed access based on the Service Multiplexing ETH UNI service attribute (per clause 8.1 of [ITU-T G.8011]) indicates multiple service instances existing across a single Ethernet UNI demarcation. Since this is the principle feature on the ingress of EVPL type 1, it is also referred to as multiplexed access.

[1] Note that the choice of customer or provider VLAN tags is dependent on service provider agreements.

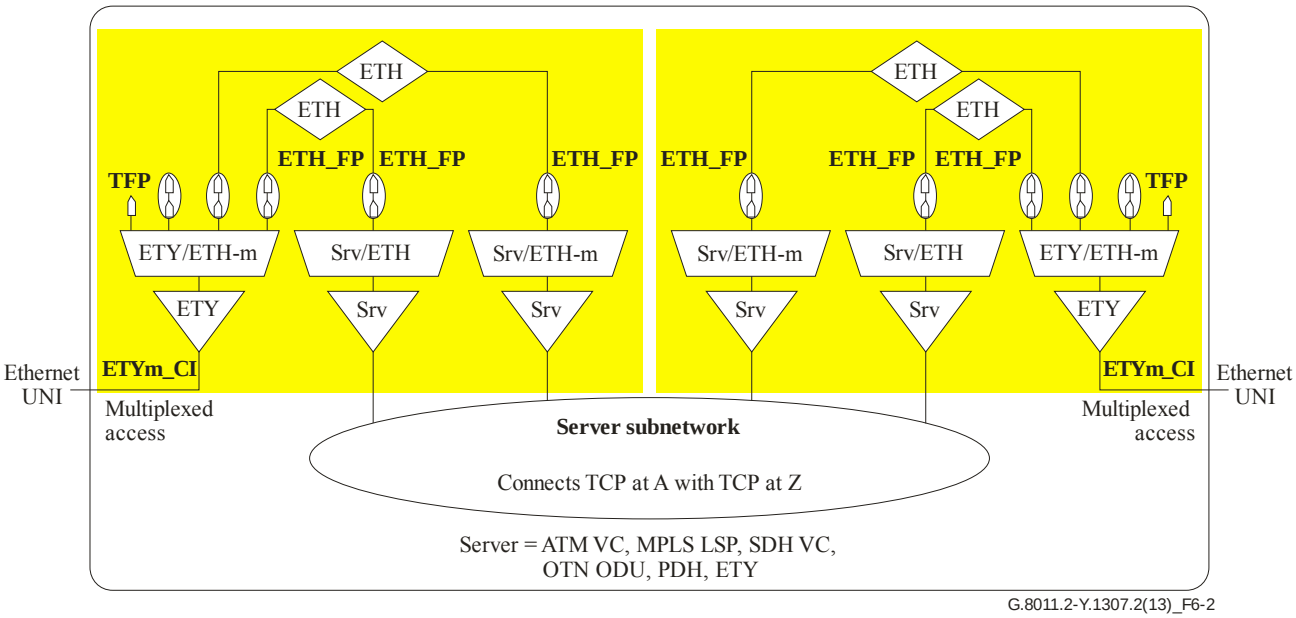

Figure 6-2 – Ethernet virtual private line type 1 (multiplexed access with dedicated server layer) architecture

6.2.1.1 EVPL type 1a

Figure 6-3 shows the basic architecture of the EVPL type 1a service. This shows a more typical case of EVPL type 1 with multiplexed access only on one side of the service.

In the case of type 1a service, the CIR of the multiplexed access Ethernet UNI must be equal to or greater than the sum of the individual CIRs of the Ethernet service instances running over the two UNIs. Additional details are outside the scope of this Recommendation.

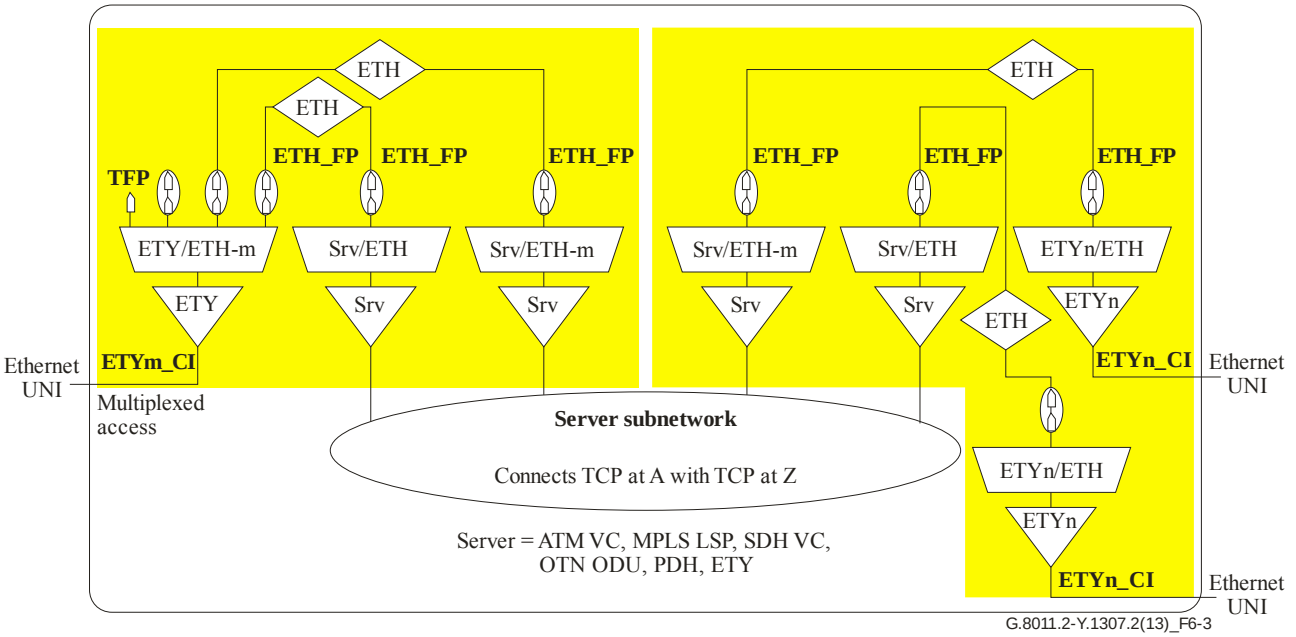

Figure 6-3 – Ethernet virtual private line type 1a (multiplexed access with dedicated server layer) architecture

6.2.2 EVPL type 2

Figure 6-4 shows the basic architecture of the EVPL type 2 service. Each service instance has dedicated access to the UNI-N. The ETY layer is terminated at the UNI-N and the ETH frames are forwarded over ETH_FPs to the shared server layer. A frame tag is associated with each frame in the server layer (i.e., logical separation) to perform the multiplexing. The tag is a service provider VLAN tag (S-VLAN).

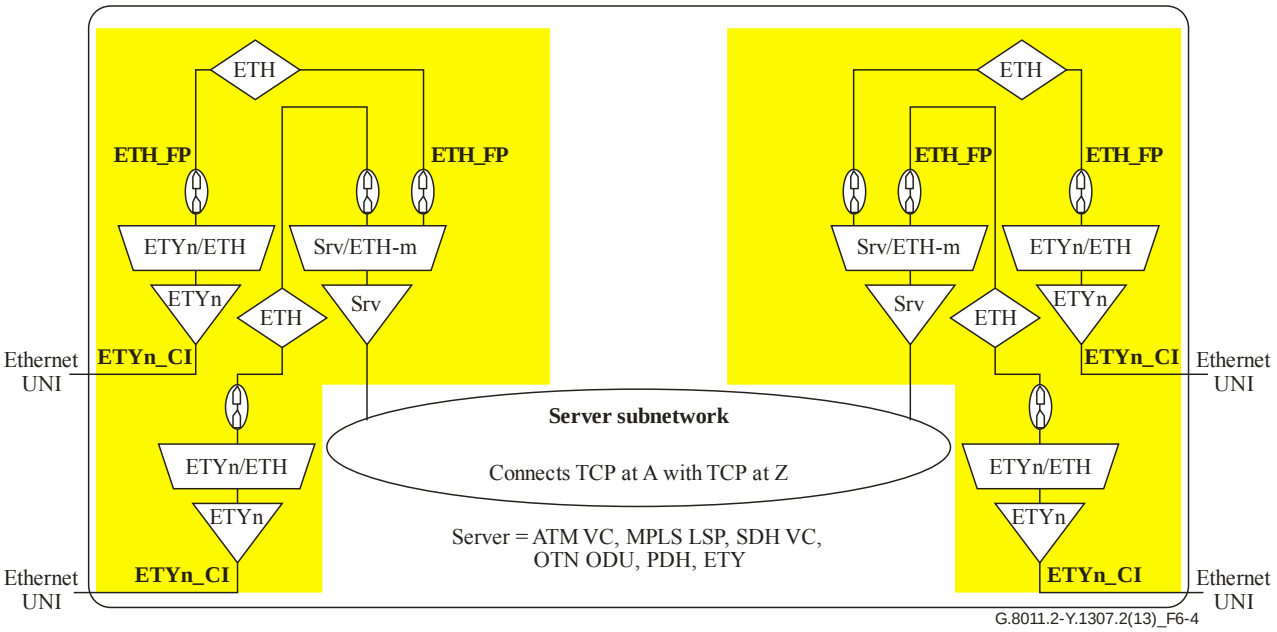

Figure 6-4 – Ethernet virtual private line type 2 (shared server layer with dedicated access) architecture

6.2.3 EVPL type 3

Figure 6-5 shows the basic architecture of the EVPL type 3 service. This specific figure shows a single Ethernet UNI and a single connection to the server layer with separate traffic conditioning per service instance The ETY layer is terminated at the UNI-N and the multiplexed ETH frames are forwarded over ETH_FPs to the shared server layer. In the combined multiplexing model, a frame tag is used for the multiplexing in the access network and in the server layer subnetwork. The access network may use VLAN tags and the server layer subnetwork may use VLAN tags (S-VLAN) or MPLS labels. For EVPL type 3, this results in two possible combinations resulting from a combination of type 1 and type 2 EVPLs, which are:

1) Access links use VLAN tags and the server layer subnetwork uses VLAN tags;

2) Access links use VLAN tags and the server layer subnetwork uses MPLS labels.

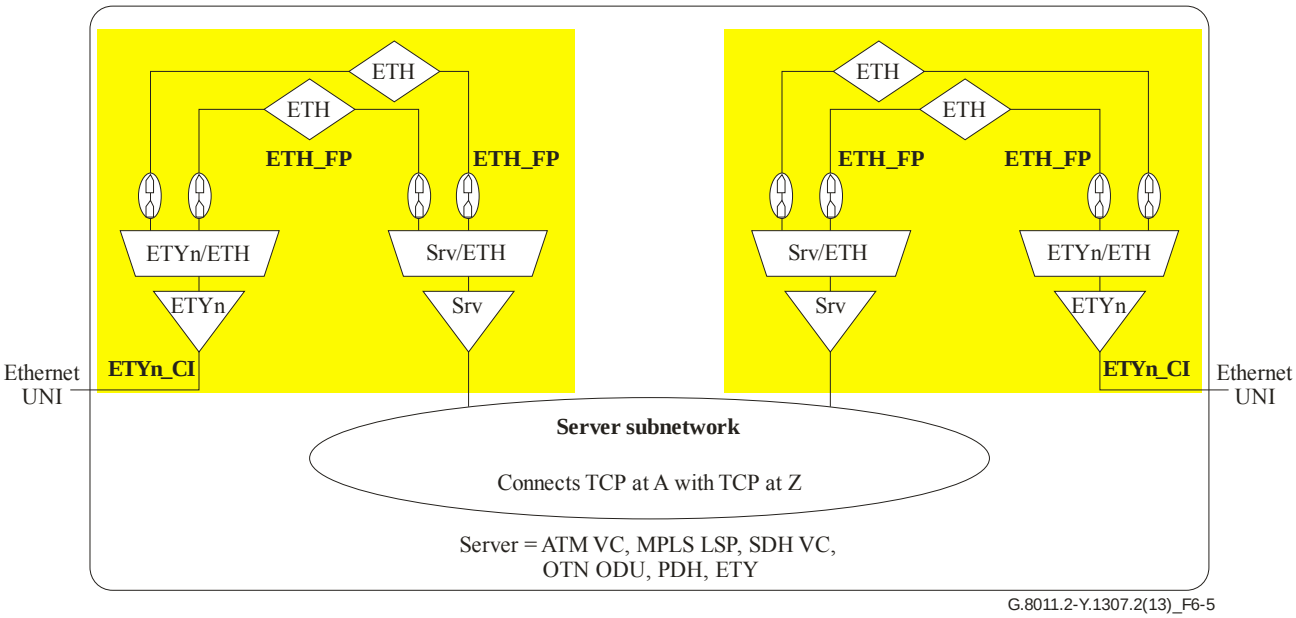

Figure 6-5 – Ethernet virtual private line type 3 (shared server layer with multiplexed access) architecture

Additional details on the server subnetwork, or EC, for supported server layers (including Ethernet bridging (ETH) per [IEEE 802.1Q] and [ITU-T G.8021.1]) are described in [ITU-T G.8012.1].

7 Ethernet virtual connection (EVC) service attributes for EVPL

The Ethernet virtual connection (EVC) service attributes are the same as the EVC attributes defined in [MEF 6.1] Table 16, as amended in [MEF 6.1.1], and are summarized in Table 7-1.

Table 7-1 – 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	**MUST** be 2
EVC MTU size	**MUST** be 2000 ≥ Integer ≥ 1522
CE-VLAN ID preservation	**MUST** be either Yes or No
CE-VLAN CoS preservation	**MUST** be either Yes or No
Unicast service frame delivery	Deliver Unconditionally or Deliver Conditionally. If Delivered Conditionally, **MUST** specify the delivery criteria
Multicast service frame delivery	Deliver Unconditionally or Deliver Conditionally. If Delivered Conditionally, **MUST** specify the delivery criteria
Broadcast service frame delivery	Deliver Unconditionally or Deliver Conditionally. If Delivered Conditionally, **MUST** specify the delivery criteria

Table 7-1 – EVC service attributes

EVC service attribute	Service attribute parameters and values
Layer 2 control protocols processing (only applies for L2CPs passed to the EVC)	**MUST** specify in accordance with section 8.1, 8.1.2 and 8.2 of [MEF 6.1.1]
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 Ethernet connection (EC) service attributes for EVPL

The Ethernet connection (EC) service attributes are described in the following clauses and are summarized in Table 7-2.

Table 7-2 – EC service attributes

EC service attribute	Service attribute parameters and values
Link type	Dedicated – EVPL type 1 Shared – EVPL types 2, 3
Survivability	None, server specific

7.1.1 Link type

The server link is referred to as dedicated for EVPL type 1, as defined in clause 7.2.1.1 of [ITU-T G.8011]. The server link is referred to as shared for EVPL type 2 and 3, as defined in clause 7.2.1.2 of [ITU-T G.8011].

7.1.2 Survivability

The transport network can provide survivability for the EVPL. The survivability options for the ETH link are, for example:

– No protection;

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

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

Various ETH server layer protection and restoration mechanisms are listed in [ITU-T G.8011].

8 EVPL UNI attributes

This clause describes the UNI service 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 ETY interfaces are further specified in [ITU-T G.8012]. The base set of EVPL UNI attributes is the same as the UNI attributes defined in [MEF 6.1], Tables 14 and 15 as amended in [MEF 6.1.1]. These are summarized in Table 8-1 indicating to which layer each attribute applies.

Table 8-1 – UNI service attributes

Layer	UNI service attribute	Service attribute parameters and values
ETH	UNI identifier	Arbitrary text string to identify the UNI
	MAC layer	[IEEE 802.3]
	UNI MTU size	**MUST** be 2000 ≥ Integer ≥ 1522
	Service multiplexing	EVPL type 1 and 3: **SHOULD** be supported at one or more UNIs. EVPL type 2: **MUST** be No
	Bundling	Yes or No. If Yes, then CE-VLAN ID Preservation **MUST** be Yes
	All to one bundling	**MUST** be No
	CE-VLAN ID for untagged and priority tagged service frames	**MUST** specify CE-VLAN ID for untagged and priority tagged service frames in the range of 1-4094
	Maximum number of EVCs	**MUST** be ≥ 1
	UNI EVC ID	A string formed by the concatenation of the UNI ID and the EVC ID
	CE-VLAN ID/EVC map	**MUST** specify mapping table of CE-VLAN IDs to the EVC ID
	Ingress bandwidth profile per UNI	**OPTIONAL.** If supported, **MUST** specify <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be allowed if any other ingress bandwidth profile is applied at this UNI
	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 <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be allowed if any other ingress bandwidth profile is applied at this UNI for this EVC
	Egress bandwidth profile per UNI	**OPTIONAL.** If supported, **MUST** specify <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be combined with any other type of egress bandwidth profile
	Egress bandwidth profile per EVC	**MUST** be No
	Egress bandwidth profile per CoS ID	**MUST** be No
	Layer 2 control protocol processing	**MUST** specify in accordance with clause 8.1, 8.1.2 and 8.2 of [MEF 6.1.1]

Table 8-1 – UNI service attributes

Layer	UNI service attribute	Service attribute parameters and values
ETY	Physical medium	UNI Type 2 Physical Interface, except for PON interfaces
	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
NOTE – The upper bound of 2000 bytes for UNI 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]).		

9 EVPL 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
Operator ENNI identifier	A string that is unique across the Operator MEN	7.1.1
Physical layer	One of the PHYs listed in [R5] of [MEF 26.1]	7.1.2
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

10 Connectivity monitoring

Connectivity monitoring can either be proactive (sub-layer monitoring, inherent monitoring) or on-demand using tools to be specified in [ITU-T G.8013]. In some network implementations, the connectivity monitoring can rely on the server layer connectivity monitoring (inherent monitoring). It is also an option to not perform monitoring.

Additional specifications on the use of connectivity fault management (CFM) as service OAM for fault management are defined in [MEF 30], and for performance monitoring are defined in [MEF 35].

Service OAM fault management [MEF 30] and service OAM performance monitoring [MEF 35] are used to implement the "EVC performance" EVC attribute.

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For further details, please refer to the list of ITU-T Recommendations.

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