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ITU-T G.8011.5/Y.1307.5

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

Packet over Transport aspects – Ethernet over Transport aspects

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Internet protocol aspects – Transport

Ethernet private LAN service

Recommendation ITU-T G.8011.5/Y.1307.5

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Recommendation ITU-T G.8011.5/Y.1307.5

Ethernet private LAN service

Summary

Recommendation ITU-T G.8011.5/Y.1307.5 defines the service attributes and parameters for carrying Ethernet private LAN characteristic information over dedicated-bandwidth, point-to-point connections provided by synchronous digital hierarchy (SDH), asynchronous transfer mode (ATM), multi-protocol label switching (MPLS), plesiochronous digital hierarchy (PDH), Ethernet PHY layer network (ETY) optical transport hierarchy (OTH), Ethernet MAC layer network (ETH) or other server layer networks.

History

Edition	Recommendation	Approval	Study Group	Unique ID[*]
1.0	ITU-T G.8011.5/Y.1307.5	2010-02-06	15	11.1002/1000/10427
2.0	ITU-T G.8011.5/Y.1307.5	2013-08-29	15	11.1002/1000/12028

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Ethernet private LAN service, service attribute.

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Ethernet private LAN service

1 Scope

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

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*.

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

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

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

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

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

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

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

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

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

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

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

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

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

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

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

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

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

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

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

3.1.8 Ethernet virtual connection (EVC): [ITU-T G.8010].

3.1.9 ENNI: [MEF 26.1].

3.1.10 flow domain fragment: [ITU-T G.8010].

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

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

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

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

3.1.15 network-to-network interface (NNI): [ITU-T G.8001].

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

3.1.17 service frame: [ITU-T G.8010].

3.1.18 subnetwork: [ITU-T G.8010].

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

3.1.20 traffic conditioning function: [ITU-T G.8010].

3.1.21 user-to-network interface (UNI): [ITU-T G.8001].

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ATM	Asynchronous Transfer Mode
ATM VC	Asynchronous Transfer Mode Virtual Circuit
CBR	Constant Bit Rate
CBS	Committed Burst Size
CF	Coupling Flag
CI	Characteristic Information
CIR	Committed Information Rate
CM	Colour Mode
CO-PS	Connection Oriented Packet Switched (service)
EC	Ethernet Connection
EFM	Ethernet in the First Mile
EIR	Excess Information Rate
E-LMI	Ethernet Local Management Interface
EPLAN	Ethernet Private Local Area Network
ETH	Ethernet MAC layer network
ETH_CI	Ethernet MAC Characteristic Information
ETH_FF	Ethernet Flow Forwarding function
ETY	Ethernet physical layer network
ETYn	Ethernet physical layer network of order *n*
ETy-NNI	Ethernet NNI
Ety-UNI	Ethernet UNI
EVC	Ethernet virtual connection
FD	Flow Domain
FDFr	Flow Domain Fragment
LACP	Link Aggregation Control Protocol
LAG	Link Aggregation
LCAS	Link Capacity Adjustment Scheme
MAC	Media Access Control
MEG	Maintenance Entity Group
MEN	Metro Ethernet Network
MEP	MEG End Point
MIP	MEG Intermediate Point
MPLS	Multi-Protocol Label Switching
MPLS LSP	Multi-Protocol Label Switching Label Switched Path
MTU	Maximum Transmission Unit

NNI	Network to Network Interface
OAM	Operations, Administration, Maintenance
OTH	Optical Transport Hierarchy
OTN	Optical Transport Network
OTN ODU	Optical Transport Network Optical channel Data Unit
OVC	Operator Virtual Connection
PDH	Plesiochronous Digital Hierarchy
PHY	Physical device
SDH	Synchronous Digital Hierarchy
SDH VC	Synchronous Digital Hierarchy Virtual Circuit
STP	Spanning Tree Protocol
UNI	User to Network Interface
UNI-C	Customer side of UNI
UNI-N	Network side of UNI

5 Conventions

None.

6 Ethernet private LAN

6.1 Description

An EPLAN service is a multipoint-to-multipoint service between two or more demarcation points, as illustrated in Figures 6-1 and 6-2. 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 EPLAN is frame-based characteristic information.

6.1.1 Single domain

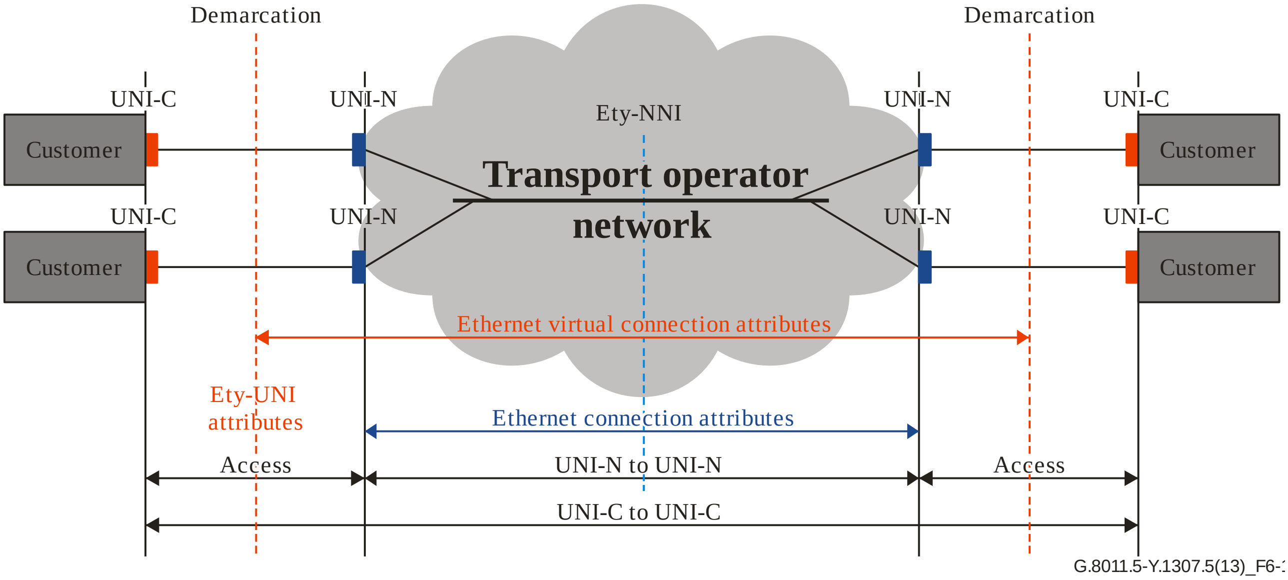

Figure 6-1 – Ethernet private LAN service (single domain)

Figure 6-1 describes the abstract model of the EPLAN service for the case in which service traffic is carried on a single server subnetwork. In this case, from the service provider's viewpoint, ETH UNI-Ns are placed facing users at the domain edge in order to provide users access to the service. As for the EPLAN, a UNI-N provides dedicated access for user traffic. In the transport operator network, a virtual multipoint-to-multipoint (MP2MP) Ethernet virtual connection and an UNI-N to UNI-N Ethernet connection are emulated by the transport network connections. EPLAN UNI-Ns are responsible for forwarding and mapping the EPLAN service traffic based on the destination MAC address. UNI-Ns are also responsible for rate control to ensure the QoS of the EPLAN service.

6.1.2 Multiple domains

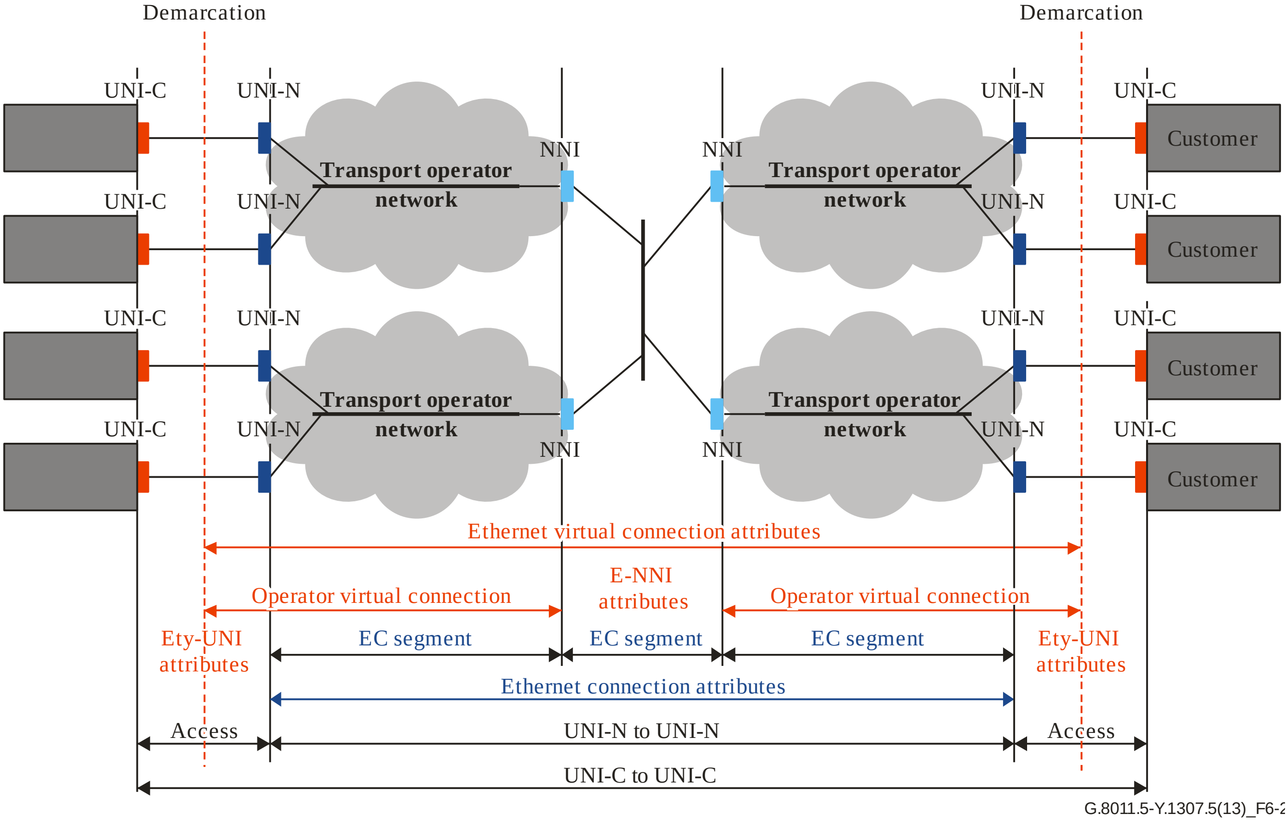

Figure 6-2 – Ethernet private LAN service (multiple domains)

Figure 6-2 describes the abstract model of the EPLAN service for the case in which service traffic is carried on multiple server subnetworks. In this case, from the service provider's viewpoint, ETH UNI-Ns are placed facing users at the domain edge in order to provide users access to the service, and ETH ENNIs are placed at the domain edge facing other domains. For a single operator network, an operator virtual connection that is a part of the EVC is manageable. As for EPLAN, a UNI-N provides dedicated access for user traffic. The MP2MP Ethernet connection includes multiple segments that belong to different domains. The UNIs and NNIs that are in the same domain are connected by a segment of the Ethernet connection. EPLAN UNI-Ns and the NNI are responsible for forwarding and mapping the EPLAN service traffic based on the destination MAC address. EPLAN UNI-Ns and the NNI are also responsible for rate control to ensure the QoS of the EPLAN service.

6.2 EPLAN service architecture

Per the attributes given in [ITU-T G.8011], there is only one EPLAN type: dedicated server layer and dedicated access.

This clause describes two subtypes of EPLAN that depend on the loop prevention mechanism being used, as shown in Table 6-1:

Table 6-1 – EPLAN subtypes

Type	Loop prevention
EPLAN subtype1	Flow port grouping
EPLAN subtype2	Spanning tree

6.2.1 Single domain

6.2.1.1 Full mesh with flow port grouping

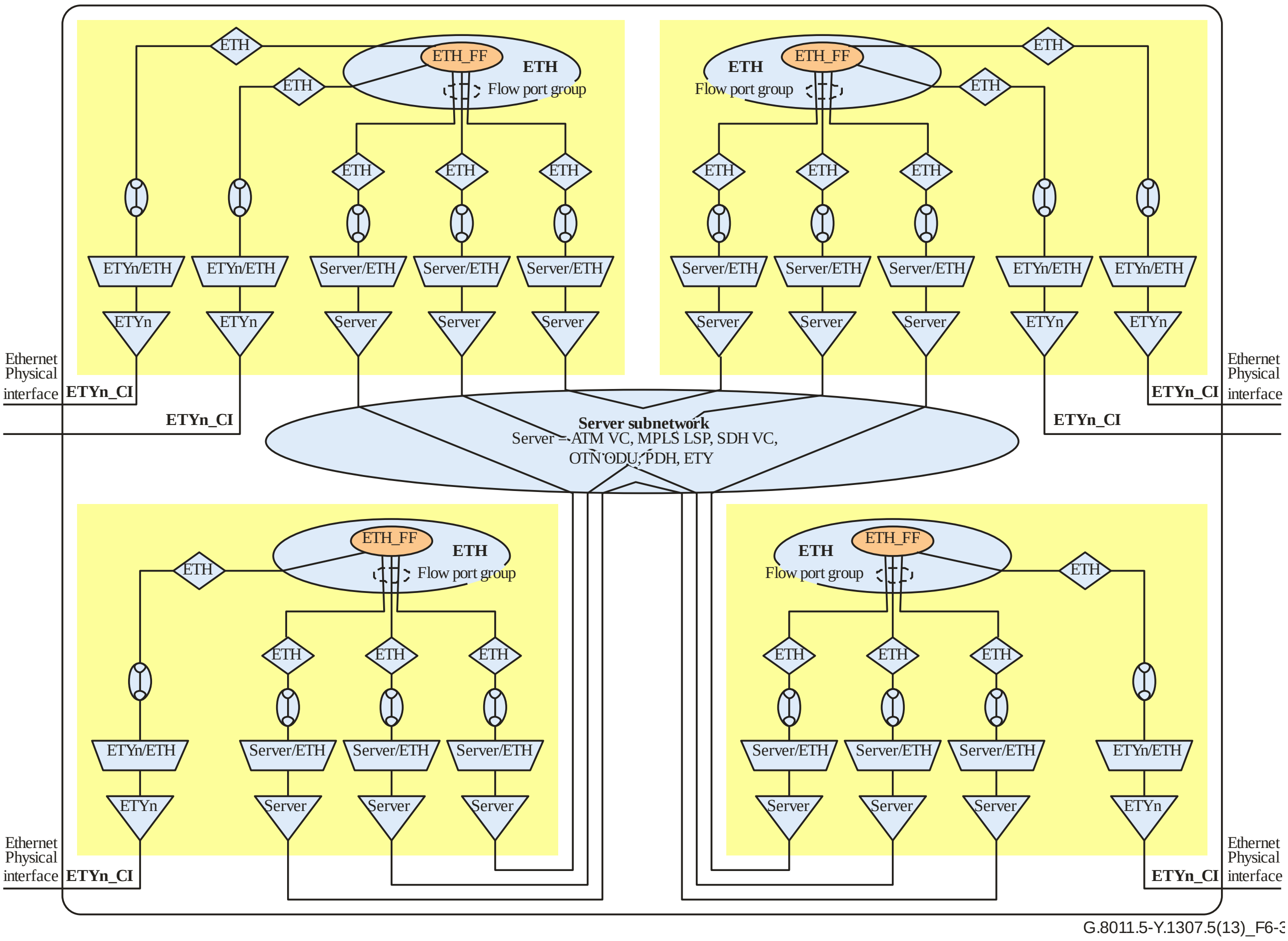

Figure 6-3 – EPLAN service architecture
(full mesh with flow port grouping, single domain)

Figure 6-3 describes the EPLAN service carried on a full-mesh server layer connection.

For each UNI, at the user side, a traffic conditioning function is present for controlling the traffic rate from/to the user network. An Ethernet flow forwarding process 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 per [ITU-T G.8021], should be deployed at the ETH_FF, i.e., packets received from the network side will only be forwarded to the UNI side.

6.2.1.2 Spanning tree

Figure 6-4 depicts EPLAN UNIs connected by a spanning tree connection. The spanning tree connection is provided by assigning a root UNI, i.e., the top-left UNI. All other UNIs are directly connected to the root UNI. The traffic from one UNI to another UNI will always pass through the root UNI. The tree-style connectivity avoids traffic looping naturally.

In this case, since traffic from several points may be carried on the same server layer connection, to ensure no traffic overload on the connection, a traffic conditioning function should be provided for controlling the rates from/to each point before mapping the traffic to the server layer connection.

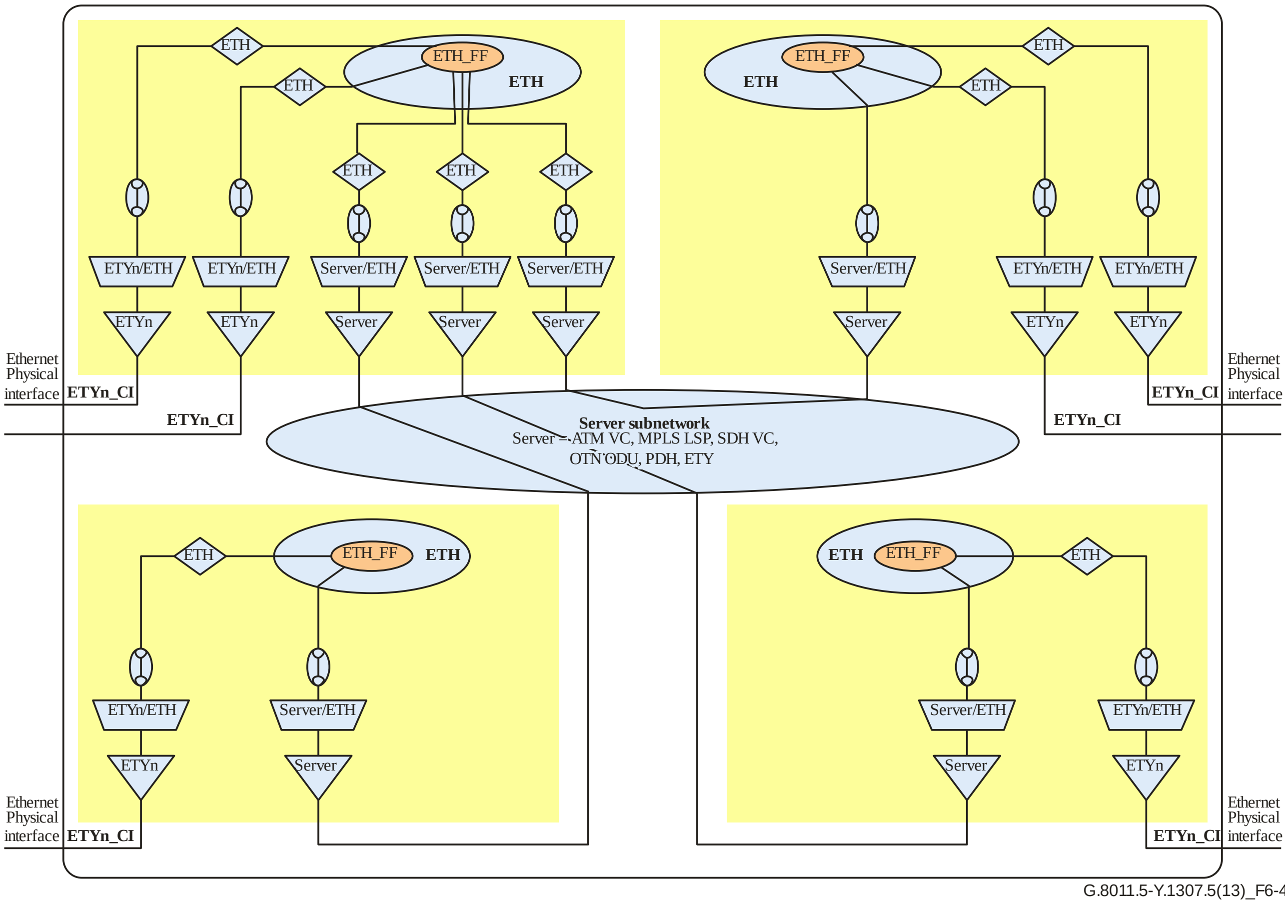

Figure 6-4 – EPLAN service architecture (spanning tree, single domain)

Note that here the spanning tree connection can be created by network management system, or by spanning tree protocol per [IEEE 802.1Q], or by Ethernet ring protection per [ITU-T G.8032], etc.

6.2.2 Multiple domains

6.2.2.1 Full mesh with flow port grouping

Figure 6-5 describes the scheme in which NNIs are interconnected by full mesh links. A link connection is present between each pair of NNIs.

For each NNI, an ETH_FF is present for traffic forwarding based on the destination MAC address. The Ethernet traffic from the UNIs and other NNIs will be mapped/de-mapped to/from server layer connections/NNI links by a server/ETH adaptation function.

Since the full-mesh connection could form traffic looping, flow port grouping per [ITU-T G.8021], should be deployed at the ETH_FF, i.e., packets received from another NNI can only be forwarded to the UNI side in the local domain.

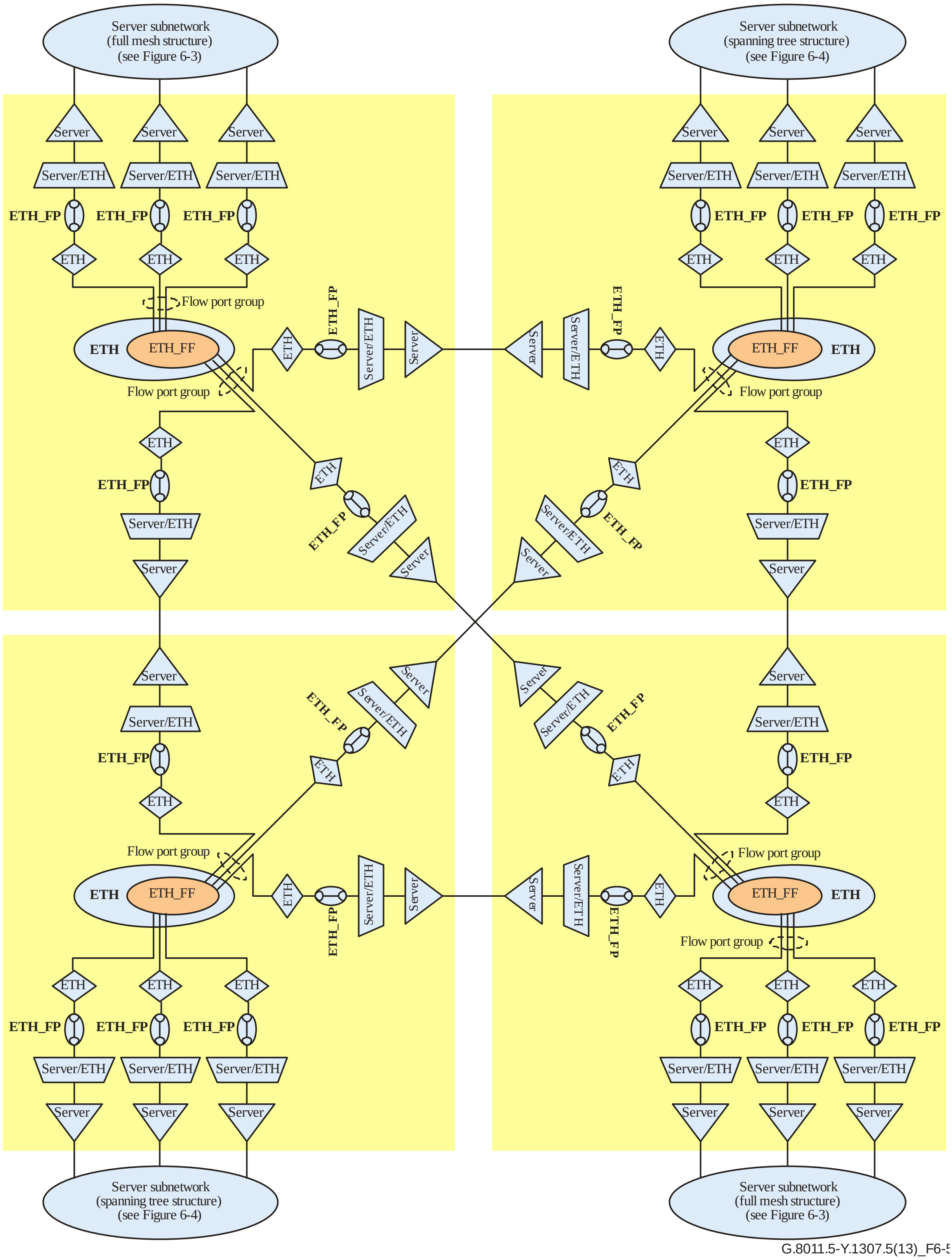

Figure 6-5 – EPLAN service architecture (full mesh with flow port grouping, multiple domains)

6.2.2.2 Spanning tree

Figure 6-6 describes the scheme in which the NNIs are interconnected in a tree style. All other NNIs are directly connected to a root NNI, i.e., the top-left NNI, by link connections. The traffic from one point to another point will always pass through a root NNI. The spanning tree connection avoids traffic looping naturally.

For each NNI, an ETH_FF is present for traffic forwarding based on the destination MAC address. The Ethernet traffic from UNIs and other NNIs is mapped/de-mapped to/from server layer connections/NNI links by a server/ETH adaptation function.

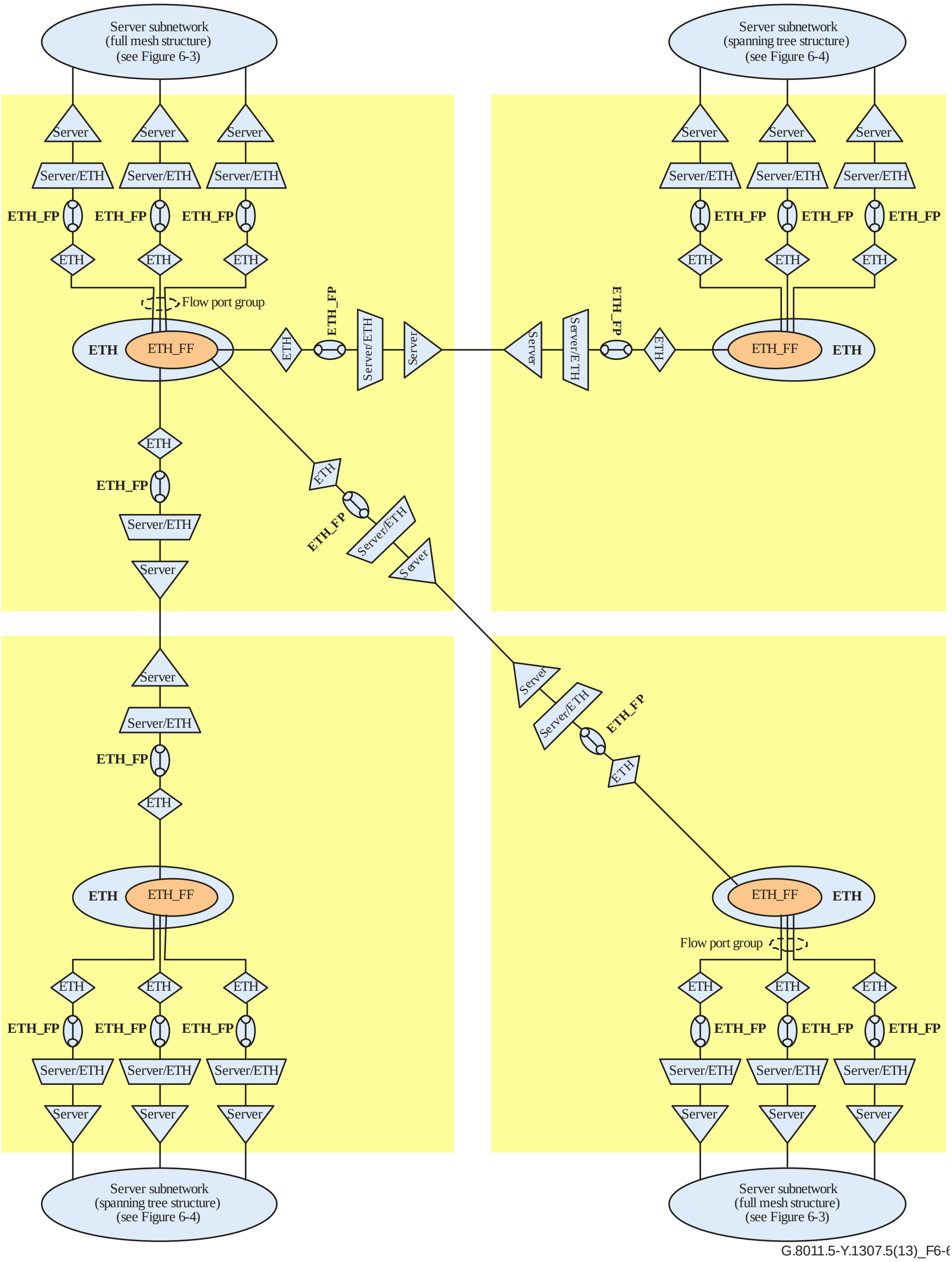

Figure 6-6 – EPLAN service architecture (spanning tree, multiple domains)

Note that here the spanning tree connection can be created by network management system, or by spanning tree protocol [IEEE 802.1Q], or by Ethernet ring protection per [ITU-T G.8032], etc.

7 EPLAN Ethernet virtual connection (EVC) and Ethernet connection (EC) attributes

7.1 EVC

This clause describes Ethernet virtual connection (or EVC) attributes that characterize a particular instance of an Ethernet service. The area of applicability of these EVC attributes is identified in Figure 6-1 as being equivalent to the ETH connection or ETH connectivity (per clause 6.6 of [ITU-T G.8010]). The EVC attributes are the same as the Ethernet virtual connection (EVC) attributes defined in [MEF 6.1] Table 20 and they are summarized in Table 7-1.

Table 7-1 – EVC attributes

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. The UNI type **MUST** be Root for each UNI
Maximum number of UNIs	**MUST** be ≥2
EVC maximum transmission unit (MTU) size	**MUST** be ≥1522 (NOTE)
CE-VLAN ID preservation	**MUST** be Yes
CE-VLAN CoS preservation	**MUST** be Yes
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	**MUST** specify in accordance with section 8.3 of [MEF 6.1]
EVC performance	At least one CoS is **REQUIRED**. **MUST** specify CoS ID, per section 6.8 of [MEF 10.2]. For each CoS, **MUST** list values for each of the following attributes {FrameDelay, Frame Delay Variation, Frame Loss Ratio, and Availability}, where Not Specified (N/S) is an acceptable value, for one or more sets of ordered UNI pairs. Each ordered UNI pair in the EVC **MUST** be mapped to at least one CoS
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].	

7.2 EC

[ITU-T G.8011] defines UNI and NNI connection attributes for Ethernet services. In the case of an EPLAN service, some of these attributes have fixed values or a limited allowed range of parameters. EC attributes are shown in Table 7-2.

Table 7-2 – EC attributes

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

7.2.1 Link type

The server link is referred to as dedicated for EPLAN.

7.2.2 Survivability

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

– no protection;

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

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

The applicability of survivability by means of LCAS (in which the ETH link operates at reduced bandwidth during the defect condition) is for further study.

8 EPLAN UNI attributes

This clause describes service UNI attributes that modify the behaviour of a particular instance of an Ethernet service at the demarcation of the UNI to characterize the service. There is a UNI defined at each of the ETH and ETY layers. The base set of EVPL UNI attributes is the same as the UNI attributes defined in [MEF 6.1] Tables 18 and 19, as amended in [MEF 6.1.1].

Table 8-1 – EPLAN UNI service attributes

Layer	UNI service attribute	Service attribute parameters and values
ETH	UNI identifier	Any string
	MAC layer	[IEEE 802.3]
	UNI maximum transmission unit (MTU) size	**MUST** be ≥ 1522
	Service multiplexing	**MUST** be No
	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	All untagged and priority tagged service frames at the UNI **MUST** map to the same EVC as is used for all other service frames
	CE-VLAN ID/EC mapping	**MUST** be No
	Maximum number of EVCs	**MUST** be 1
	Bundling	**MUST** be No
	All to one bundling	**MUST** be Yes
	Ingress bandwidth profile per ingress UNI	**OPTIONAL**. If supported, **MUST** specify <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be combined with any other type of ingress bandwidth profile

Table 8-1 – EPLAN UNI service attributes

Layer	UNI service attribute	Service attribute parameters and values
	Ingress bandwidth profile per class of service identifier	**OPTIONAL**. If supported, **MUST** specify CoS ID per [MEF 10.2], section 6.8, and **MUST** specify <CIR, CBS, EIR, EBS, CM, CF> for each CoS. **MUST NOT** be combined with any other type of ingress bandwidth profile
	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
	Egress bandwidth profile per egress 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 class of service identifier	**OPTIONAL**. If supported, **MUST** specify CoS ID per section 6.8 of [MEF 10.2], and **MUST** specify <CIR, CBS, EIR, EBS, CM, CF> for each CoS. **MUST NOT** be combined with any other type of egress bandwidth profile
	Egress bandwidth profile per EVC	**OPTIONAL**. If supported, **MUST** specify <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be combined with any other type of egress bandwidth profile
	Layer 2 control protocols processing	**MUST** specify in accordance with section 8.3 of [MEF 6.1]
ETY	Physical medium	UNI Type 2 Physical Interface [IEEE 802.3]
	Speed	10 Mbit/s, 100 Mbit/s, 10/100 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 EPLAN NNI and OVC service attributes

This clause describes service NNI attributes that modify the behaviour of a particular instance of an Ethernet service at the demarcation of the NNI to characterize the service. It is optional that a NNI is defined for an EPLAN service.

9.1 Internal NNI attributes

As described in [ITU-T G.8012] and [ITU-T G.8012.1].

9.2 External NNI attributes

External NNI service attributes are summarized in Table 9-1, per [MEF 26.1].

Table 9-1 – External NNI service attributes

ENNI service attribute	Service attribute parameters and values
Operator ENNI identifier	A string that is unique across the Operator MEN
Physical layer	[IEEE 802.3]
Frame format	[IEEE 802.1Q] frame formats
Number of links	An integer with value 1 or 2
Protection mechanism	Link Aggregation, none, or other
ENNI maximum transmission unit size	An integer number of bytes greater than or equal to 1526
End-point map	A table with rows of the form <S-VLAN ID value, End Point Identifier, End Point Type>
Maximum number of OVCs	An integer greater than or equal to 1
Maximum number of OVC end-points per OVC	An integer greater than or equal to 1

10 Connectivity monitoring

10.1 EC connectivity monitoring

Connectivity monitoring requires the use of Ethernet OAM specified in [ITU-T G.8013] 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.

EPLAN services supported by a single network operator (see Figures 6-1, 6-3 and 6-4) provide:

– 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 (which is the network operator); and

– ETH MIP functions on the intra domain NNI ports which are accessible from the service provider ETH MEP functions.

Figures 10-1 and 10-2 illustrate those ETH MEP and ETH MIP functions.

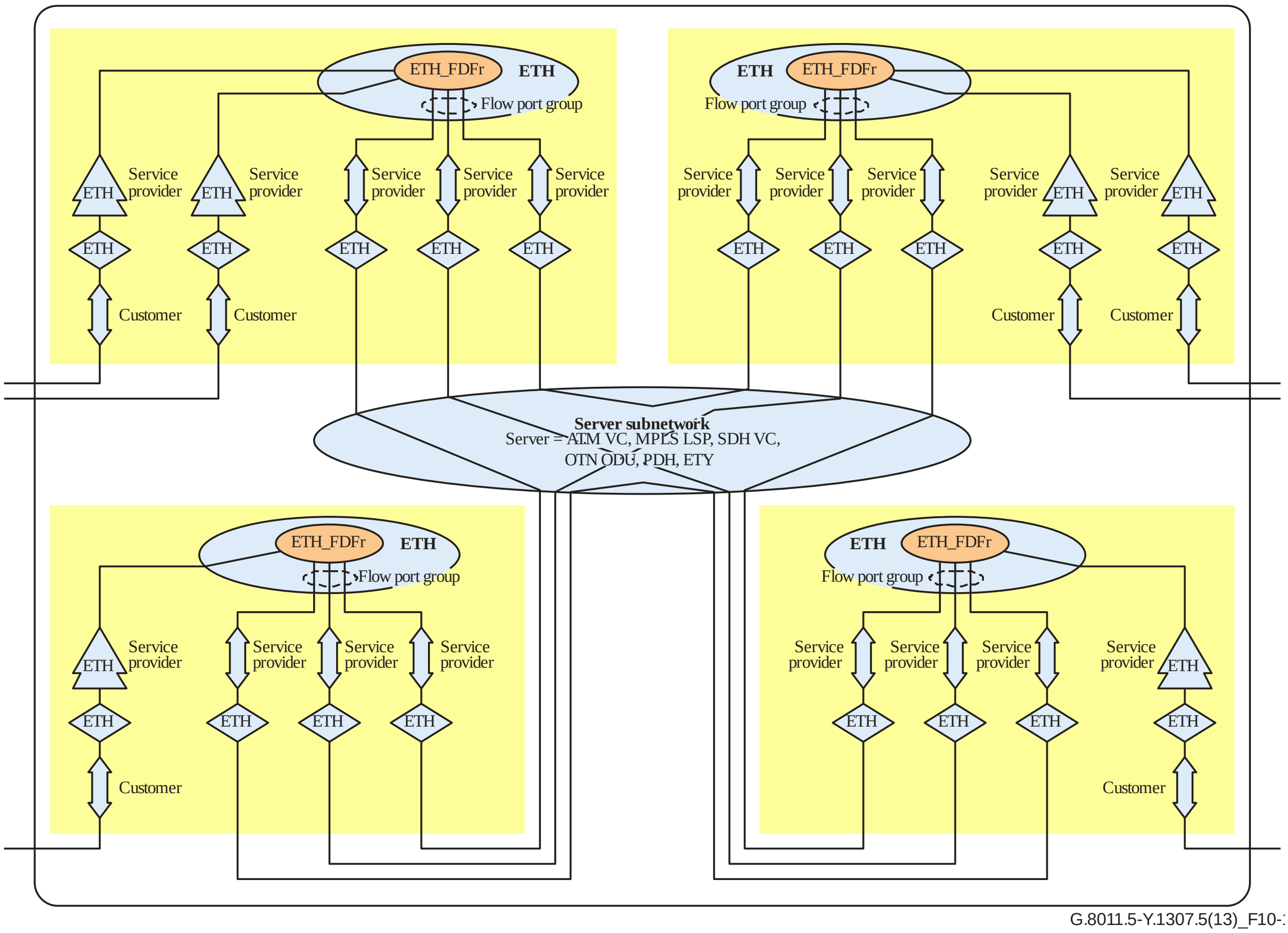

Figure 10-1 – Basic ETH MEP and MIP functions for the example in Figure 6-3

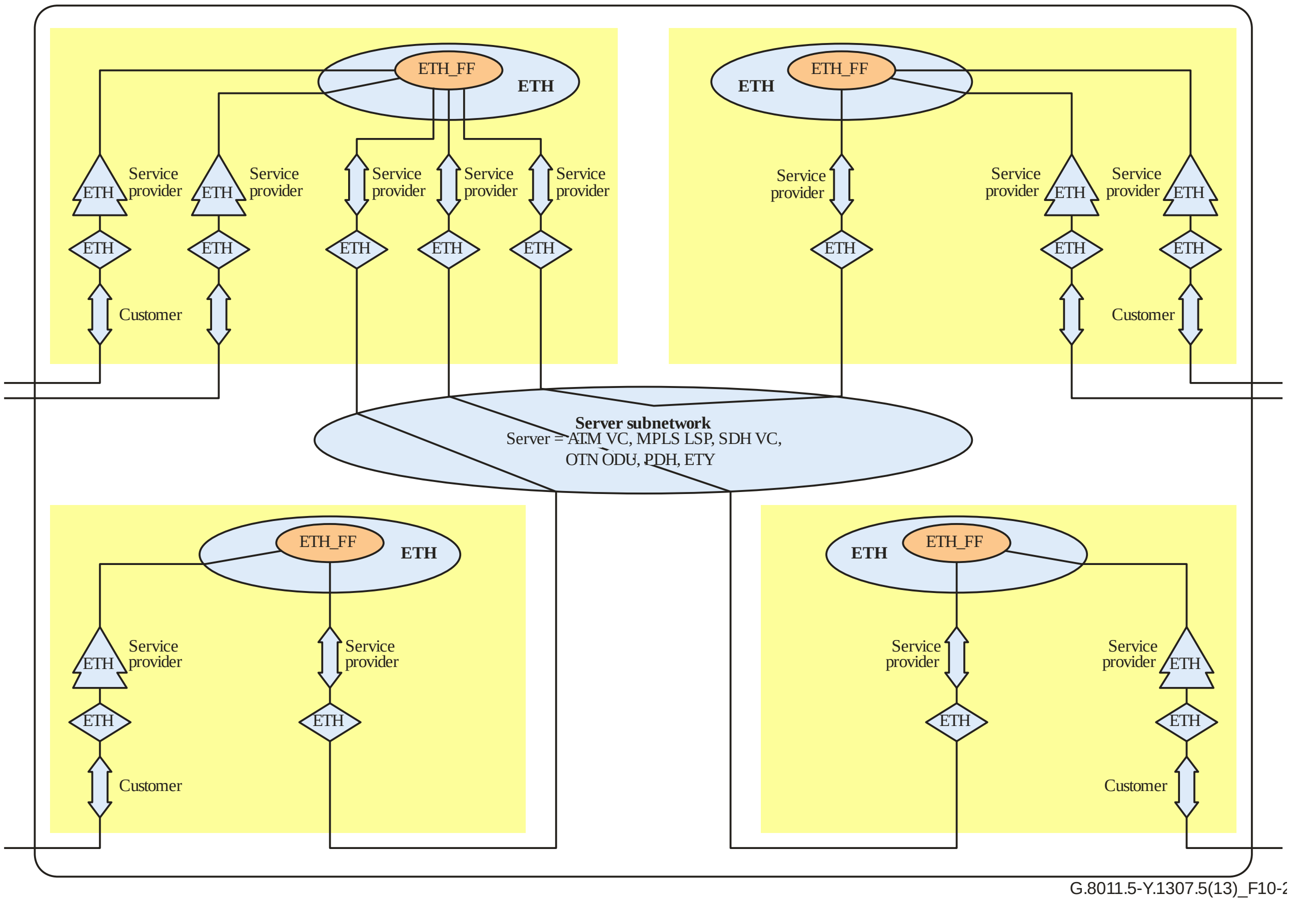

Figure 10-2 – Basic ETH MEP and MIP functions for the example in Figure 6-4

EPLAN services supported by a multiple network operator (see Figures 6-2, 6-5 and 6-6) provide:

– ETH MIP functions on the UNI-N ports (see Figure 10-5) which are accessible from ETH MEP functions located in the customer network;

– ETH MEP functions on the UNI-N ports (see Figure 10-5) which are accessible by the service provider;

– ETH MIP functions on the inter domain NNI ports (see Figures 10-3 and 10-4) which are accessible from the service provider ETH MEP functions;

– ETH MEP functions on the UNI-N ports (see Figure 10-5) which are accessible by the network operator;

– ETH MEP functions on the inter domain NNI ports (see Figures 10-3 and 10-4) which are accessible by the network operator;

– ETH MIP functions on the intra domain NNI ports (see Figures 10-3, 10-4 and 10-5) which are accessible from the network operator ETH MEP functions.

The service provider ETH MEP functions are responsible for UNI-N-to-UNI-N connectivity monitoring. The network operator ETH MEP functions are responsible for connectivity monitoring of the Ethernet connection within the domain of one network operator.

The ETH MIP functions on the UNI-N ports are used to help in 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 in locating connectivity faults observed by the service provider, which are not observed by any of the network domains. The ETH MIP functions on the inter domain NNI ports are used to help in locating connectivity faults inside the network.

Figures 10-3, 10-4 and 10-5 illustrate those ETH MEP and ETH MIP functions.

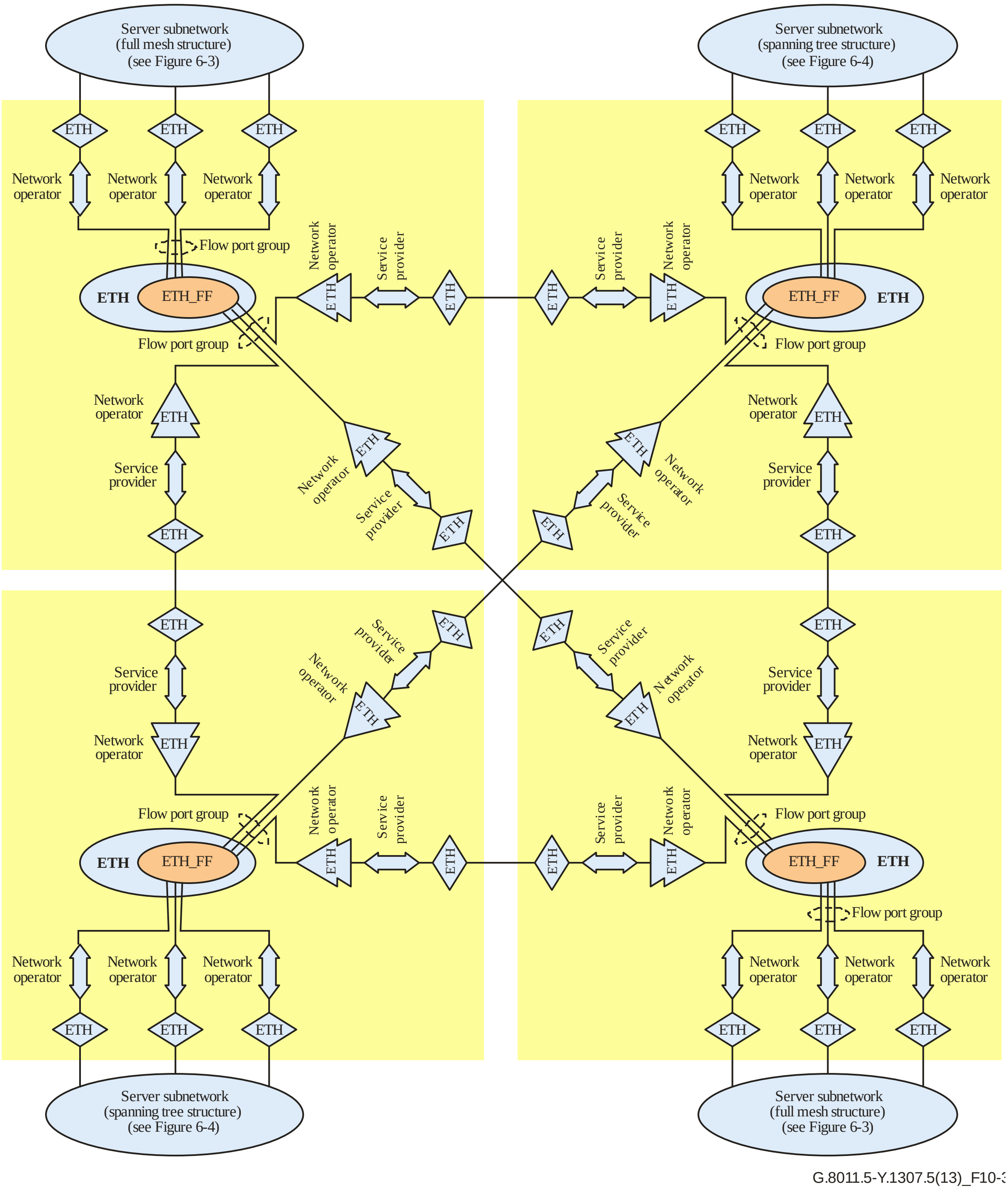

Figure 10-3 – Basic ETH MEP and MIP functions for the example in Figure 6-5

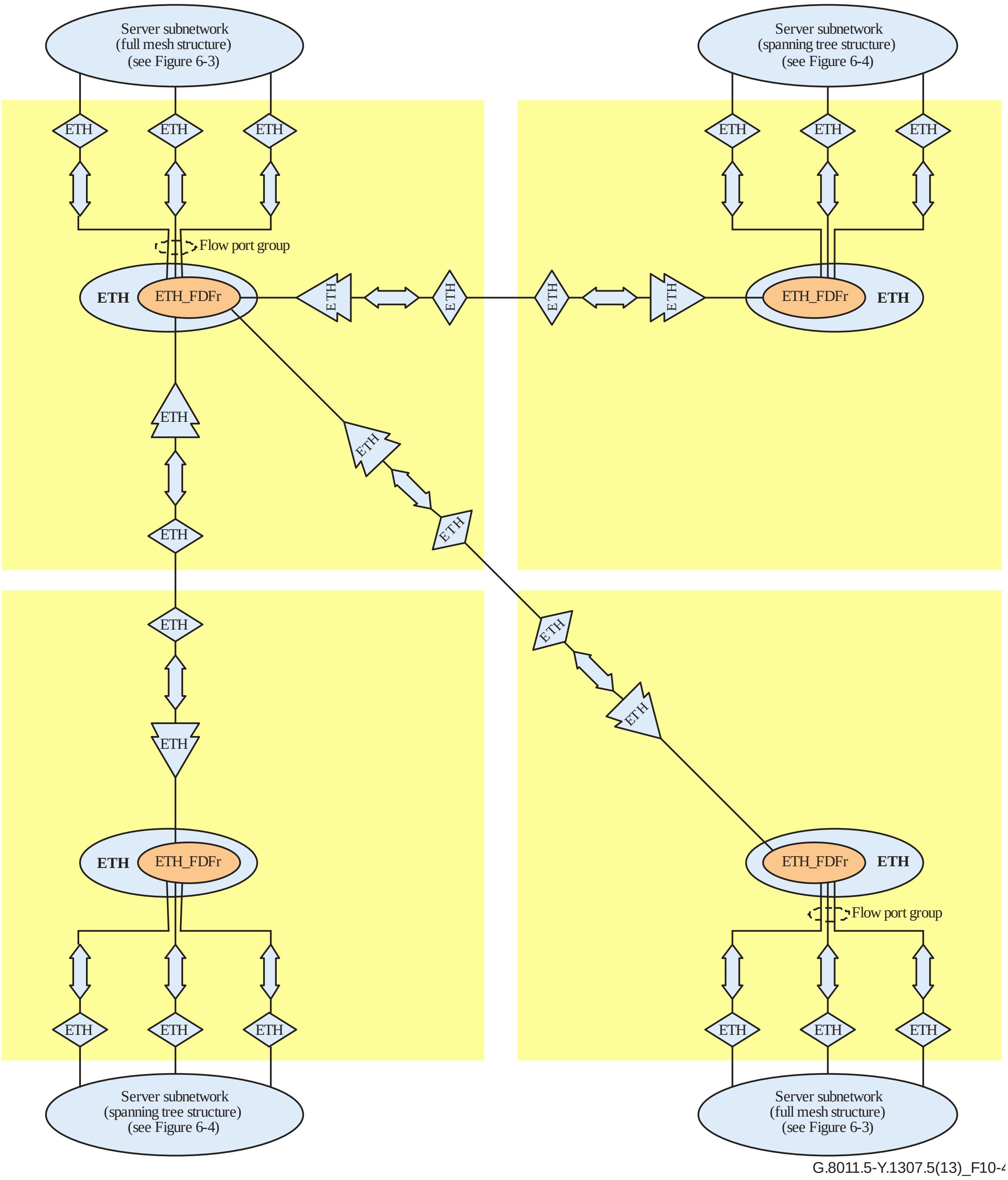

Figure 10-4 – Basic ETH MEP and MIP functions for the example in Figure 6-6

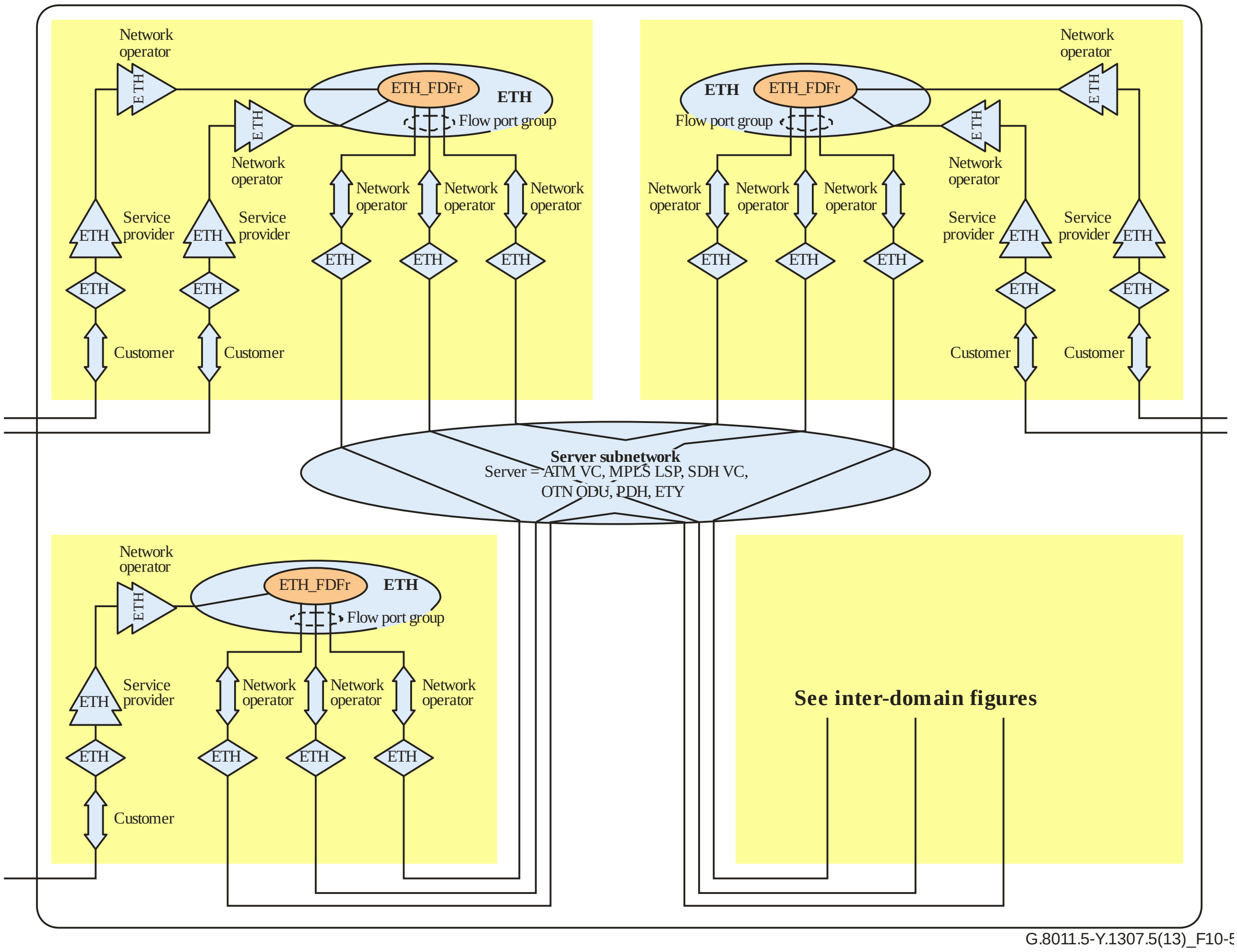

Figure 10-5 – Basic ETH MEP and MIP functions for the multipoint-to-multipoint Ethernet connection segment within the domain of one transport operator

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, or between any two network-operator ETH MEP functions.

Frame loss monitoring via the service provider or network operator ETH MEP functions is not possible with the Ethernet OAM frames currently specified in [ITU-T G.8013]. For this 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 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 the 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 end-points of the p2p ETH link connections are activated. Those ETH MEP functions are not illustrated in Figures 10-1 to 10-5.

10.2 UNI connectivity monitoring

EPLAN connectivity monitoring is achieved via Ethernet OAM mechanisms as defined in [ITU-T G.8013] and is optional. If specified, the MEG level at the customer service layer is:

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 G.8013 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. 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 described in [ITU-T G.8011] clause 8. There are implications on network performance when these messages are tunnelled or blocked.

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