International Telecommunication Union

ITU-T G.8011.3/Y.1307.3

TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

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SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

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Ethernet virtual private LAN service

Recommendation ITU-T G.8011.3/Y.1307.3

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Recommendation ITU-T G.8011.3/Y.1307.3

Ethernet virtual private LAN service

Summary

Recommendation ITU-T G.8011.3/Y.1307.3 defines the service attributes and parameters for carrying Ethernet characteristic information over shared bandwidth, multipoint-to-multipoint connections, provided by SDH, PDH, ATM, MPLS, OTH, ETY or ETH server layer networks. This type of service is referred to as Ethernet virtual private LAN 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
1.0	ITU-T G.8011.3/Y.1307.3	2010-02-06	15

FOREWORD

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Ethernet virtual private LAN service

1 Scope

This Recommendation defines the service attributes and parameters for carrying Ethernet characteristic information over shared-bandwidth, multipoint-to-multipoint connections, provided by SDH, ATM, MPLS, PDH, ETY, OTH or ETH server layer networks. This type of service is referred to as Ethernet virtual private LAN service. This Recommendation is based on the Ethernet service framework as defined in [ITU-T G.8011].

This Recommendation specifies three attributes sets (EVC, UNI and NNI) and values to describe an Ethernet virtual private LAN service from the perspective of the network.

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 (2001), *Interfaces for the Optical Transport Network (OTN)*.

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

[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.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 (2009), *Ethernet private line service*.

[ITU-T G.8011.2] Recommendation ITU-T G.8011.2/Y.1307.2 (2009), *Ethernet virtual private line service*.

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

[ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (2004), *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 802.1AB] IEEE 802.1AB-2005, *IEEE Standard for Local and metropolitan area networks – Station and Media Access Control Connectivity Discovery*.

[IEEE 802.1ag] IEEE 802.1ag-2007, *IEEE Standard for Local and metropolitan area networks – Virtual Bridged Local Area Networks Amendment 5: Connectivity Fault Management*.

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

[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-2005, *IEEE standard for Local and metropolitan area networks – Virtual Bridged Local Area Networks*.

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

[IEEE 802.3] IEEE 802.3-2008, *IEEE Standard for 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 802.3ad] IEEE 802.3ad-2000, *Amendment to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications – Aggregation of Multiple Link Segments*.

[IEEE 802.3ah] IEEE 802.3ah-2004, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirement. Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications. Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks*.

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

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

[MEF 16] The Metro Ethernet Forum MEF (2006), *Technical Specification MEF 16 – Ethernet Local Management Interface (E-LMI)*.

3 Definitions

3.1 Terms defined elsewhere

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

3.1.1 ETH link

3.1.2 flow domain fragment (FDFr)

3.1.3 traffic conditioning function

This Recommendation uses the following terms defined in [ITU-T G.8011] and/or [MEF 10.1]:

3.1.4 all-to-one bundling

3.1.5 bundling

3.1.6 CE-VLAN CoS

3.1.7 CE-VLAN ID

3.1.8 CE-VLAN ID preservation

3.1.9 CE-VLAN ID/EVC map

3.1.10 CE-VLAN tag

3.1.11 class of service (CoS)

3.1.12 class of service identifier

3.1.13 colour mode (CM)

3.1.14 committed burst size (CBS)

3.1.15 committed information rate (CIR)

3.1.16 coupling flag (CF)

3.1.17 customer edge (CE)

3.1.18 customer edge VLAN CoS

3.1.19 customer edge VLAN ID

3.1.20 customer edge VLAN tag

3.1.21 egress bandwidth profile

3.1.22 excess burst size (EBS)

3.1.23 excess information rate (EIR)

3.1.24 Ethernet virtual connection (EVC)

3.1.25 EVC maximum transmission unit size

3.1.26 ingress bandwidth profile

3.1.27 ingress service frame

3.1.28 Layer 2 control protocol service frame

3.1.29 Layer 2 control protocol tunnelling

3.1.30 maximum number of UNIs (MNU)

3.1.31 multipoint-to-multipoint EVC

3.1.32 point-to-point EVC

3.1.33 rooted-multipoint EVC

3.1.34 service multiplexing

3.1.35 service provider

3.1.36 subscriber

3.1.37 UNI maximum transmission unit (MTU) size

3.1.38 user network interface (UNI)

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

3.1.39 flow domain

3.1.40 flow domain flow

3.1.41 flow point

3.1.42 flow termination

3.1.43 link flow

3.1.44 network flow

3.1.45 termination flow point

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 Ethernet virtual private LAN (EVPLAN) service: A multipoint-to-multipoint Ethernet connection (EC) for which several UNIs are attached (often with multiplexed access) over a shared server layer to a common UNI is defined as a virtual private LAN service.

3.2.2 EVPLAN type 1: EVPLAN type 1 is a multipoint-to-multipoint service over multiplexed access and a dedicated server layer.

3.2.3 EVPLAN type 2: EVPLAN type 2 is a multipoint-to-multipoint service over dedicated access and a shared server layer.

3.2.4 EVPLAN type 3: EVPLAN type 3 is a multipoint-to-multipoint service over multiplexed access and a shared server layer.

4 Acronyms and abbreviations

This Recommendation uses the following abbreviations:

ATM	Asynchronous Transfer Mode
CBR	Constant Bit Rate
CBS	Committed Burst Size
CCM	Continuity Check Message
CE	Customer Edge
CE-VLAN	Carrier Ethernet VLAN
CF	Coupling Flag
CI	Characteristic Information
CIR	Committed Information Rate
CLPS	Connectionless Packet Switched
CM	Colour Mode
CO-CS	Connection Oriented-Circuit Switched
CO-PS	Connection Oriented-Packet Switched
DA	Destination Address
DMM	Delay Measurement Message
DMR	Delay Measurement Reply
EBS	Excess Burst Size
EC	Ethernet Connection
EFM	Ethernet in the First Mile

EIR	Excess Information Rate
E-LAN	Ethernet Local Area Network
E-LMI	Ethernet Local Management Interface
ETH	Ethernet MAC layer network
ETH_CI	Ethernet MAC Characteristic Information
ETH_FF	Ethernet Flow Forwarding Function
ETH_FP	Ethernet Flow Point Function
ETY	Ethernet PHY layer network
EVC	Ethernet Virtual Connection
EVPLAN	Ethernet Virtual Private LAN
FCS	Frame Check Sequence
FDFr	Flow Domain Fragment
FF	Flow Forwarding
FP	Flow point
GARP	Generic Attribute Registration Protocol
GFP	Generic Framing Procedure
GMRP	GARP Multicast Registration Protocol
GVRP	GARP VLAN Registration Protocol
ID	Identification
LACP	Link Aggregation Control Protocol
LAMP	Link Aggregation Marker Protocol
LBM	Loopback Message
LC	Link Connection
LCAS	Link Capacity Adjustment Scheme
LTM	Link Trace Message
MAC	Media Access Control
MEF	Metro Ethernet Forum
MEG	Maintenance Entity Group
MEN	Metro Ethernet Network
MEP	MEG End Point
MIP	MEG Intermediate Point
MPLS	Multi-Protocol Label Switching
MSTP	Multiple Spanning Tree Protocol
MTU	Maximum Transmission Unit
NNI	Network-to-Network Interface
OAM	Operation, Administration, Maintenance
OTH	Optical Transport Hierarchy

OTN	Optical Transport Network
PA	(Ethernet) Preamble
PDH	Plesiochronous Digital Hierarchy
PHY	Physical device
RSTP	Rapid Spanning Tree Protocol
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
TFP	Termination Flow Point
UNI	User Network Interface
UNI-C	Customer side of UNI
UNI-N	Network side of UNI
VLAN	Virtual Local Area Network

5 Conventions

The diagrammatic convention for Ethernet services described in this Recommendation is that of [ITU-T G.8010].

Furthermore, the use of ETH link in this Recommendation is that of [ITU-T G.8010]. Specifically, ETH link is a generalization that collectively refers to ETH link and ETH link connection.

6 Ethernet virtual private LAN (EVPLAN) service

6.1 Description

An EVPLAN service is a multipoint-to-multipoint service between two or more 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 EVPLAN is frame-based characteristic information.

Some subscribers commonly desire an E-LAN service type to connect their UNIs in a metro 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 E-LAN service among the subscriber's several metro locations. We define the Ethernet virtual private LAN (EVPLAN) service in this clause to address this need.

Bundling may or may not be used on the UNIs in the multipoint-to-multipoint EC. As such, CE-VLAN tag preservation and tunnelling of certain Layer 2 control protocols may or may not be provided. Figure 6-1 below shows the basic structure of the EVPLAN service.

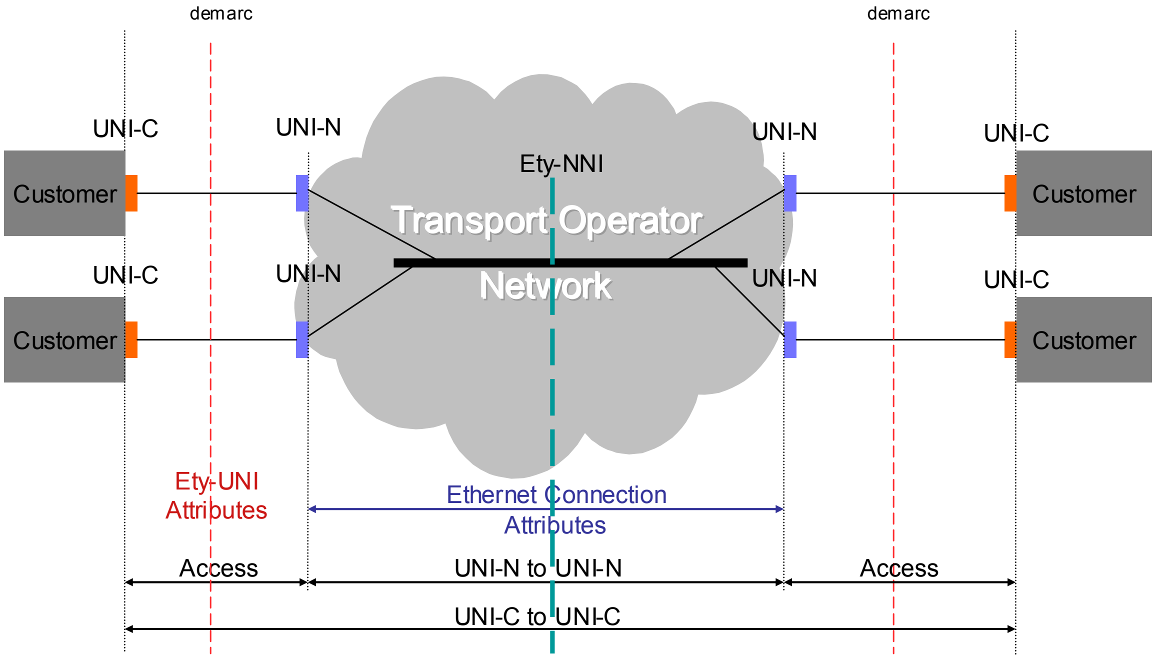


Figure 6-1 – Ethernet virtual private LAN (EVPLAN) service

6.2 Ethernet virtual private LAN (EVPLAN) service architecture

There are three types of EVPLAN described in this clause:

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

These types are based on a combination of the ITU-T G.8011/Y.1307 attributes shown in Table 6-1. The subtypes shown in the following clauses are degenerate cases of the base types.

Table 6-1 – EVPLAN types

Type	Shared server layer	Multiplexed access
EVPLAN type 1	N	Y
EVPLAN type 2	Y	N
EVPLAN type 3	Y	Y

The following clauses describe the three basic types and their subtypes.

6.2.1 EVPLAN type 1

For this type of EVPLAN 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. Multiplexed access (per clause 8.1.2 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 EVPLAN type 1, it is also referred to as multiplexed access.

There are two sub-types of EVPLAN type 1, depending on the loop prevention mechanism being used, as described in Table 6-2:

Table 6-2 – EVPLAN type 1 sub-types

Type	Loop prevention
EVPLAN type 1a	Full mesh with flow port grouping
EVPLAN type 1b	Spanning tree

6.2.1.1 EVPLAN type 1a

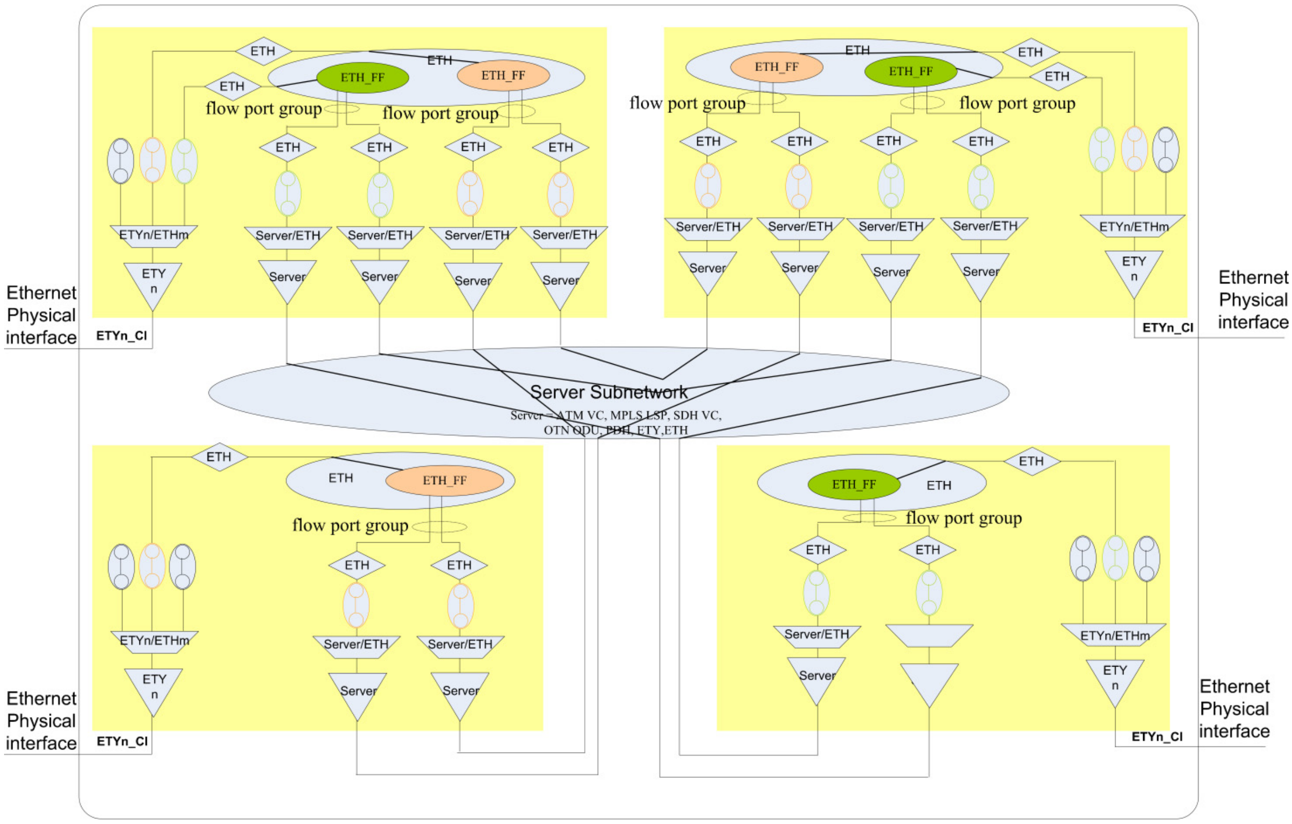


Figure 6-2 – EVPLAN type 1 service architecture

Figure 6-2 shows the basic architecture of the EVPLAN type 1a service. For each service, there is a dedicated server layer connection to any of the other UNIs. At the user side, a traffic conditioning function is present for controlling the traffic rate from/to the user network. An ETH_FF is present at each UNI for traffic forwarding based on the destination MAC address. The Ethernet traffic from the user will be mapped/de-mapped to/from the server layer connections by a server/ETH adaptation function.

Since the full-mesh connection could form traffic looping, flow port grouping should be deployed at the ETH_FF, i.e., the packet received from one UNI will not be forwarded to another UNI.

6.2.1.2 EVPLAN type 1b

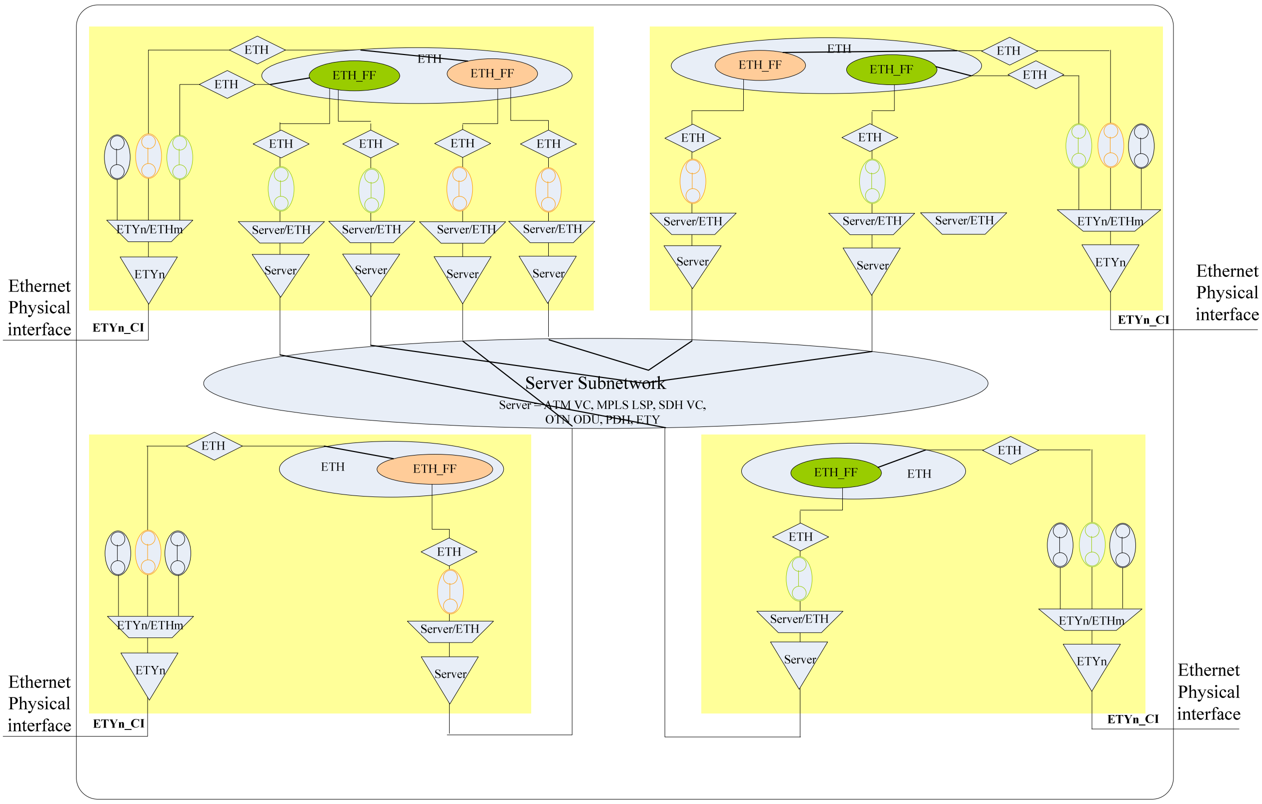


Figure 6-3 – EVPLAN type 1b service architecture

Figure 6-3 shows the basic architecture of the EVPLAN type 1b service. For each service, the EVPLAN UNIs are connected by a dedicated spanning tree connection. The tree-style connectivity could avoid traffic looping. A traffic conditioning function should be provided at the UNI for controlling the rates from/to each point before mapping the traffic to the server layer connection.

6.2.2 EVPLAN type 2

For this type of EVPLAN 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.

There are two sub-types of EVPLAN type 2, based on the loop prevention mechanism being used, as described in Table 6-3:

Table 6-3 – EPLAN type 2 sub-types

Type	Loop prevention
EVPLAN type 2a	Full mesh with flow port grouping
EVPLAN type 2b	Spanning tree

6.2.2.1 EVPLAN type 2a

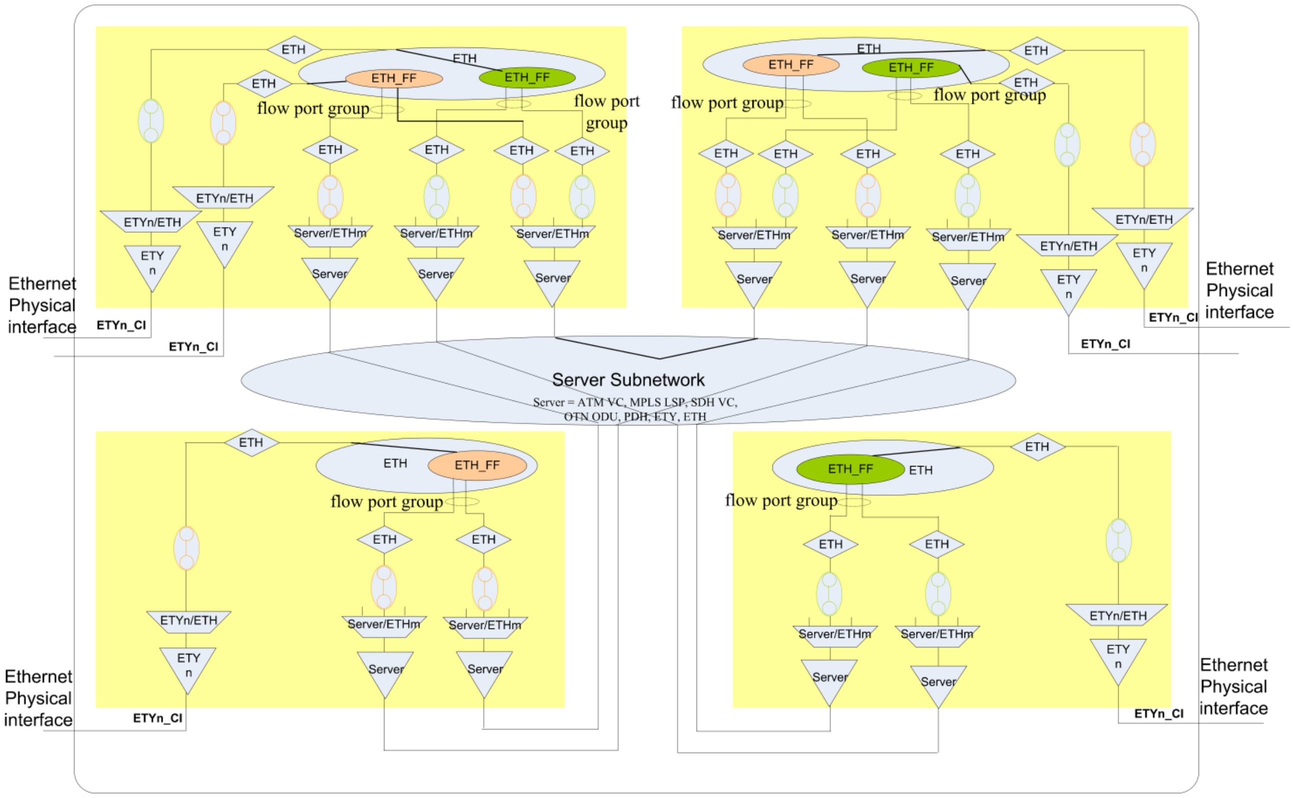


Figure 6-4 – EVPLAN type 2a service architecture

Figure 6-4 shows the basic architecture of the EVPLAN type 2a service. There is a server layer connection between each pair of UNIs. Each server layer connection can be shared by multiple services between the two UNIs. At the user side, a traffic conditioning function is present for controlling the traffic rate from/to the user network. An ETH_FF is present at each UNI for traffic forwarding based on the destination MAC address. The Ethernet traffic from the user will be mapped/de-mapped to/from the server layer connections by a server/ETH adaptation function.

Since the full-mesh connection could form traffic looping, flow port grouping should be deployed at the ETH_FF, i.e., the packet received from one UNI will not be forwarded to another UNI.

6.2.2.2 EVPLAN type 2b

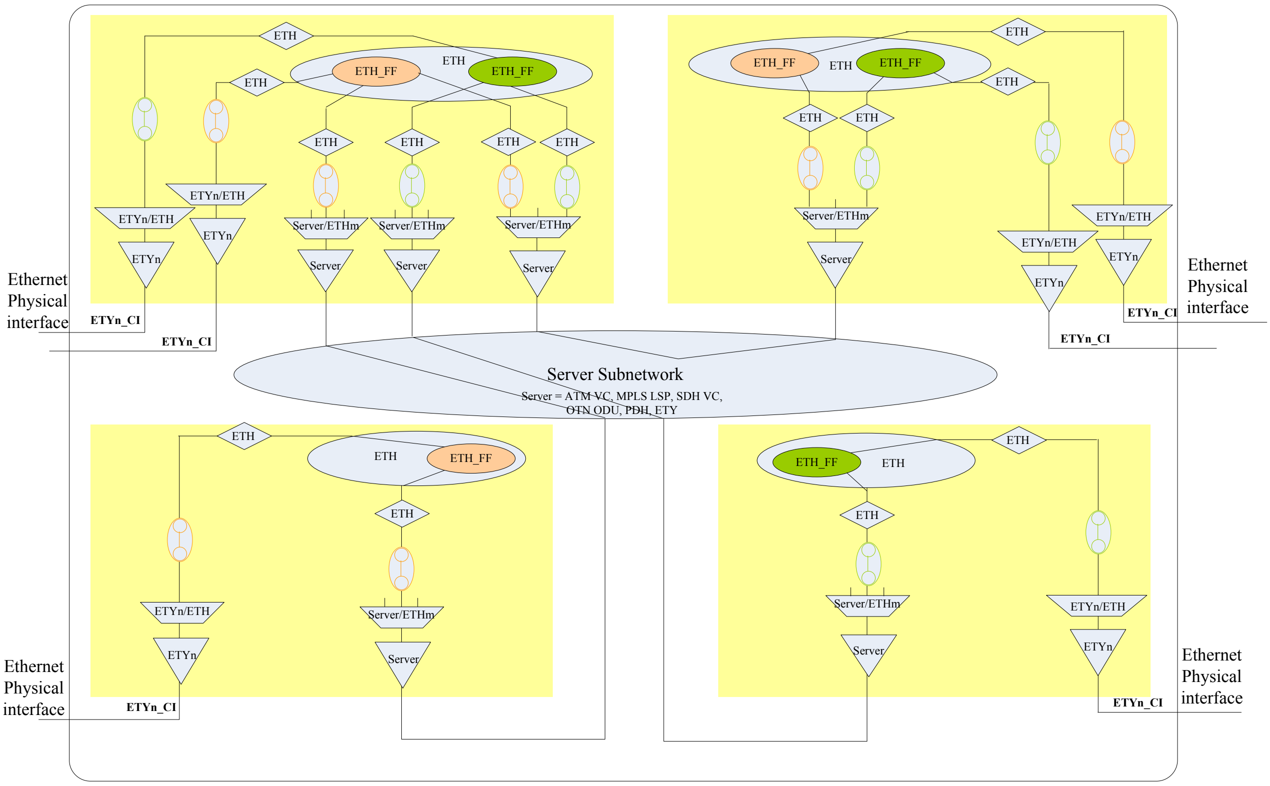


Figure 6-5 – EVPLAN type 2b service architecture

Figure 6-5 shows the basic architecture of the EVPLAN type 2b service. For each UNI, the EVPLAN UNIs are connected by a dedicated spanning tree connection. The tree-style connectivity could avoid traffic looping. A traffic conditioning function should be provided at the UNI for controlling the rates from/to each point before mapping the traffic to the server layer connection.

6.2.3 EVPLAN type 3

For this type of EVPLAN service, each service instance is separated either logically or spatially at the UNI-N. 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.

There are two sub-types of EVPLAN type 3, based on the loop prevention mechanism being used, as described by Table 6-4:

Table 6-4 – EVPLAN type 3 sub-types

Type	Loop prevention
EVPLAN type 3a	Full mesh with flow port grouping
EVPLAN type 3b	Spanning tree

6.2.3.1 EVPLAN type 3a

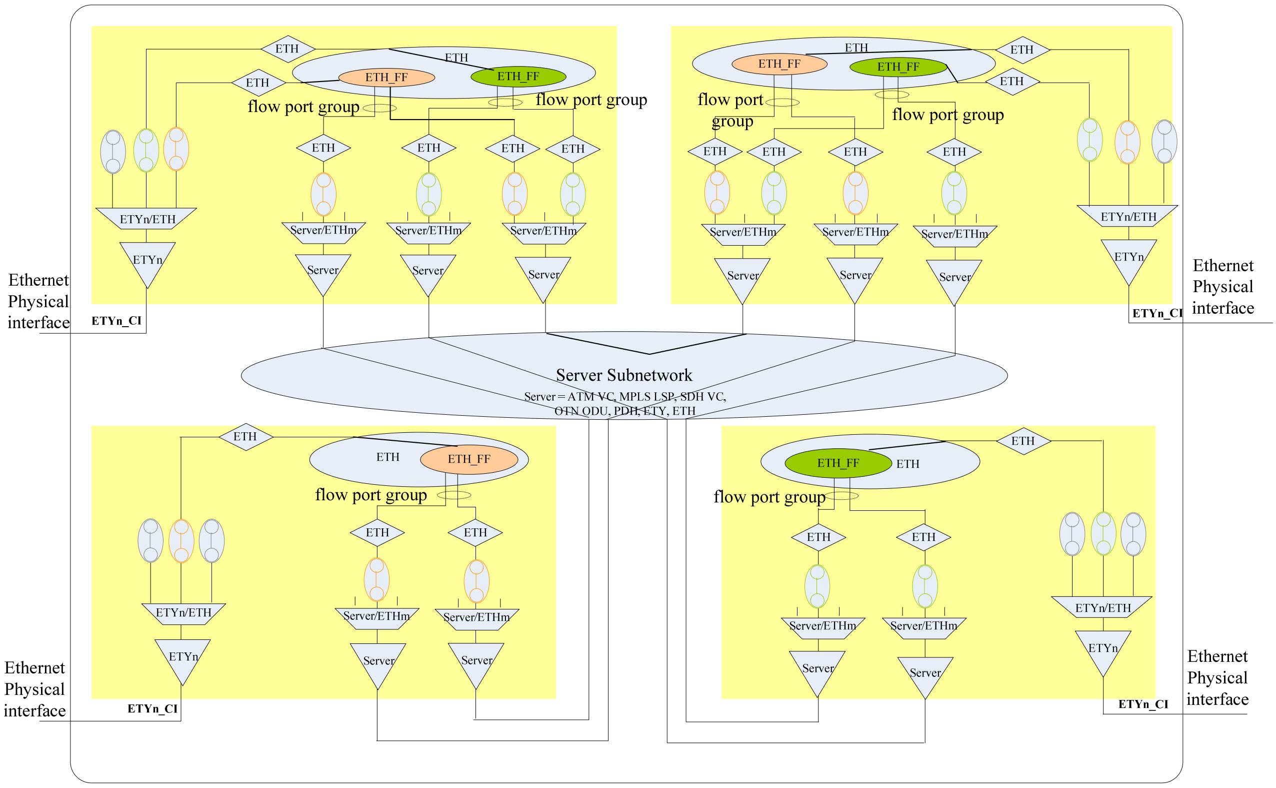


Figure 6-6 – EVPLAN type 3a service architecture

Figure 6-6 shows the basic architecture of the EVPLAN type 3a service. There is a server layer connection between each pair of UNIs. Each server layer connection can be shared by multiple services between the two UNIs. At the user side, a traffic conditioning function is present for controlling the traffic rate from/to the user network. An ETH_FF is present at each UNI for traffic forwarding based on the destination MAC address. The Ethernet traffic from the user will be mapped/de-mapped to/from the server layer connections by a server/ETH adaptation function.

Since the full-mesh connection could form traffic looping, flow port grouping should be deployed at the ETH_FF, i.e., the packet received from one UNI will not be forwarded to another UNI.

6.2.3.2 EVPLAN type 3b

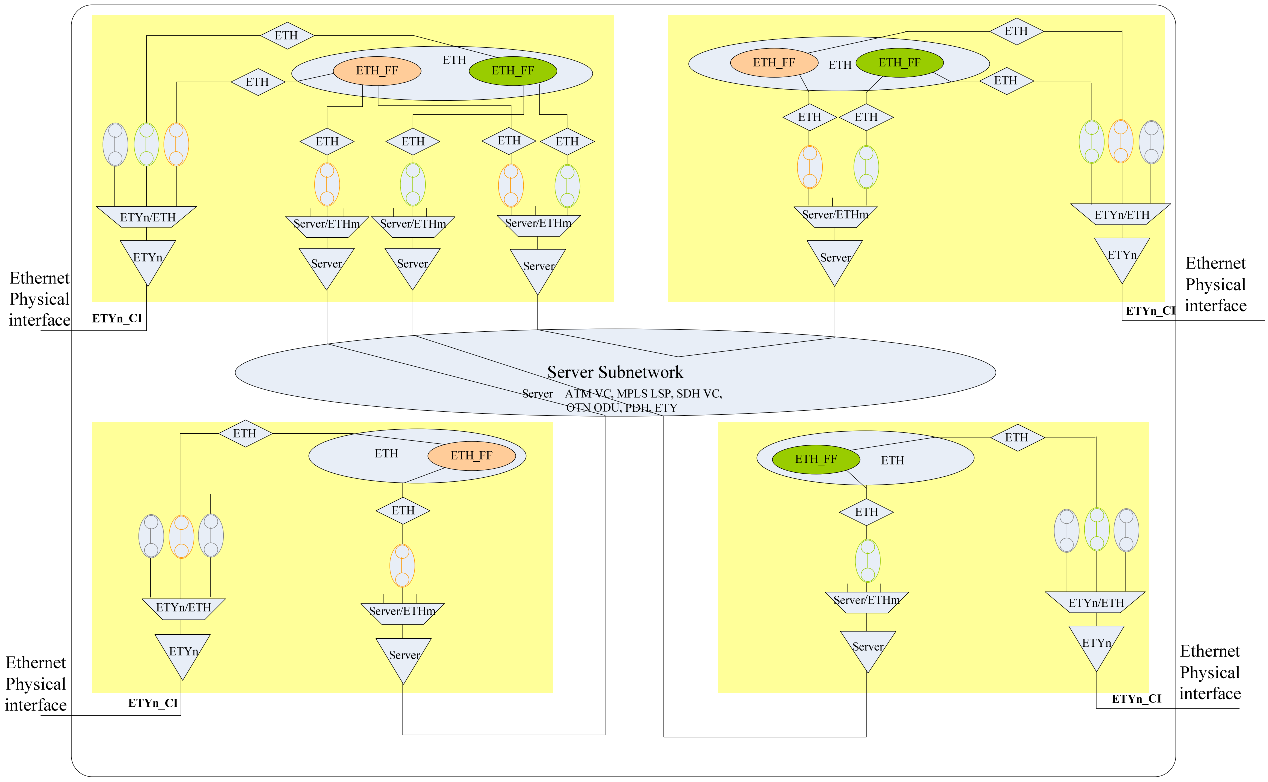


Figure 6-7 – EVPLAN type 3b service architecture

Figure 6-7 shows the basic architecture of the EVPLAN type 3b service. For each UNI, the EVPLAN UNIs are connected by a dedicated spanning tree connection. The tree-style connectivity could avoid traffic looping. A traffic conditioning function should be provided at the UNI for controlling the rates from/to each point before mapping the traffic to the server layer connection.

7 Ethernet virtual connection (EVC) attributes for the EVPLAN service

The Ethernet virtual connection attributes are described in the following subclauses and are summarized in Table 7-1.

Table 7-1 – EVC service attributes for the EVPLAN service

EVC service attribute	Service attribute parameters and values
EVC type	MUST be multipoint-to-multipoint.
EVC ID	An arbitrary string, unique across the MEN, for the EVC supporting the service instance.
UNI list	MUST list the UNIs associated with the EVC.
Maximum number of UNIs	MUST be ≥ 2
EVC maximum transmission unit size	Integer, MUST be <= 2000 and MUST be $\leq$ minimum of UNI MTU sizes.
CE-VLAN ID preservation	MUST be either Yes or No
CE-VLAN CoS preservation	MUST be either Yes or No

Table 7-1 – EVC service attributes for the EVPLAN service

EVC service attribute	Service attribute parameters and values
Unicast service frame delivery	Discard, Deliver Unconditionally or Deliver Conditionally. If Delivered Conditionally, MUST specify the delivery criteria.
Multicast service frame delivery	Discard, Deliver Unconditionally or Deliver Conditionally. If Delivered Conditionally, MUST specify the delivery criteria.
Broadcast service frame delivery	Discard, Deliver Unconditionally or Deliver Conditionally. If Delivered Conditionally, MUST specify the delivery criteria.
Layer 2 control protocols processing	For each protocol passed to the EVC, MUST specify one of: Tunnel or Discard. MUST specify in accordance with clause 7.8.
EVC performance	Performance objectives for frame delay performance, frame delay variation performance, frame loss ratio performance, and availability performance; and the associated class of service identifier(s) defined in section 6.8 of [MEF 10.1].
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	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 for this EVC.
Link type	Dedicated, shared.
Traffic separation	Service instance: Spatial, logical. Customer: Spatial, logical.
Connectivity monitoring	Sub-layer monitoring: on demand, proactive, none. Inherent monitoring: proactive.
Survivability	None, server specific.

7.1 EVC type

The connectivity of EVPLAN is multipoint-to-multipoint.

7.2 EVC ID

An arbitrary string, unique across the domain, for EVCs supporting the service instance.

7.3 UNI list

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

7.4 Maximum number of UNIs

The number of UNIs should be more than two.

7.5 EVC maximum transmission unit size

The maximum MAC frame size supported at the UNI is at least 1522 bytes, as defined in section 6.10 of [MEF 10.1], but not larger than 2000 bytes (as specified in [IEEE 802.3]) and UNI MTU size.

7.6 Preservation (CE-VLAN ID/CoS 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 EVC. The two parameters are the ingress VLAN ID and class of service (priority) of the ETH_CI. Both can be preserved in EVPLAN.

7.7 Service frame delivery

All Ethernet MAC data frames are transported regardless of their destination address, including unicast, multicast or broadcast.

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 such as frame delay performance, frame delay variation performance, frame loss ratio performance and availability performance; and associated class of service identifier(s) of the Ethernet virtual connection.

It MAY specify one or more CoS. For each CoS, it MUST specify a CoS identifier and one or more sets of ordered UNI pairs. It MAY specify a frame delay value, a frame delay variation value, a frame loss value, and an availability value for each set of ordered UNI pairs.

7.10 Bandwidth profile

It is generally defined by the traffic parameters: CIR, CBS, EIR, EBS, CM and CF, per [MEF 6.1].

It is OPTIONAL. If supported, MUST specify <CIR, CBS, EIR, EBS, CM, CF>. It MUST NOT be allowed if any other egress bandwidth profile is applied at this UNI for this EVC.

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

7.12 Traffic separation

The EVPLAN may use logical or spatial separation between customer traffic, as defined in clause 7.12 of [ITU-T G.8011], for EVPLAN types 2 and 3. EVPLAN type 1 uses logical separation.

The EVPLAN may use logical or spatial separation between service instances, as defined in clause 7.12 of [ITU-T G.8011], for EVPLAN types 2 and 3. EVPLAN type 1 uses logical separation.

7.13 Connectivity monitoring

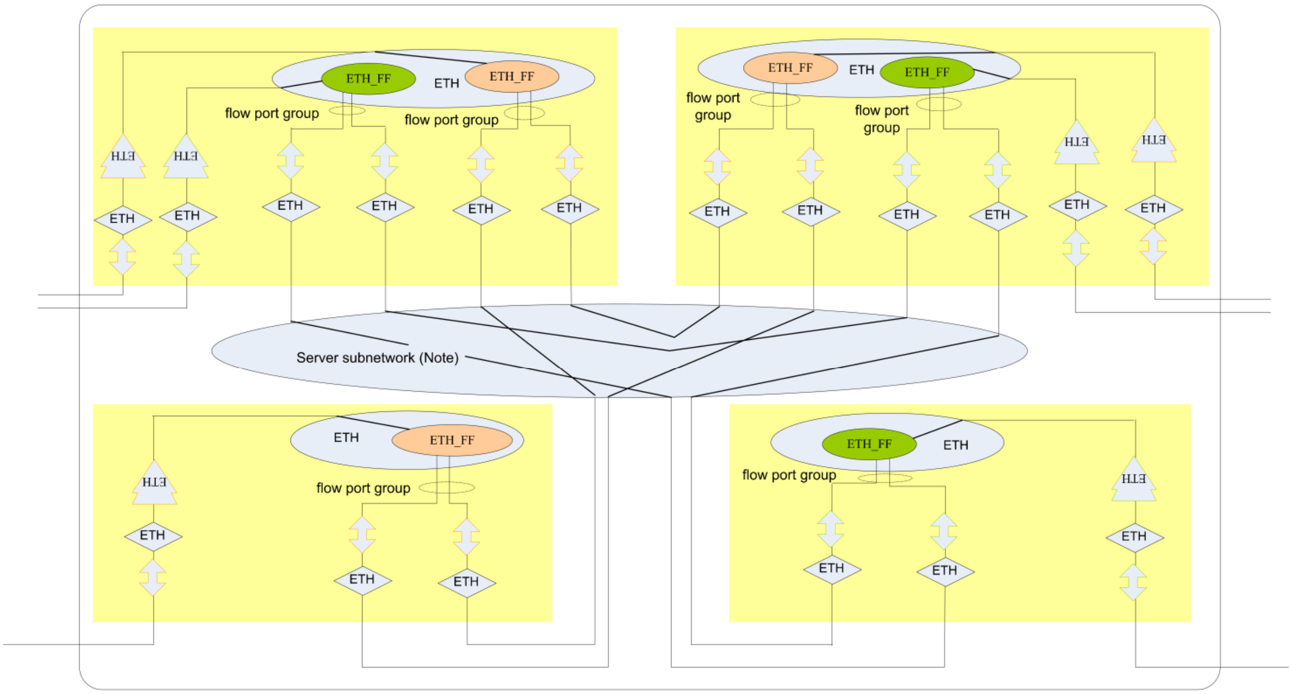
Connectivity monitoring of multipoint-to-multipoint Ethernet connections requires the use of Ethernet OAM specified in [ITU-T Y.1731] and Ethernet MEP and MIP functions specified in [ITU-T G.8010] and [ITU-T G.8021]. Ethernet OAM is the only OAM that can detect connectivity problems within ETH connection functions.

Figures 7-1 and 7-2 provide the typical OAM configurations on UNI-N and intra domain NNI ports for EVPLAN services supported by a single network operator of full mesh (see Figures 6-1, 6-2, 6-4 and 6-6) type and spanning tree (see Figures 6-1, 6-3, 6-5 and 6-7) type.

– ETH MIP functions on the UNI-N ports which are accessible from ETH MEP functions located in the customer network;
– ETH MEP functions on the UNI-N ports which are accessible by the service provider (who is the network operator); and
– ETH MIP functions on the intra domain NNI ports which are accessible from the service provider ETH MEP functions.

The service provider ETH MEP functions are responsible for UNI-N-to-UNI-N connectivity monitoring.

The ETH MIP functions on the UNI-N ports are used to help locating connectivity faults observed by the customer, which are not observed by the network. The ETH MIP functions on the intra domain NNI ports are used to help locating connectivity faults inside the network.



Note - Server = ATM VC, MPLS LSP, SDH VC, OTN ODU, PDH, ETY

Figure 7-1 – Basic ETH MEP and MIP functions for the full mesh types 1a, 2a, 3a

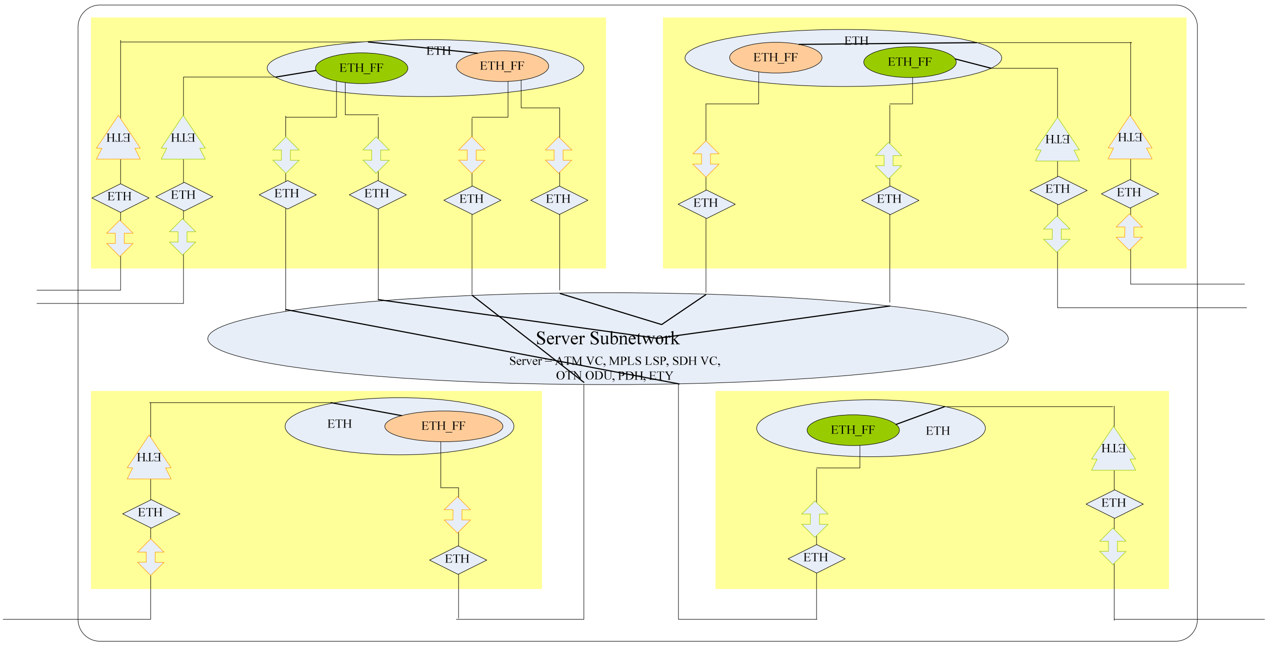


Figure 7-2 – Basic ETH MEP and MIP functions for the spanning tree types 1b, 2b, 3b

Frame delay and frame delay variation monitoring within these multipoint-to-multipoint Ethernet connections can be supported via on-demand Ethernet DMM/DMR OAM. Such DMM/DMR OAM is run between any two service provider ETH MEP functions.

Frame loss monitoring via the service provider ETH MEP functions is not possible with the Ethernet OAM frames currently specified in [ITU-T Y.1731]. For the case frame loss would be monitored between any two service provider ETH MEP functions or between any two network operator ETH MEP functions, then such measurement will count frames that are lost due to transmission errors (bit errors and congestion) on the ETH links and that are lost due to traffic conditioning at the ingress of the ETH link connections. The service provider and network operators are not accountable for the latter frame loss, which is due to customer traffic exceeding service level agreement for the link. Frames lost due to transmission errors on the ETH links can be detected when additional ETH MEP functions at the endpoints of the p2p ETH link connections are activated. Those ETH MEP functions are not illustrated in Figures 7-1 or 7-2.

7.14 Survivability

The transport network (service layer) can provide survivability for the EVPLAN. 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.

8 UNI attributes

8.1 ETH UNI attributes

A UNI can have a number of characteristics that will be important to the way that the CE sees a service. One of the key aspects of a service description will be the allowable mix of UNIs with different characteristics in an EVC. For example, a specific (simple) service might require all UNIs to have the same speed at the physical layer. A more sophisticated service may allow a wide variety of speeds.

Table 8-1 provides the UNI service attributes, parameters, and values for the EVPLAN service.

Table 8-1 – UNI service attributes for the EVPLAN service

Layer	UNI service attribute	Service attribute parameters and values
ETH	UNI identifier	Arbitrary text string to identify the UNI.
	MAC layer	IEEE 802.3 – 2008
	UNI maximum transmission unit size	MUST be between 1522 and 2000
	Service multiplexing	SHOULD be supported at one or more UNIs.
	UNI EVC ID	A string formed by the concatenation of the UNI ID and the EVC ID.
	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.
	CE-VLAN ID/EVC map	MUST specify mapping table of CE-VLAN IDs to the EVC ID.
	Maximum number of EVCs	MUST be ≥ 1
	Bundling	Yes or No. If Yes, then CE-VLAN ID preservation MUST be Yes.
	All to one bundling	MUST be No
	Ingress bandwidth profile per ingress 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 class of service identifier	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.

Table 8-1 – UNI service attributes for the EVPLAN service

Layer	UNI service attribute	Service attribute parameters and values
	Egress bandwidth profile per egress 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 for this EVC.
	Egress bandwidth profile per class of service identifier	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 for this EVC.
	Layer 2 control protocols processing	A list of Layer 2 control protocols with each being labelled with one of Discard, Peer, Pass to EVC, Peer and Pass to EVC. MUST specify in accordance with clause 8.1.11.
	UNI type	NA
	Connectivity monitoring	MEG levels, [ITU-T Y.1731] messages
ETY	Physical medium	A standard Ethernet PHY
	Speed	10 Mbit/s, 100 Mbit/s, 10/100 Mbit/s auto-negotiation, 1 Gbit/s, or 10 Gbit/s.
	Mode	Full duplex.

8.1.1 UNI ID

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

8.1.2 MAC layer

The EVPLAN 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 Maximum MTU size

The maximum MAC frame size supported at the UNI is at least 1522, as defined in section 7.4 of [MEF 10.1], but not larger than 2000 (as specified in [IEEE 802.3].

8.1.4 Service multiplexing

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

8.1.5 UNI EVC ID

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

For CE-VLAN ID for untagged and priority tagged service frames, it MUST specify CE-VLAN ID for untagged and priority tagged service frames in the range of 1-4094.

8.1.6 CE-VLAN ID/EVC mapping

At the UNI, there is a mapping of each customer VLAN ID to at most one EVC. For EVPLAN, VLAN ID mapping is supported. It MUST specify a mapping table of CE-VLAN IDs to the EVC ID.

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 EVC at the UNI. For EVPLAN type 2, all-to-one bundling is supported and bundling is not supported. For EVPLAN types 1 and 3, bundling is either supported or not supported. If bundling is supported, the CE-VLAN ID/EVC mapping MUST be specified.

8.1.9 All-to-one bundling

For EVPLAN type 2, all-to-one bundling is supported. For EVPLAN types 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 of [MEF 10.1]; it is OPTIONAL. If supported, it MUST specify <CIR, CBS, EIR, EBS, CM, CF>. It MUST NOT be allowed if any other ingress bandwidth profile is applied at this UNI.

8.1.11 Layer 2 control protocol processing

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

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

Table 8-2 specifies the L2CP processing requirements for EVPLAN service at UNI. The first column identifies the standard protocol, and the second the MAC DA used to carry that protocol data unit. The third column specifies the required action, and the fourth column specifies the applicability, i.e., whether the action taken must be the same at all UNIs in the EC, or whether it can be different on different UNIs in the EC.

Table 8-2 – L2CP processing requirements for the EVPLAN service at UNI

Protocol	MAC DA	L2CP requirement (Ingress)	L2CP requirement (Egress)
STP/RSTP/MSTP	01-80-C2-00-00-00	MUST Peer or Discard	Generate or none
PAUSE	01-80-C2-00-00-01	MUST Discard	none
LACP/LAMP	01-80-C2-00-00-02	MUST Peer or Discard	Generate or none
Link OAM	01-80-C2-00-00-02	MUST Peer or Discard	Generate or none
Port Authentication	01-80-C2-00-00-03	MUST Peer or Discard	Generate or none
E-LMI	01-80-C2-00-00-07	MUST Peer or Discard	Generate or none
LLDP	01-80-C2-00-00-0E	MUST Discard	none
GARP/MRP Block	01-80-C2-00-00-20 through 01-80-C2-00-00-2F	MUST Peer or Tunnel or discard	Generate or none

Table 8-3 – CFM requirement

Protocol	MAC DA	Requirement (Ingress)	Requirement (Egress)
Service OAM, UNI ME, CC	01-80-C2-00-00-3X or Unicast	SHOULD Peer or Discard	Generate or none
Service OAM, UNI ME, LT	01-80-C2-00-00-3Y	SHOULD Peer or Discard	Generate or none
Service OAM, UNI ME, LB	Unicast	SHOULD Peer or Discard	Generate or none
Service OAM – Subscriber MD	Unicast	SHOULD Peer or Discard	Generate or none

8.1.12 UNI type

For further study.

8.1.13 Connectivity monitoring

For EVPLAN 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.

For each level, any specific ITU-T 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 E-LMI support at the UNI are already covered by listing it under clause 8.1.11. There are implications on network performance when these messages are tunnelled or blocked.

OAM requirements in this clause are based on protocols specified in [IEEE 802.1ag] and [ITU-T Y.1731].

Connectivity monitoring can either be proactive (layer monitoring, sub-layer monitoring, inherent monitoring) or on-demand, as specified in [ITU-T G.8010] and [ITU-T Y.1731]. In some network implementations, connectivity monitoring can rely on the server layer connectivity monitoring (inherent monitoring). It is an option to not perform pro-active monitoring.

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 EVPLAN 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]. It is a standard Ethernet PHY including 10BASE-T, 100BASE-T, 1000BASE-SX, 1000BASE-LX, 10GBASE-SR, 10GBASE-LR, 10GBASE-ER.

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 or 10 Gbit/s.

8.2.3 Mode

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

9 EVPLAN NNI service attributes

9.1 ETH NNI attribute

Table 9-1 – NNI service attributes for the EVPLAN service

Layer	NNI service attribute	Service attribute parameters and values
ETH	MAC service	IEEE 802.3-2008 frame format.
	NNI ID	Arbitrary text string to identify each NNI instance.
	NNI EVC ID	Arbitrary text string to identify each EVC instance.
	Multiplexed link	Yes, No.
	VLAN ID mapping	For further study.
	Bundling	For further study.
	Bandwidth profile	<CIR, CBS, EIR, EBS, CM, CF>.
	Layer 2 control protocol processing	Discard (Block), Peer (process), pass per protocol on ingress. Generate or none per protocol on egress.
	NNI type	For further study.
	Connectivity monitoring	For further study.
Server	Server layer	SDH, PDH, OTH, ETY, ATM, MPLS.

9.1.1 MAC service

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

9.1.2 NNI ID

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

9.1.3 NNI EVC ID

It is an arbitrary text string to identify each EVC instance.

9.1.4 Multiplexed link

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

9.1.5 VLAN ID mapping

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

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

It is for further study.

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 the action taken at the UNI.

9.1.9 NNI type

For further study.

9.1.10 Connectivity monitoring

For further study.

9.2 Server layer

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

Table 9-2 – EVPLAN server layers

Server layer technology
SDH
OTH
PDH
MPLS
ATM
ETY
ETH

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