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Internet protocol aspects – Transport

Ethernet virtual private line service

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 SDH, PDH, ATM, MPLS, OTH, 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 Recommendation ITU-T G.8011/Y.1307.

Source

Recommendation ITU-T G.8011.2/Y.1307.2 was approved on 13 January 2009 by ITU-T Study Group 15 (2009-2012) under Recommendation ITU-T A.8 procedures.

Keywords

Ethernet, Ethernet service, private line.

FOREWORD

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Recommendation ITU-T G.8011.2/Y.1307.2

Ethernet virtual private line service

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, 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 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.707] Recommendation ITU-T G.707/Y.1322 (2003), *Network node interface for the synchronous digital hierarchy (SDH)*.

[ITU-T G.709] Recommendation ITU-T G.709/Y.1331 (2003), *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 (2008), *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 (2009), *Ethernet service characteristics*.

[ITU-T G.8011.1] Recommendation ITU-T G.8011.1/Y.1307.1 (2004), *Ethernet private line service*, plus Corrigendum 1 (2005).

[ITU-T G.8012] Recommendation ITU-T G.8012/Y.1308 (2007), *Ethernet UNI and Ethernet NNI*.

[ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (2007), *Characteristics of Ethernet transport network equipment functional blocks*.

[ITU-T Y.1731] Recommendation ITU-T Y.1731 (2008), *OAM functions and mechanisms for Ethernet based networks*.

[IEEE 802.3-2008] IEEE 802.3-2008, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications*.

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

[IEEE 802.1X-2004] IEEE 802.1X-2004, *IEEE Standard for local and metropolitan area networks – Port-Based Network Access Control*.

[IEEE 802.1Q-2005] IEEE 802.1Q-2005, *IEEE Standard for local and metropolitan area networks – Virtual Bridged Local Area Networks*.

[IEEE 802.1ah-2008] IEEE 802.1ah-2008, *Standard for Local and Metropolitan Area Networks – Virtual Bridged Local Area Networks – Amendment 7: Provider Backbone Bridges*.

[IEEE 802.1ad-2005] IEEE 802.1ad-2005, *Standard for Local and Metropolitan Area Networks – Virtual Bridged Local Area Networks – Amendment 4: Provider Bridges*.

[IEEE 802.1AB-2005] IEEE 802.1AB-2005, *IEEE Standard for local and metropolitan area networks – Station and Media Access Control Connectivity Discovery*.

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

[MEF 10.1] The Metro Ethernet Forum MEF (2006), *Technical Specification MEF 10.1 – Ethernet Service Attributes – Phase 2*.

3 Terms and definitions

This Recommendation uses the following terms defined in [ITU-T G.8010]:

31 ETH link

3.2 Subnetwork

3.3 Flow domain fragment

3.4 Link connection

This Recommendation uses the following terms defined in [ITU-T G.8011]:

3.5 Block

3.6 Committed information rate (CIR)

3.7 Dedicated

3.8 Pass

3.9 Process (with respect to L2 control protocol frames)

3.10 Service instance

3.11 Spatial

This Recommendation uses the following terms defined in [ITU-T G.809]:

3.12 Flow Point

3.13 Flow termination

3.14 Termination flow point

This Recommendation uses the following terms defined in [ITU-T G.8001]:

3.15 Access link

3.16 Customer

3.17 Ethernet service

3.18 Ety-NNI

3.19 Ety-UNI

3.20 EPL type 1

3.21 EPL type 2

3.22 EVPL type 1

3.23 EVPL type 2

3.24 EVPL type 3

3.25 Traffic Conditioning function

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
CLPS	Connectionless Packet Switched
CO-CS	Connection Oriented Circuit Switched
CO-PS	Connection Oriented Packet Switched
DA	Destination Address
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 Circuit
FCS	Frame Check Sequence
FDFr	Flow Domain Fragment
GFP	Generic Framing Procedure
LACP	Link Aggregation Control Protocol
LCAS	Link Capacity Adjustment Scheme

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
PA	(Ethernet) Preamble
PDH	Plesiochronous Digital Hierarchy
PHY	Physical device
SA	Source Address
SDH	Synchronous Digital Hierarchy
SDU	Service Data Unit
SFD	Start of Frame Delimiter
SN	Subnetwork
SNCP	Subnetwork Connection Protection
STP	Spanning Tree Protocol
UNI	User Network Interface

5 Conventions

In this Recommendation, the term 'shared server layer' is equivalent to a server layer that is supporting Ethernet links with a [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]. Unlike the previous version of this Recommendation, the base Ethernet services attributes are imported from [MEF 10.1] 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), 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.

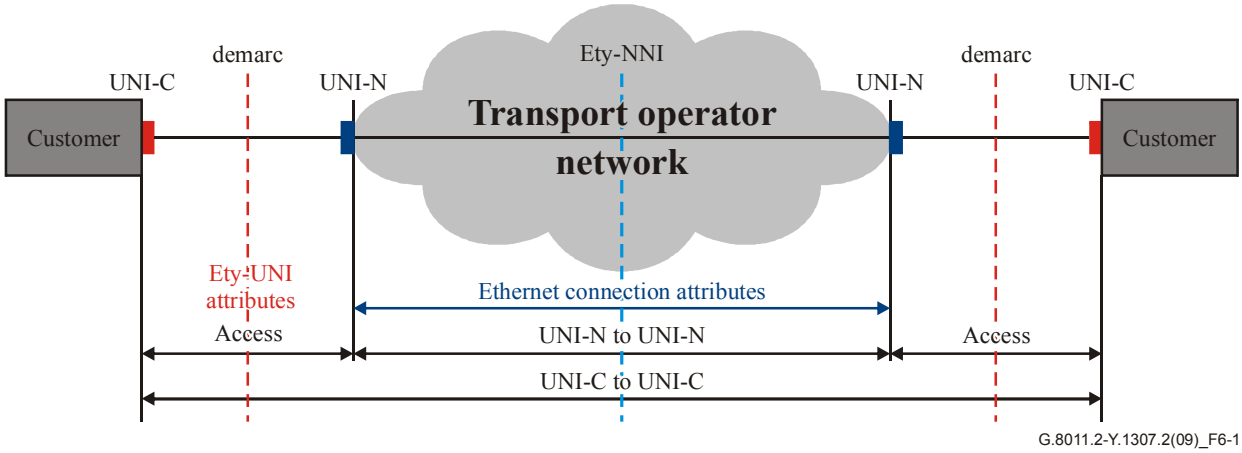

Figure 6-1 – Ethernet virtual private line

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 Y.1731].

6.2 EVPL service architecture

There are three types of EVPL described in this clause:

- EVPL type 1 (multiplexed access with EPL);
- 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 and Ethernet-over-MPLS with CIR, EIR, CBS and EBS NNIs. The UNI and NNI are specified in [ITU-T G.8012].

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 (per clause 8.1.4 of [ITU-T G.8011] is an Ethernet UNI attribute that 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.

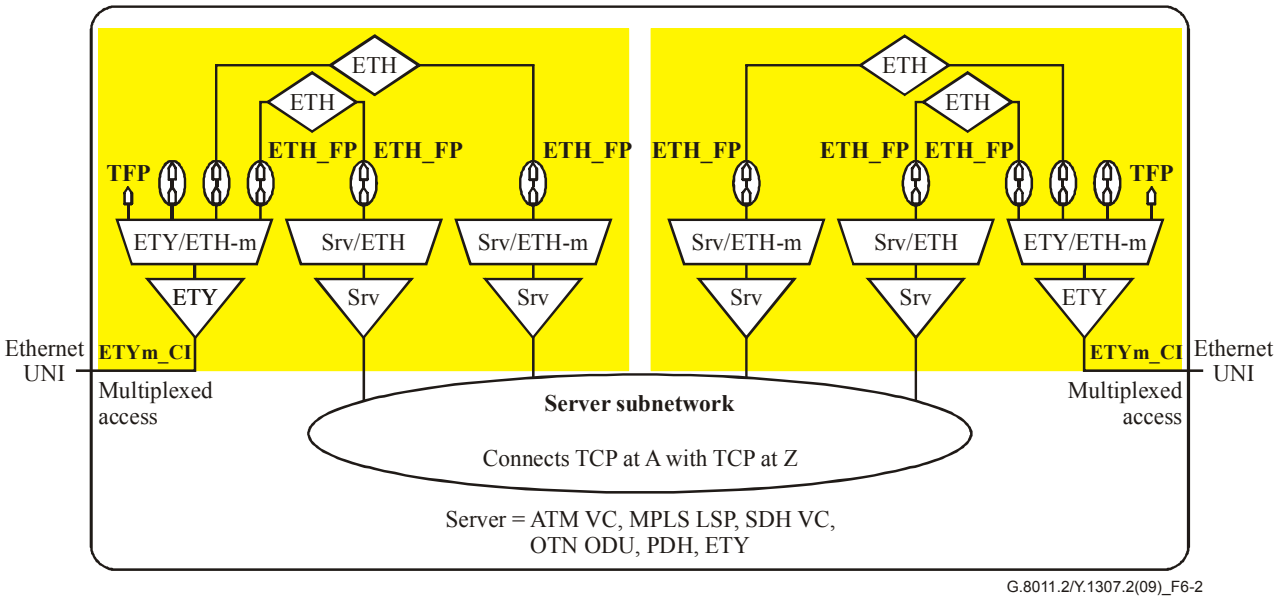

Figure 6-2 – Ethernet virtual private line type 1 (multiplexed access with EPL) architecture

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 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.

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

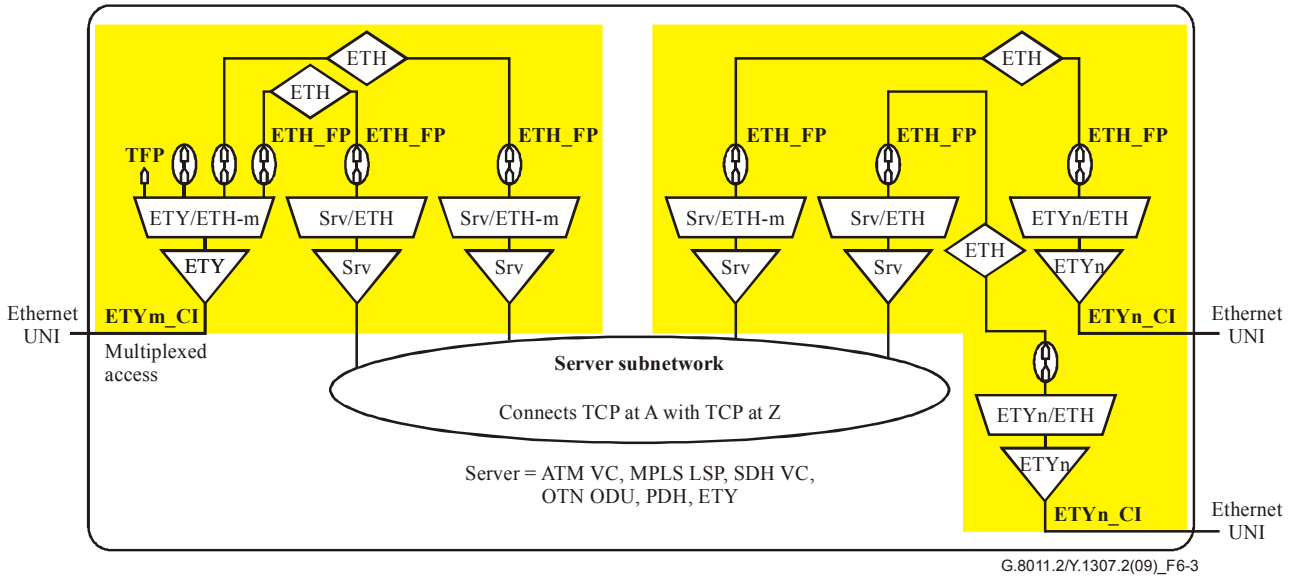

Figure 6-3 – Ethernet virtual private line type 1a (multiplexed access with EPL) architecture

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).

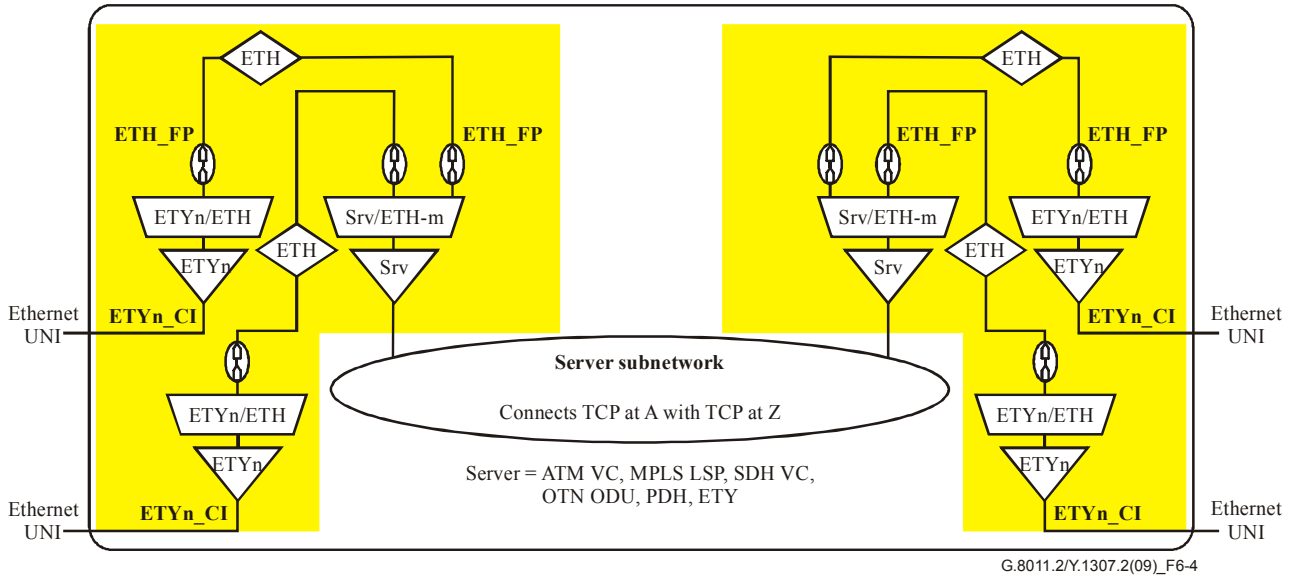

Figure 6-4 – Ethernet virtual private line type 2 (shared server layer with dedicated access) architecture

6.2.2.1 EVPL type 2a

Figure 6-5 shows the basic architecture of the EVPL type 2a 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 a first dedicated server layer (i.e., spatial separation). The first server layer is connected to a second server layer (not illustrated) which multiplexes the flows (e.g., as in EVPL type 2). This is the case where the two server layer subnetworks are joined by some type of multiplexing function.

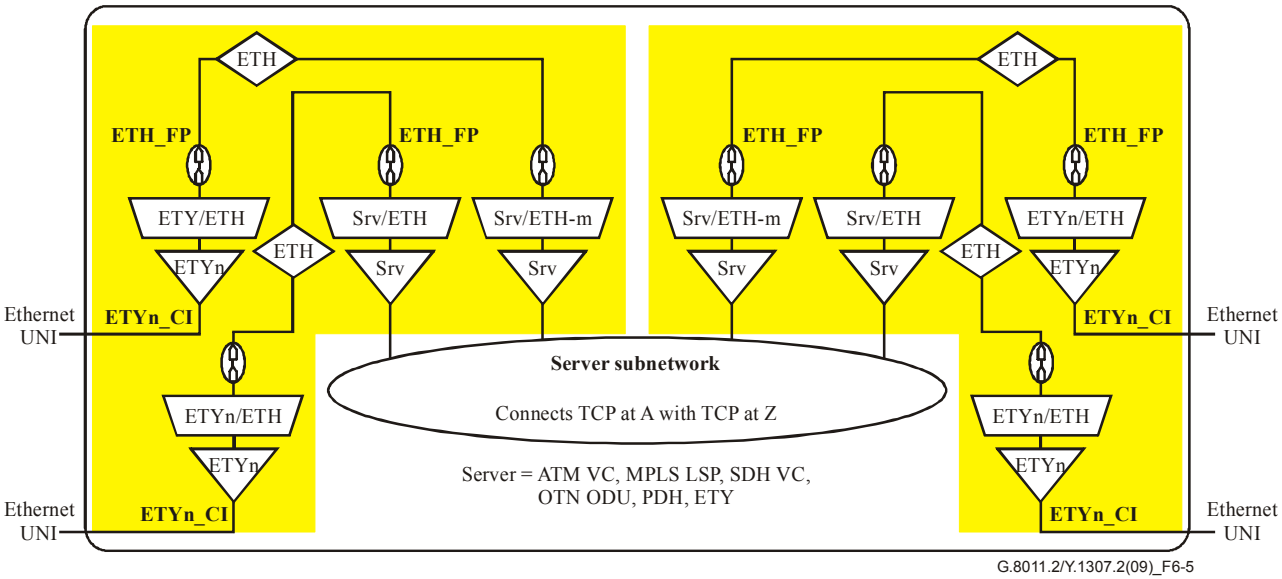

Figure 6-5 – Ethernet virtual private line type 2a (shared server layer with dedicated access) architecture

Though not explicitly shown in Figure 6-5, type 2a service is distinguished by multiplexing within the server layer subnetwork.

A frame tag is associated with each frame in the server layer (i.e., logical separation) to perform the multiplexing. The tag may be an MPLS label, or some other server layer tag. This label/tag is inserted by the adaptation function (not illustrated) below the SRV_TT/SRV_FT function.

6.2.3 EVPL type 3

Figure 6-6 shows the basic architecture of the EVPL type 3 service. Each service instance is separated either logically or spatially at the UNI-N (as shown in the figure). The ETY layer is terminated at the UNI-N and the multiplexed ETH frames (i.e., logical separation) 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.

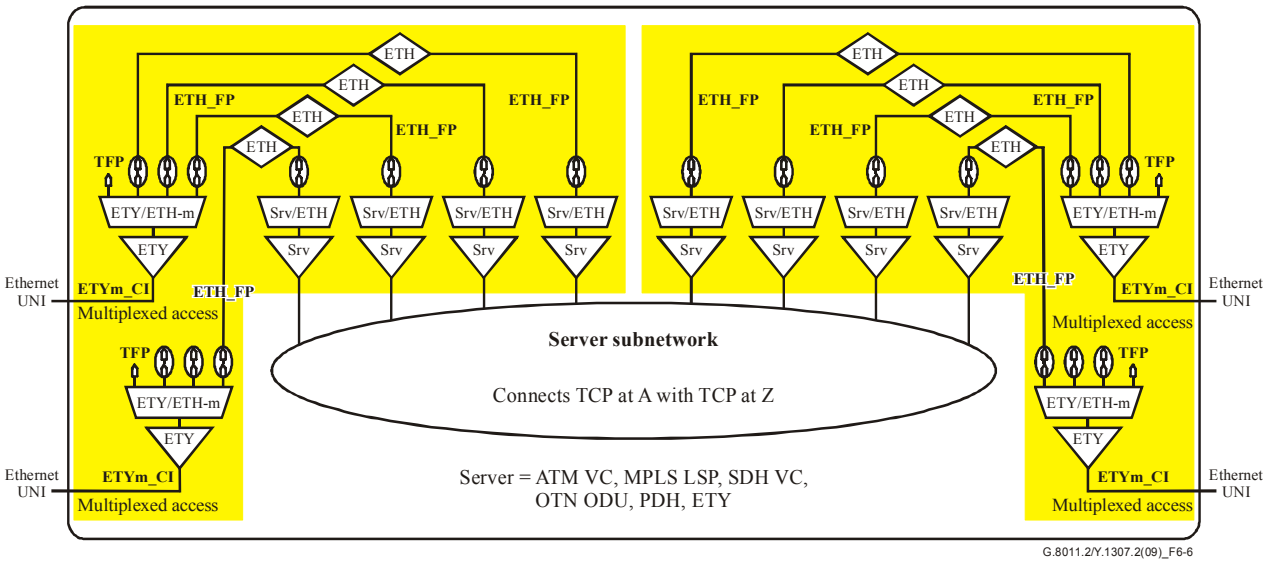

Figure 6-6 – Ethernet virtual private line type 3 (shared server layer with multiplexed access) architecture

6.2.3.1 EVPL type 3a

Figure 6-7 shows a subset of the EVPL type 3 service. This specific architecture shows a single Ethernet UNI and a single connection to the server layer with separate traffic conditioning per service instance.

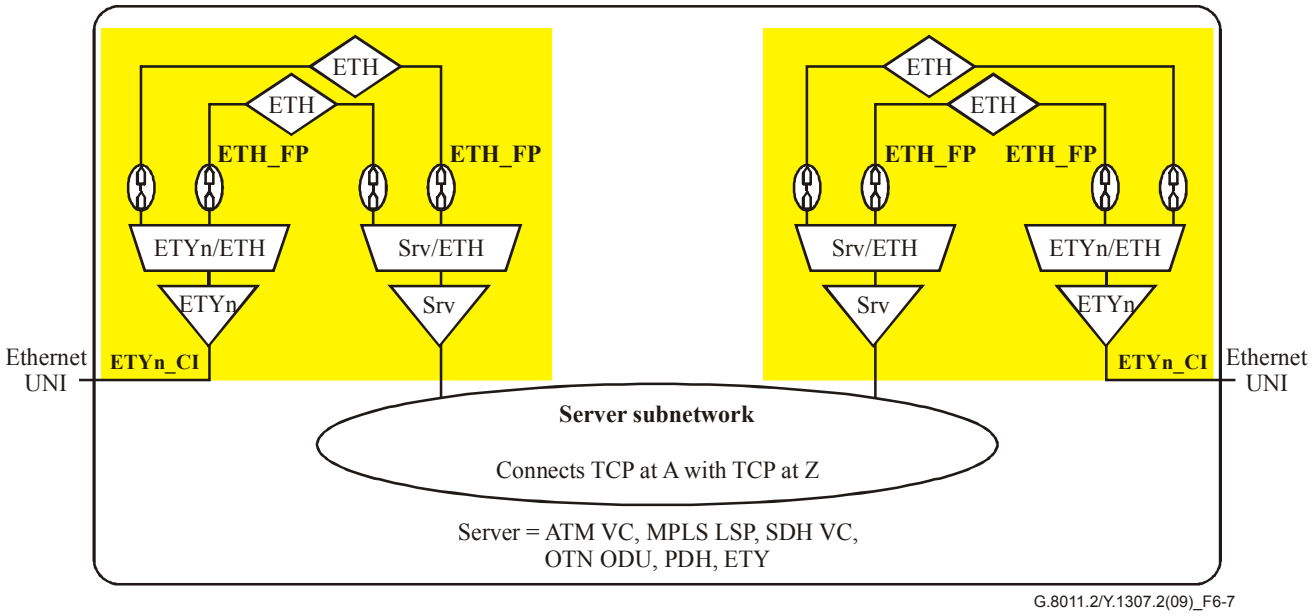

Figure 6-7 – Ethernet virtual private line type 3a (shared server layer with multiplexed access) architecture

7 Ethernet virtual connection (EVC) service attributes for EVPL

The Ethernet connection service attributes are described in the following clauses 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 ≥ 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.
Layer 2 control protocols processing (only applies for L2CPs passed to the EVC)	**MUST** specify in accordance with clause 7.8.
Service performance	**MAY** support none, one, or more than one CoS. If supported, a CoS ID, and values for frame delay, frame delay variation, frame loss ratio, and availability **MUST** be specified for each CoS.
Ingress bandwidth profile per EVC	**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 EVC	**MUST** be No.
Link type	Dedicated – EVPL type 1 Shared – EVPL types 2, 3
Traffic separation	Logical – EVPL type 1 Spatial or logical – EVPL types 2, 3
Connectivity monitoring	Sub-layer monitoring: On demand and/or proactive. Inherent monitoring: Proactive.
Survivability	None, server specific.

7.1 EVC type

The connectivity of EVPL is point-to-point.

7.2 EVC ID

An arbitrary string.

7.3 UNI list

The UNI list is an arbitrary string administered by the service provider that is used to identify the UNIs connected to the EC. It is intended for management and control purposes.

7.4 Maximum number of UNIs

The maximum number of UNIs allowed is 2, per [MEF 6.1].

7.5 EVC maximum transmission unit size

The maximum MAC frame size supported at the UNI is at least 1522, as defined in clause 6.10 of [MEF 10.1], but no larger than 2000 (as specified in IEEE 802.3ap).

7.6 Preservation

This attribute indicates the preservation of specific components of the ETH_CI provided by the ETH layer network that is used to transport the Ethernet service. Preservation means that the parameter value will be the same on ingress and egress to the EC. The two parameters are the ingress VLAN ID and class of service (priority) of the ETH_CI. Both can be preserved in EVPL.

7.7 Service frame delivery

All Ethernet MAC data frames are transported regardless of their Destination Address.

For EVPL type 1 and 3 with multiplexed access, the Ethernet MAC data frames may be conditionally transported based on their Destination Address and optionally class of service (priority) of the ETH_CI.

7.8 Layer 2 control protocols

This attribute indicates which layer 2 control protocols will be tunnelled by the EVC and which will be discarded. The layer 2 control protocols are listed in Table 8-2. Only the tunnel and discard directives in the L2CP Requirements are relevant for the EVC – irrespective of the UNI applicability.

7.9 Performance

This parameter indicates the overall performance of the Ethernet Connection (EC or EVC), as defined in [MEF 6.1].

7.10 Bandwidth profile

Except for EVPL type 1, the EVPL service is generally defined by the four traffic parameters: CIR, CBS, EIR, and EBS, per [MEF 6.1]. For EVPL type 1, the service definition is based on CIR and CBS only. Table 7-2 below summarizes the traffic parameters relevant to each EVPL type. However, per [MEF 6.1], all parameters must be specified, i.e., <CIR, CBS, EIR, EBS, CM, CF>.

Table 7-2 – EVPL bandwidth profile parameters

EVPL service type	Traffic parameters
Type 1	CIR, CBS
Type 2	CIR, CBS, EIR, EBS
Type 3	CIR, CBS, EIR, EBS

An Ethernet flow that exceeds its committed rate will have its frames dropped or tagged with high drop precedence depending on the value of the EIR. Frames that exceed the flow EIR will be denied entry to the network and will be dropped at the access. Frames that exceed the flow CIR but are within its EIR will be marked with high drop precedence. Frames with high drop precedence will be dropped first when the network encounters congestion.

The function of the traffic conditioner includes frame metering and marking. The metering function is responsible for ensuring flow compliance to CIR and EIR. The marking function is responsible

for marking the flow frames with the appropriate drop precedence based on frame compliance with CIR or EIR. A customer may implement shaping to avoid frame loss due to statistical variation in traffic.

Network engineering and a level of resource allocation is required in order to ensure that flow performance objectives, e.g., frame delay and frame loss, are satisfied. Performance measures are usually applicable only to frames that are compliant with the flow CIR.

7.11 Link type

The server link is referred to as dedicated for EVPL type 1, as defined in clause 7.11.1 of [ITU-T G.8011]. The server link is referred to as shared for EVPL type 2 and 3, as defined in clause 7.11.2 of [ITU-T G.8011].

7.12 Traffic separation

The EVPL may use logical or spatial separation between customer traffic, as defined in clause 7.12.2 of [ITU-T G.8011], for EVPL types 2 and 3. EVPL type 1 uses logical separation.

The EVPL may use logical or spatial separation between service instances, as defined in clause 7.12.1 of [ITU-T G.8011], for EVPL types 2 and 3. EVPL type 1 uses logical separation.

7.13 Connectivity monitoring

Connectivity monitoring can either be proactive (sub-layer monitoring, inherent monitoring) or on-demand using tools to be specified in [ITU-T Y.1731]. 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.

7.14 Survivability

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

– No protection;

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

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

The applicability of survivability by means of LAG is for further study.

8 EVPL UNI attributes

8.1 ETH_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. These are summarized in Table 8-1.

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 802.3-2005
	UNI MTU size	**MUST** be ≥ 1522
	Service multiplexing	EVPL type 1 and 3: **SHOULD** be supported. EVPL type 2: **MUST** be No.

Table 8-1 – UNI service attributes

Layer	UNI service attribute	Service attribute parameters and values
	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.
	Bundling.	EVPL type 1 and 3: Yes or No. If Yes, then CE-VLAN ID Preservation **MUST** be Yes. EVPL type 2: **MUST** be No.
	All to one bundling.	EVPL type 1 and 3: **MUST** be No. EVPL type 2: **MUST** be Yes.
	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
	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 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 allowed if any other egress bandwidth profile is applied at this UNI.
	Egress bandwidth profile per CoS ID.	**MUST** be No.
	Layer 2 control protocol processing.	**MUST** specify in accordance with clause 8.1.11.
ETY	Physical medium.	UNI Type 2 Physical Interface.
	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.

8.1.1 UNI ID

The UNI ID is an arbitrary string administered by the service provider, that is used to identify the UNI. It is intended for management and control purposes.

8.1.2 MAC layer

The EVPL type 1 UNI supports all 802.3 MAC frames. From a service viewpoint, the FCS is passed through at the ETY_UNI. If the FCS is bad (i.e., the frame is errored) at the ETY_UNI, the frame is dropped.

8.1.3 MTU size

The maximum MAC frame size supported at the UNI is at least 1522, as defined in clause 7.4 of [MEF 10.1], but no larger than 2000 (as specified in IEEE 802.3ap).

8.1.4 Service multiplexing

This attribute indicates if the access to the Ethernet transport service is multiplexed (i.e., contains multiple service instances) or not. EVPL type 2 does not use multiplexed access. However, EVPL type 1 and 3 support multiplexed access.

8.1.5 UNI EVC ID

The UNI EC ID is an arbitrary string administered by the service provider, that is used to identify an EC at the UNI. It is intended for management and control purposes.

8.1.6 C-VLAN ID mapping

At the UNI there is a mapping of each customer VLAN ID to at most one EC. For EVPL, VLAN ID mapping is supported.

8.1.7 Maximum number of EVCs

The maximum number of EVCs supported at the UNI is at least 1, per [MEF 6.1].

8.1.8 Bundling

When a UNI has the bundling attribute, it is configurable so that more than one VLAN ID can map to an EC at the UNI. For EVPL type 2, bundling is all-to-one and bundling is no. For EVPL type 1 and 3, bundling is not supported.

8.1.9 All-to-one bundling

For EVPL type 2, bundling is all-to-one. For EVPL type 1 and 3, all-to-one bundling is not supported.

8.1.10 Bandwidth profile

The bandwidth profile at the ETH_UNI is specified in clause 7.10

8.1.11 Layer 2 control protocol processing

L2 control frames may be tunnelled (passed), peered (processed), discarded (blocked) or generated as specified in Tables 8-2 and 8-3 below. [ITU-T G.8011] describes these actions.

For EVPL, the choice of pass, block or process is independent of the server layer (except as noted), but is customer service dependent.

Table 8-2 – Ingress (sink) 802 L2 control protocols UNI processing for EVPL type 1, 2 and 3

Protocol	MAC DA	L2CP requirement	Applicability
STP/RSTP/MSTP	01-80-C2-00-00-00	**MUST** Peer or Discard	All UNIs in the EVC
PAUSE	01-80-C2-00-00-01	**MUST** Discard	All UNIs in the EVC
LACP/LAMP	01-80-C2-00-00-02	**MUST** Peer or Discard	Per UNI
Link OAM	01-80-C2-00-00-02	**MUST** Peer or Discard	Per UNI
Port Authentication	01-80-C2-00-00-03	**MUST** Peer or Discard	Per UNI
E-LMI	01-80-C2-00-00-07	**MUST** Peer or Discard	Per UNI
LLDP	01-80-C2-00-00-0E	**MUST** Discard	All UNIs in the EVC
GARP/MRP Block	01-80-C2-00-00-20 through 01-80-C2-00-00-2F	**MUST** Peer, Tunnel or Discard	Per UNI

NOTE 1 – Link layer protocols (e.g., Slow protocols) processed at the UNI are port based and will act on all services on the link.

NOTE 2 – If there is no UNI/NNI process implementing the 802.3ah OAM and the Slow protocols are not processed by the UNI, then the valid action becomes Pass for the ingress table. For the egress table below it becomes none. As a consequence, if the customer is sending OAM frames across the access link, these frames will be received by the customer equipment at the other end of the virtual private line. For example, such a situation may occur when there is no support for 802.3ah OAM on the provider edge devices, while there is support for 802.3ah OAM on the two end customer devices (i.e., at the end of each access link).

Table 8-3.1 – Egress (source) 802.3 L2 control protocols UNI processing for EVPL type 1 and 3

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-01 or unicast	88-08	0x0001	None	MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02	None or generate	Slow protocols – LACP, LAMP
01-80-C2-00-00-02	88-09	0x03	None or generate	Slow protocols – EFM OAM

Table 8-3.2 – Egress (source) 802.3 L2 control protocols UNI processing for EVPL type 2

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-01 or unicast	88-08	0x0001	None or generate	MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02	None or generate	Slow protocols – LACP, LAMP
01-80-C2-00-00-02	88-09	0x03	None or generate	Slow protocols – EFM OAM
NOTE – Slow protocols generated at the UNI are port based and will represent all services on the link.				

8.1.12 Connectivity monitoring

For EVPL connectivity monitoring is achieved via Ethernet OAM mechanisms defined in [ITU-T Y.1731]/IEEE 802.1ag 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.

The appropriate CFM protocol processing at the UNI-N is summarized in Table 8-4. Note that the action applies to per UNI.

Table 8-4 – CFM protocol processing at UNI-N

CFM Protocol	MAC DA	MEG level	Action
UNI ME, CC	01-80-C2-00-00-3X or Unicast	Specify	**SHOULD** Peer or Discard
UNI ME, LT	01-80-C2-00-00-3Y	Specify	**SHOULD** Peer or Discard
UNI ME, LB	Unicast	Specify	**SHOULD** Peer or Discard
Test ME	Unicast	Specify	**SHOULD** Peer or Discard
Subscriber ME	Unicast	Specify	**SHOULD** Peer or Discard

For each level, any specific Y.1731 messages (e.g., CCM, LT, LB, AIS) that can be supported (i.e., tunnelled, peered or blocked) are listed (the default, if nothing is listed, is that they are all supported).

In addition, there is a need to indicate at which level AIS/LCK is expected at. This may be indicated in the previous attribute, if it is not indicated it is not expected.

Note that EFM OAM and ELMI support at the UNI have already been by listing them under clause 8.1.11 L2CP. There are implications on network performance when these messages are tunnelled or blocked.

8.2 ETY UNI attributes

The ETY_UNI is a PHY characterized by speed, mode, and medium. These attributes are described in [ITU-T G.8011]. The attributes that apply to EVPL are specified as follows:

8.2.1 Medium

This attribute indicates the medium of Ethernet PHY layer that is used to transport the Ethernet service. The values are defined in clause 8 of [ITU-T G.8012].

8.2.2 Speed

This attribute indicates the speed of Ethernet PHY layer that is used to transport the Ethernet service. There are four values defined by [ITU-T G.8012]: 10 Mbit/s, 100 Mbit/s, 1 Gbit/s and 10 Gbit/s.

8.2.3 Mode

This attribute indicates the mode of Ethernet PHY layer that is used to transport the Ethernet service. EVPL uses the full duplex mode.

9 EVPL NNI attributes

9.1 ETH_NNI attributes

Table 9-1 – NNI service attributes

	NNI service attribute	Service attribute parameters and values
ETH	MAC service	IEEE 802.3-2005 frame format.
	NNI ID	Arbitrary text string to identify each NNI instance.
	NNI EC ID	Arbitrary text string to identify each EC instance.
	Multiplexed link	No – EVPL type 1. Yes or No – EVPL types 2 and 3.
	VLAN mapping	Not applicable – EVPL type 1 Specify, or not applicable – EVPL types 2 and 3
	Bundling	For further study.
	Bandwidth profile	For further study.
	Layer 2 control protocol processing	Specified in Tables 8-2 and 8-3.
	NNI type	N/A
Server	Server layer	SDH, PDH, OTH, ETY, ATM, MPLS, ETH

9.1.1 MAC service

The EVPL NNI supports all 802.3 MAC frames. All ETH_CI is passed.

9.1.2 NNI identification

The NNI ID is an arbitrary string administered by the service provider that is used to identify the NNI. It is intended for management and control purposes.

9.1.3 NNI EC identification

Per clause 8.1.5.

9.1.4 Multiplexed link

EVPL type 1 does not support multiplexed NNI links. EVPL types 2 and 3 can use or not use multiplexed NNI links.

9.1.5 VLAN mapping

At the multiplexed NNI there is a mapping of service provider VLAN ID to at most one EC.

For non-multiplexed NNI, VLAN ID mapping is not applicable.

9.1.6 Bundling

For further study.

9.1.7 Bandwidth profile

For further study.

9.1.8 Layer 2 control protocol processing

L2 protocols are only visible at the NNI if it is an ETY. In this case, the L2 control protocols can be passed, processed, blocked, or none (per [ITU-T G.8011]). All 802 L2 protocols as listed in Table 8-2 of [ITU-T G.8011] are passed. Note that the action taken at the NNI should be consistent with action taken at the UNI.

9.2 Server layer adaptation

The server layers for all EVPL types described in clause 6 are specified in Table 9-2.

Table 9-2 – EVPL server layers

Server layer technology
SDH
OTH
PDH
MPLS
ATM
ETY
ETH

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