International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.8011.5/Y.1307.5

(02/2010)

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

Packet over Transport aspects – Ethernet over Transport aspects

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Internet protocol aspects – Transport

Ethernet private LAN service

Recommendation ITU-T G.8011.5/Y.1307.5

ITU-T

ITU-T G-SERIES RECOMMENDATIONS

TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
MULTIMEDIA QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
Ethernet over Transport aspects	**G.8000–G.8099**
MPLS over Transport aspects	G.8100–G.8199
Quality and availability targets	G.8200–G.8299
Service Management	G.8600–G.8699
ACCESS NETWORKS	G.9000–G.9999

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

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 SDH, ATM, MPLS, PDH, ETY, OTH, ETH or other server layer networks.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.8011.5/Y.1307.5	2010-02-06	15

Keywords

Ethernet private LAN service, service attribute.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

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/.

CONTENTS

Recommendation ITU-T G.8011.5/Y.1307.5

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 services 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 (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.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 (2007), *Characteristics of Ethernet transport network equipment functional blocks*; Amendment 2 (2010).

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

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

[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 – IEEE standard for local and metropolitan area networks – Specific requirements – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications*.

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

[MEF 10.1] MEF 10.1-2006, *Ethernet Services Attributes – Phase 2*.

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

3.1.3 subnetwork

3.1.4 traffic conditioning function

This Recommendation uses the following terms defined in [ITU-T G.805]:

3.1.5 link

3.1.6 link connection

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

3.1.7 flow point

3.1.8 flow termination

3.1.9 termination flow point

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

3.1.10 access link

3.1.11 customer

3.1.12 Ethernet connection (EC)

3.1.13 Ethernet service

3.1.14 Ethernet service area

3.1.15 Ethernet service instance

3.1.16 network-to-network interface (NNI)

3.1.17 user-to-network interface (UNI)

4 Acronyms and abbreviations

This Recommendation uses the following abbreviations:

ATM	Asynchronous Transfer Mode
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)
DA	Destination Address
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 Circuit
FCS	Frame Check Sequence
FD	Flow Domain
FDFr	Flow Domain Fragment
LACP	Link Aggregation Control Protocol
LAG	Link Aggregation
LCAS	Link Capacity Adjustment Scheme
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
MTU	Maximum Transmission Unit
NNI	Network to Network Interface
OAM	Operations, Administration, Maintenance
OTH	Optical Transport Hierarchy

OTN	Optical Transport Network
PDH	Plesiochronous Digital Hierarchy
PHY	Physical device
SDH	Synchronous Digital Hierarchy
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 demarc 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

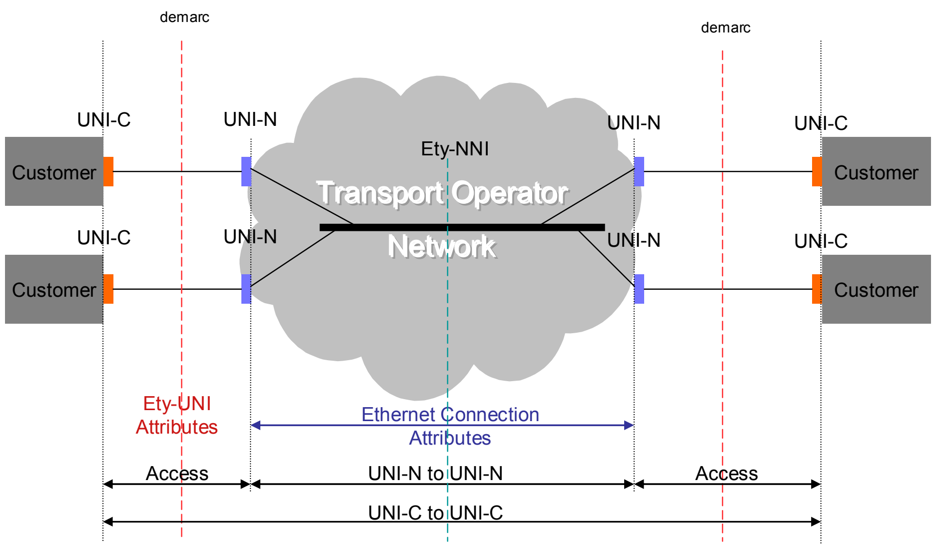

Figure 6-1 – Ethernet private LAN service (single domain)

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 point of view, 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 connection is 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

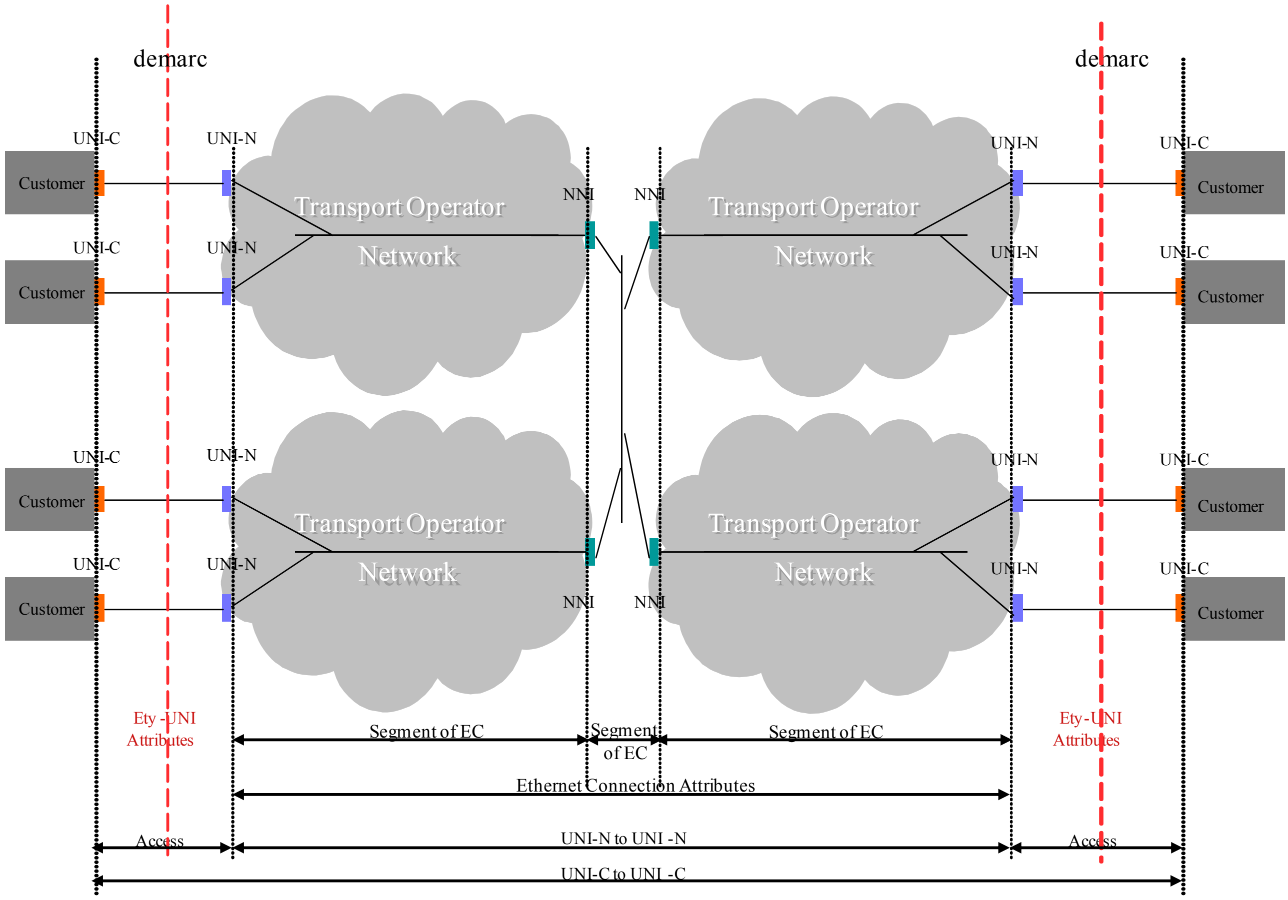

Figure 6-2 – Ethernet private LAN service (multiple domains)

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 point of view, ETH UNI-Ns are placed facing users at the domain edge in order to provide users access to the service and ETH NNIs are placed at the domain edge facing other domains. 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 NNI are responsible for forwarding and mapping the EPLAN service traffic based on the destination MAC address. EPLAN UNI-Ns and 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 sub-types of EPLAN that depend on the loop prevention mechanism being used, as shown in Table 6-1:

Table 6-1 – EPLAN sub-types

Type	Loop prevention
EPLAN sub-type1	Flow port grouping
EPLAN sub-type2	Spanning tree

6.2.1 Single domain

6.2.1.1 Full mesh with flow port grouping

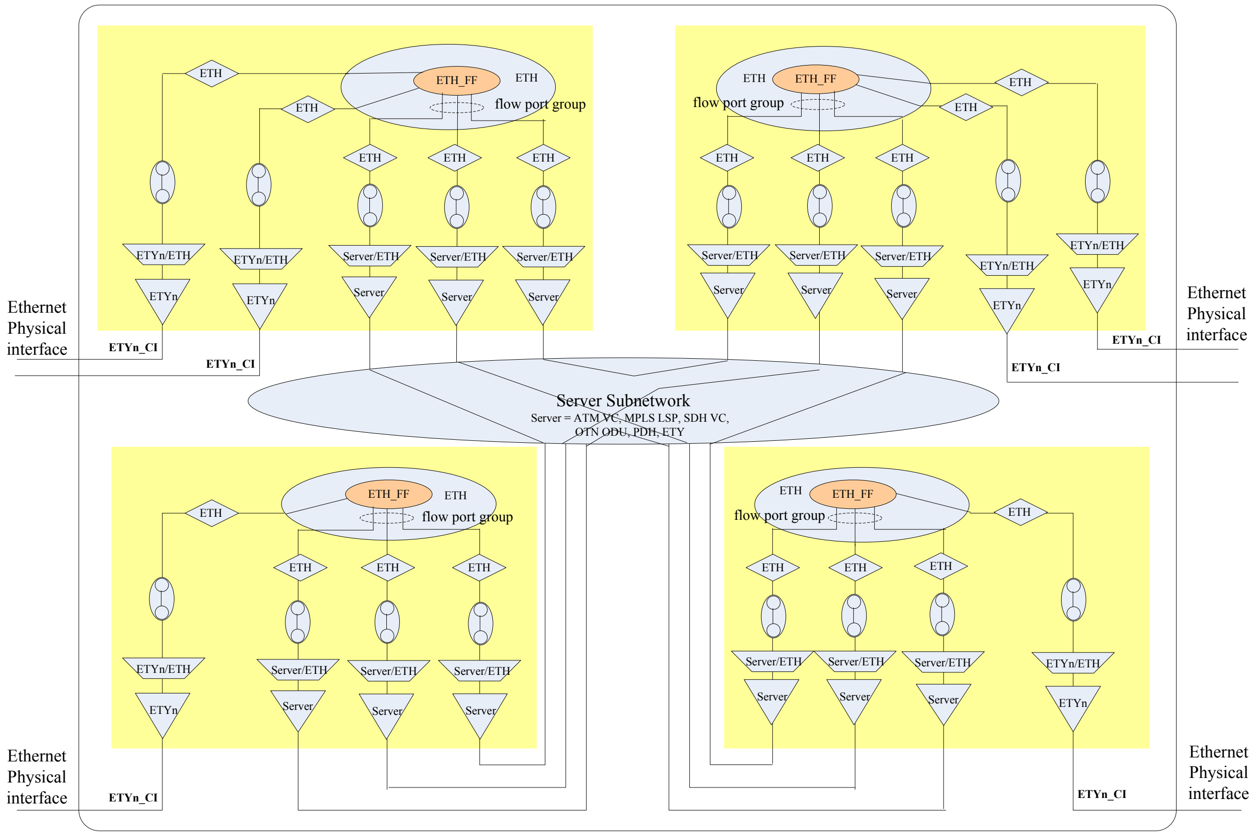

Figure 6-3 – EPLAN service architecture (full mesh with flow port grouping, single domain)

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 a 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.

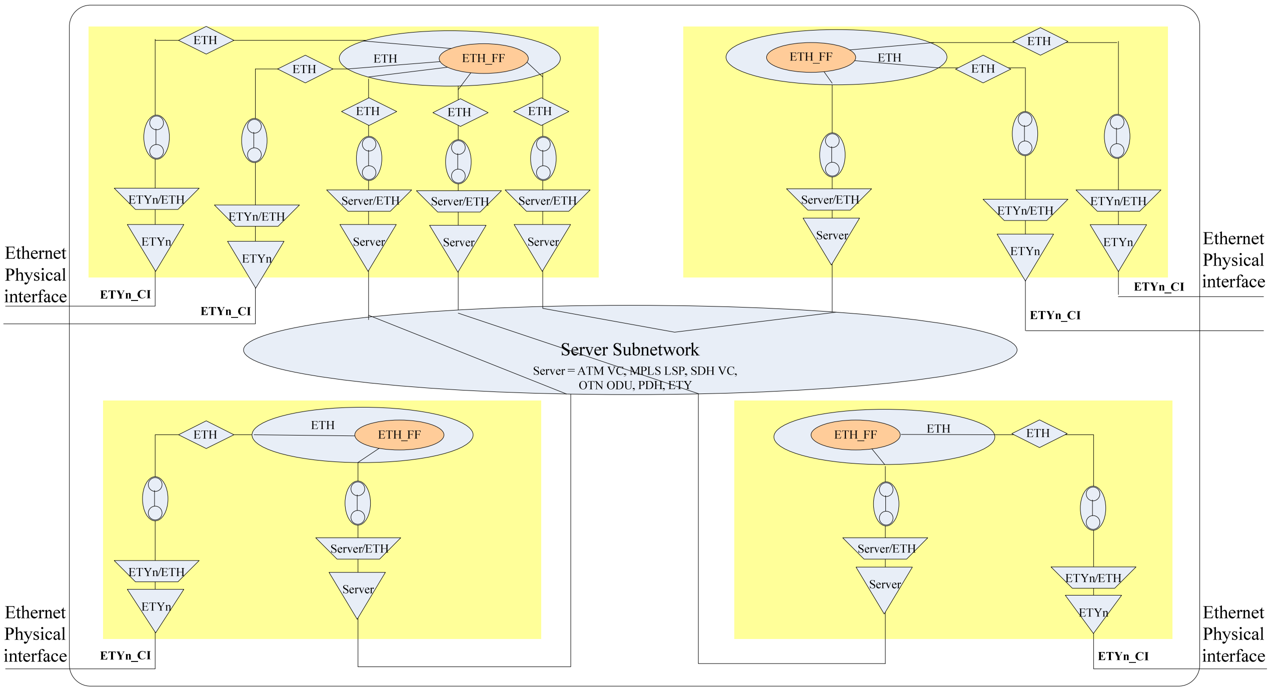

Figure 6-4 – EPLAN service architecture (spanning tree, single domain)

Note that here the spanning tree can be created under control of network management, and does not require the use of a spanning tree protocol.

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.

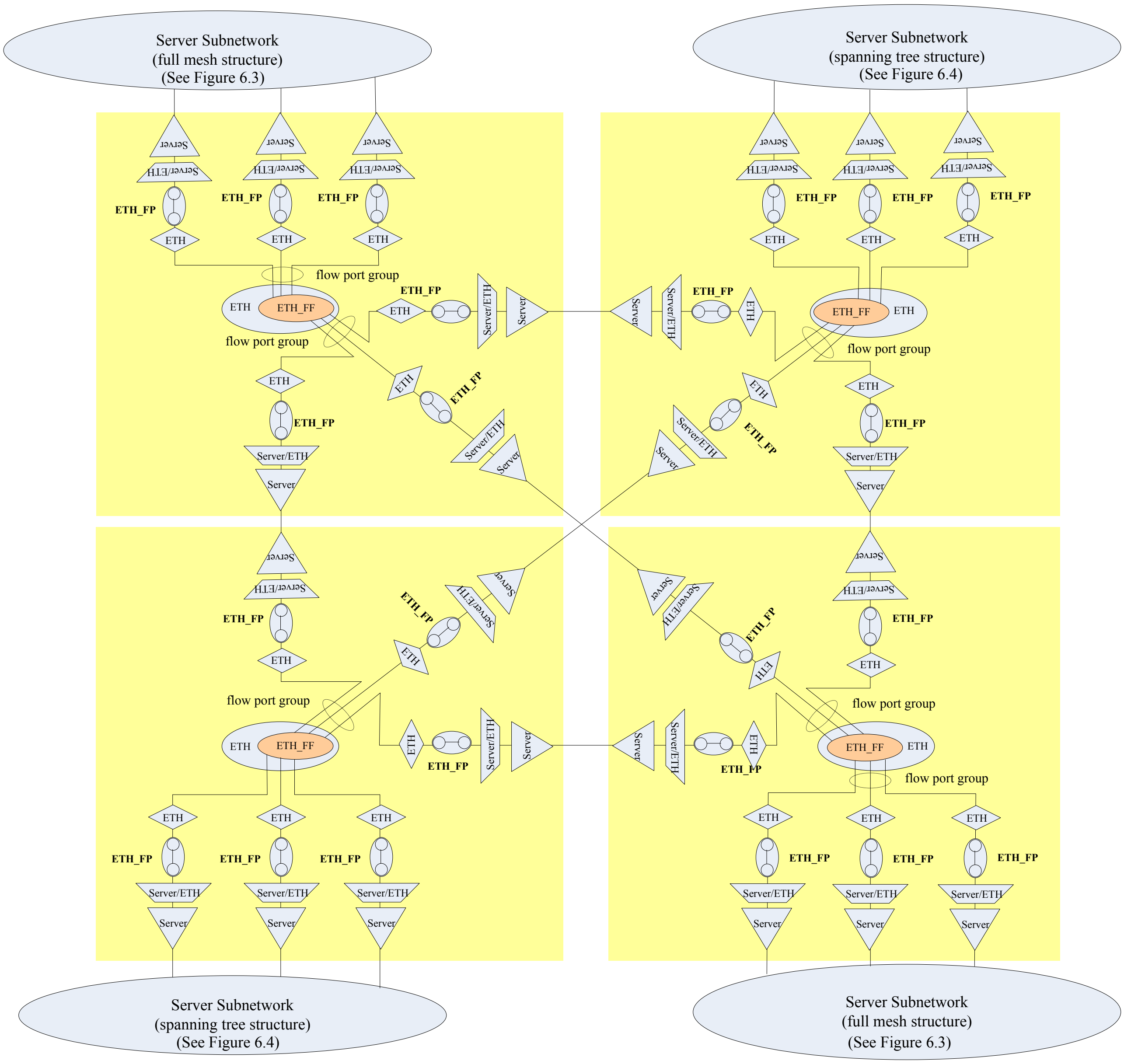

Figure 6-5 – EPLAN service architecture (full mesh with flow port grouping, multiple domains)

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.

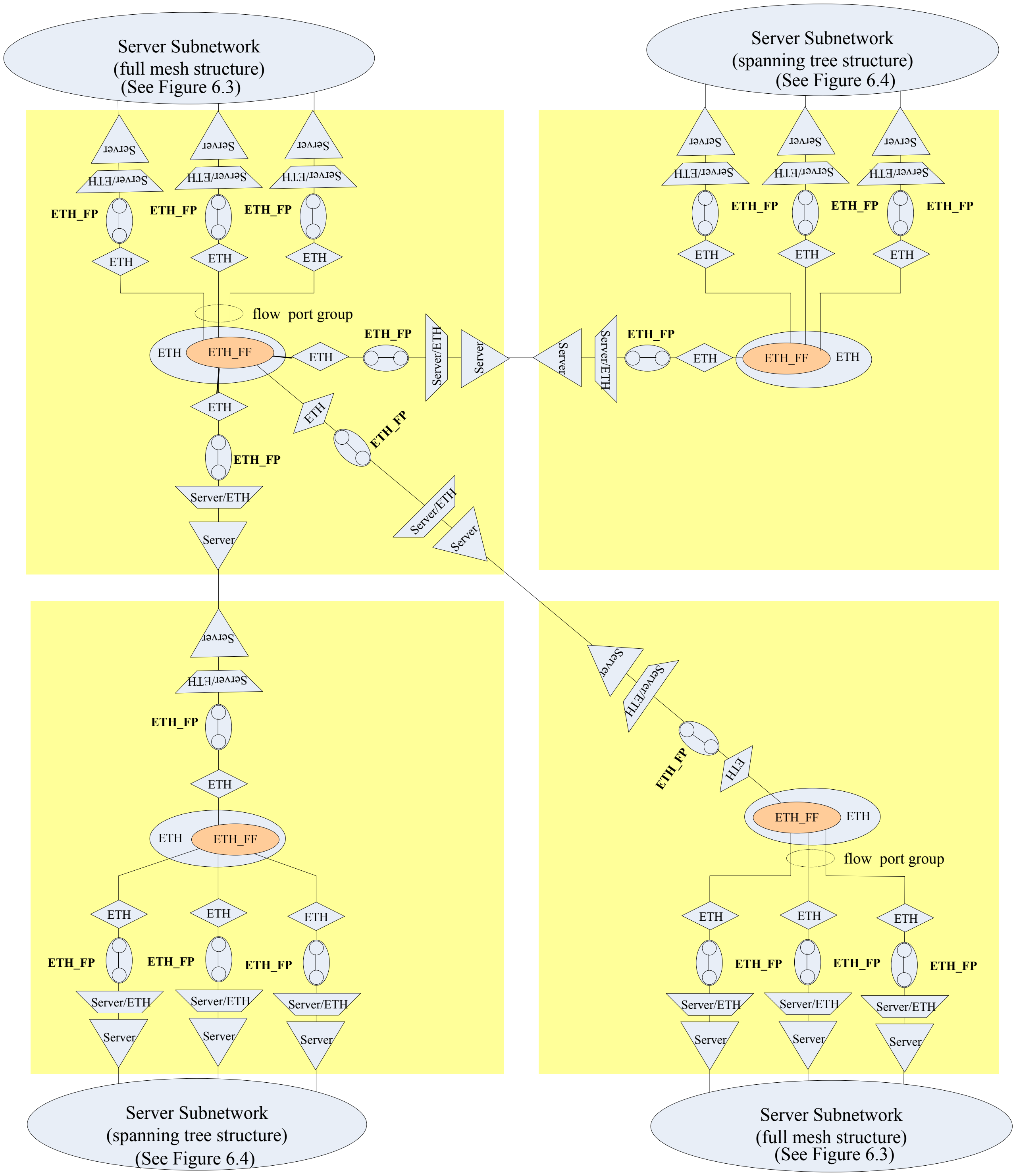

Figure 6-6 – EPLAN service architecture (spanning tree, multiple domains)

Note that here the spanning tree can be created under control of network management, and does not require the use of a spanning tree protocol.

7 Ethernet connection (EC) attributes for EPLAN

[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.

Table 7-1 – EC attributes

EC service attribute	Service attribute parameters and values
EC type	Multipoint-to-multipoint.
EC ID	An arbitrary string, unique across the MEN, for the EC supporting the service instance.
UNI list	A list of <UNI Identifier, UNI Type> pairs.
Maximum number of UNIs	Integer ≥ 2.
EC maximum transmission unit size	2000 ≥ Integer ≥ 1522.
CE-VLAN ID preservation	Must be Yes.
CE-VLAN CoS preservation	Must be Yes.
Unicast service frame delivery	Must Deliver Unconditionally.
Multicast service frame delivery	Must Deliver Unconditionally.
Broadcast service frame delivery	Must Deliver Unconditionally.
Layer 2 control protocols processing	MUST specify in accordance with clause 8.1.
EC 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 EC	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.
Egress bandwidth profile per EC	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.
Link type	Dedicated.
Traffic separation	Service instance: Spatial. Customer: Spatial.
Connectivity monitoring	Sub-layer monitoring: on demand, proactive, none. Inherent monitoring: proactive.
Survivability	None, server specific.

7.1 EC type

The connectivity of EPLAN is multipoint-to-multipoint.

7.2 EC ID

An arbitrary string.

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 EC. It is intended for management and control purposes.

7.4 Maximum number of UNIs

The maximum number of UNIs allowed must be not less than 2, per [MEF 6.1].

7.5 EC 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 (as specified in [IEEE 802.3]).

7.6 Preservation

The ingress VLAN ID and class of service (priority) of the ETH_CI are both preserved in EPLAN.

7.7 Service frame delivery

All Ethernet MAC data frames are transported according to their destination address.

7.8 Layer 2 control protocols

Layer 2 control protocol processing in EPLAN is described in Tables 8-2 and 8-3.

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

The EPLAN service is characterized by the six parameter group <CIR, CBS, EIR, EBS, CM, CF>. The EPLAN requires a traffic conditioning function at each UNI and NNI. A circuit will be allocated inside the network based on the flow CIR. An Ethernet flow may exceed its assigned rate at its own risk. A customer may implement shaping in order to avoid frame loss due to statistical variations in traffic.

7.11 Link type

The server link is referred to as dedicated for EPLAN, as defined in clause 7.11.1 of [ITU-T G.8011].

7.12 Traffic separation

EPLAN uses spatial separation between customer traffic as defined in clause 7.12.2 of [ITU-T G.8011].

EPLAN uses spatial service instance separation as defined in clause 7.12.1 of [ITU-T G.8011].

7.13 Connectivity monitoring

Connectivity monitoring 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.

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.

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.

Figures 7-1 and 7-2 illustrate those ETH MEP and ETH MIP functions.

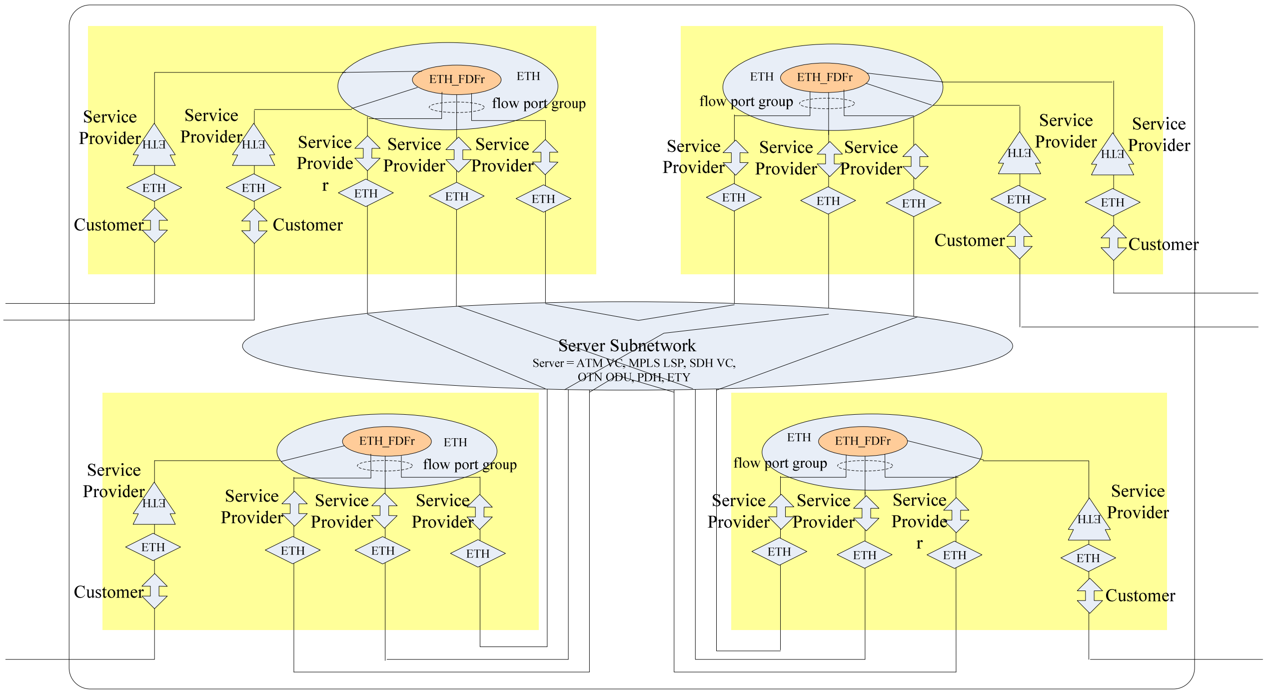

Figure 7-1 – Basic ETH MEP and MIP functions for the example in Figure 6-3

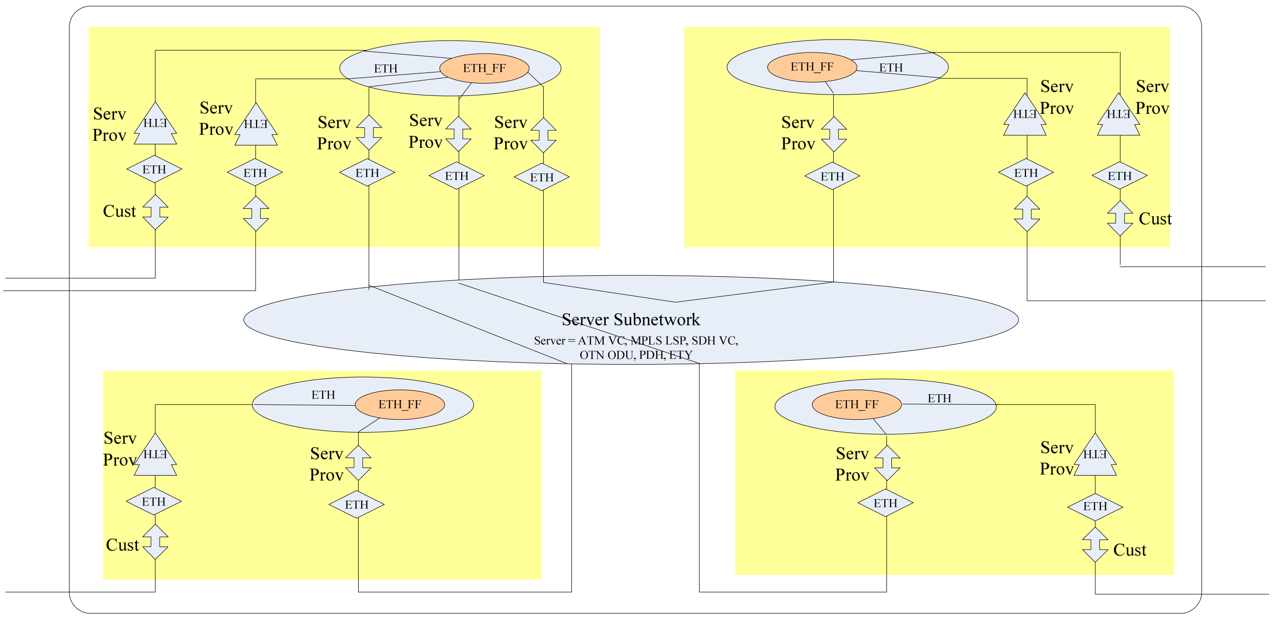

Figure 7-2 – Basic ETH MEP and MIP functions for the example in Figure 6-4

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 7-5) which are accessible from ETH MEP functions located in the customer network;
– ETH MEP functions on the UNI-N ports (see Figure 7-5) which are accessible by the service provider;
– ETH MIP functions on the inter domain NNI ports (see Figures 7-3 and 7-4) which are accessible from the service provider ETH MEP functions;
– ETH MEP functions on the UNI-N ports (See Figure 7-5) which are accessible by the network operator;
– ETH MEP functions on the inter domain NNI ports (see Figures 7-3 and 7-4) which are accessible by the network operator;
– ETH MIP functions on the intra domain NNI ports (see Figures 7-3, 7-4 and 7-5) 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 locating connectivity faults observed by the customer, which are not observed by the network. The ETH MIP functions on the inter domain NNI ports are used to help 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 locating connectivity faults inside the network.

Figures 7-3, 7-4 and 7-5 illustrate those ETH MEP and ETH MIP functions.

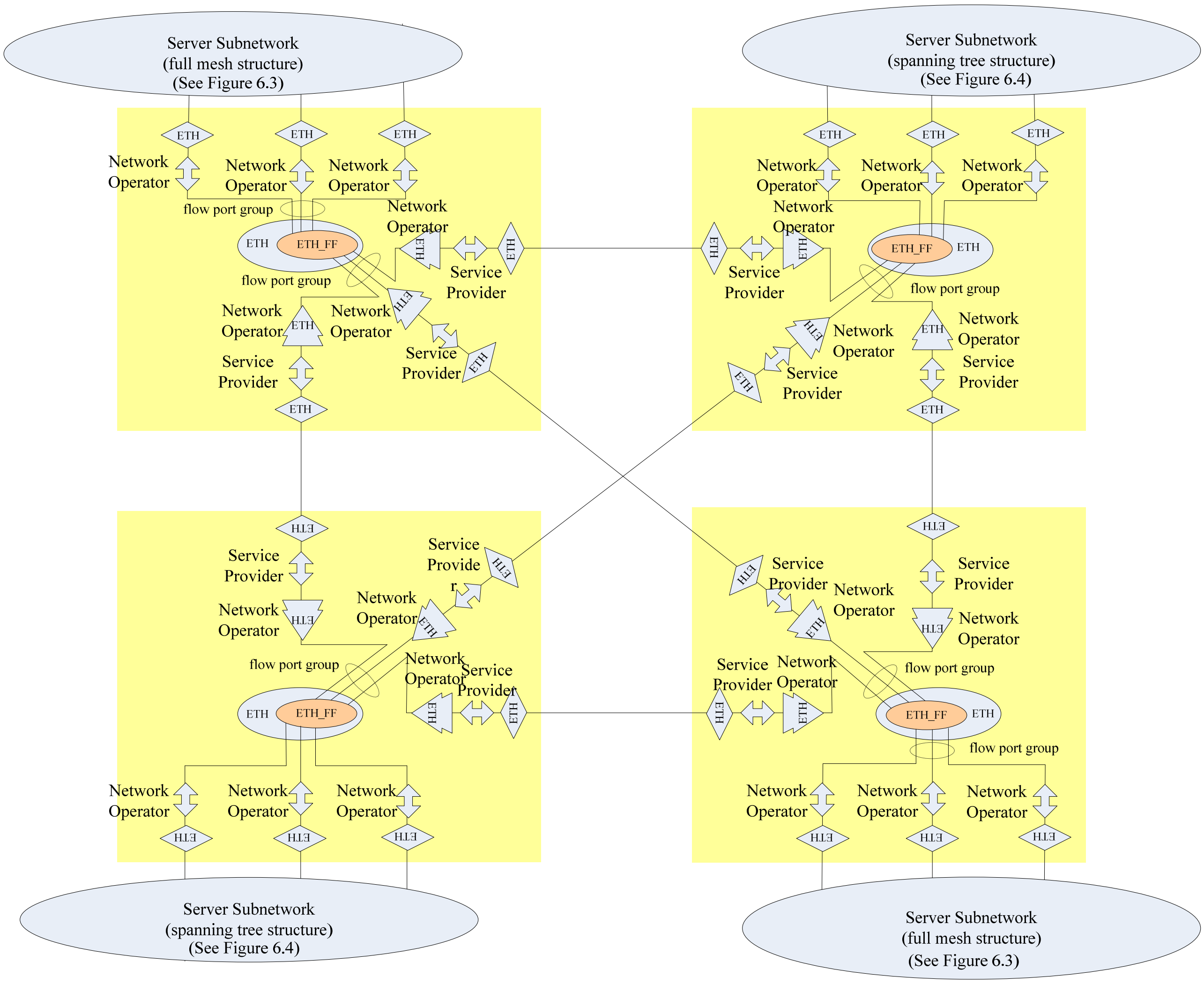

Figure 7-3 – Basic ETH MEP and MIP functions for the example in Figure 6-5

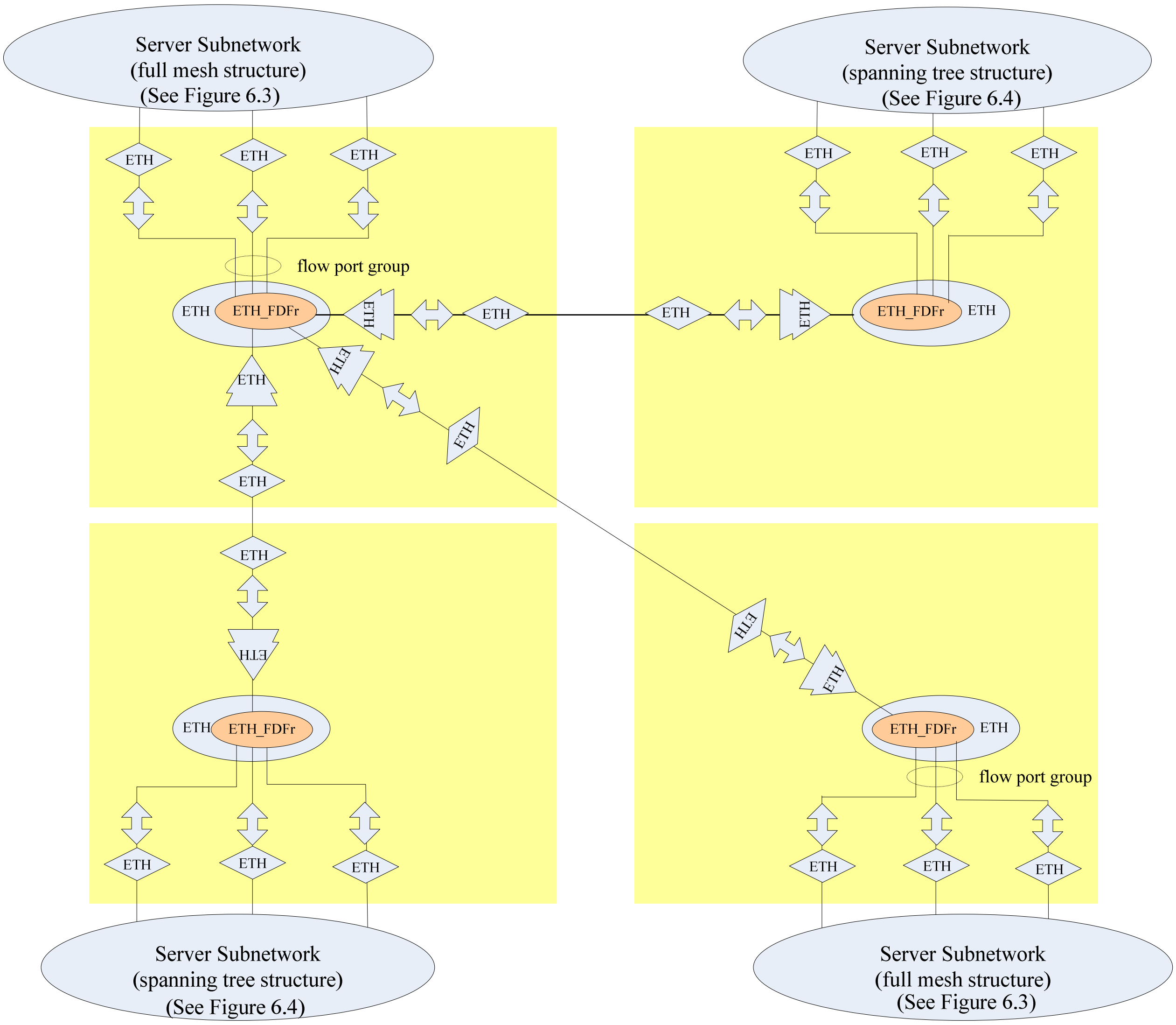

Figure 7-4 – Basic ETH MEP and MIP functions for the example in Figure 6-6

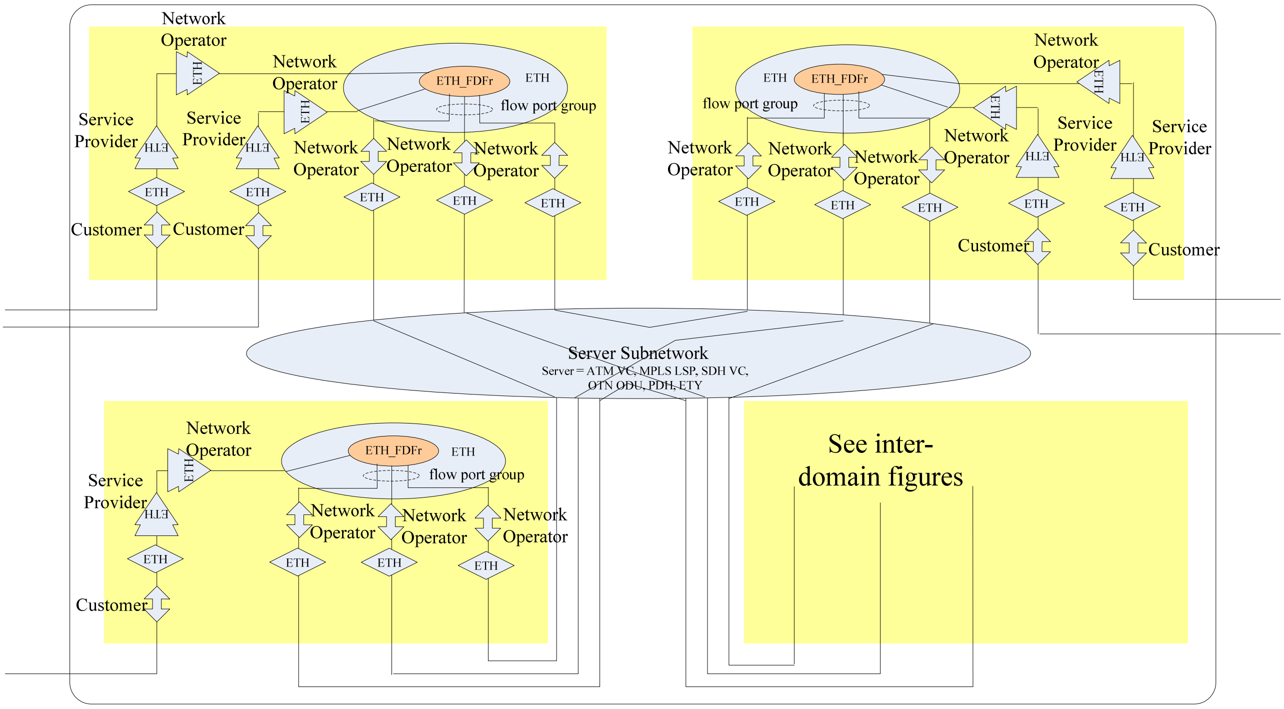

Figure 7-5 – Basic ETH MEP and MIP functions for the multipoint-to-multipoint Ethernet connection segment within the domain of one transport operator

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 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 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 endpoints of the p2p ETH link connections are activated. Those ETH MEP functions are not illustrated in Figures 7-1 to 7-5.

7.14 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 MPLS protection schemes;

– restoration by means of SDH or OTH or ATM 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.

The applicability of survivability by means of LAG 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. These are summarized in Table 8-1.

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 – 2008.
	UNI maximum transmission unit size	2000 ≥ Integer ≥ 1522.
	Service multiplexing	No.
	UNI EC ID	A string formed by the concatenation of the UNI ID and the EC ID.
	CE-VLAN ID for untagged and priority tagged service frames	A number in 1, 2, …, 4094.
	CE-VLAN ID/EC mapping	MUST be No.
	Maximum number of ECs	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 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 CoS ID, and MUST specify <CIR, CBS, EIR, EBS, CM, CF>. MUST NOT be allowed if any other ingress bandwidth profile is applied at this UNI.
	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.
	Egress bandwidth profile per class of service identifier	OPTIONAL. If supported, MUST specify CoS ID, and MUST specify <CIR, CBS, EIR, EBS, CM, CF>. MUST NOT be allowed if any other egress bandwidth profile is applied at this UNI.
	Layer 2 control protocols processing	MUST specify in accordance with Tables 8-2 and 8-3.
	UNI type	Not applicable.
	Connectivity monitoring	OPTIONAL. All ITU-T Y.1731 commands supported.
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 ETH_UNI attributes

8.1.1 UNI identifier

The UNI ID, as defined in section 7.1 of [MEF 10.1], 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 EPL 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 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

EPLAN does not use multiplexed access.

8.1.5 UNI EC ID

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

8.1.6 CE-VLAN ID/EC mapping

CE-VLAN ID is an integer between 1 and 4094.

For EPLAN, all VLAN IDs are mapped into the same EC. VLAN ID mapping is not supported.

8.1.7 Maximum number of ECs

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

8.1.8 Bundling

No, per [MEF 6.1].

8.1.9 All to one bundling

For EPLAN, bundling is all-to-one.

8.1.10 Bandwidth profile

The bandwidth profile at the ETH_UNI is specified in clause 7.10.

8.1.11 Layer 2 control protocols processing

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

Table 8-2 – Ingress (sink) L2CP UNI processing for the EPLAN subtypes 1 and 2

Protocol	MAC DA	L2CP requirement	UNI applicability
STP/RSTP/MSTP	01-80-C2-00-00-00	MUST Tunnel or Discard	All UNIs in the EC
PAUSE	01-80-C2-00-00-01	MUST Discard	All UNIs in the EC
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 EC
GARP/MRP block	01-80-C2-00-00-20 through 01-80-C2-00-00-2F	MUST Peer, Tunnel or Discard	Per UNI
Service OAM, UNI ME, CC	01-80-C2-00-00-3X or Unicast	MUST Peer, Tunnel or Discard	All UNIs in the EC
Service OAM, UNI ME, LT	01-80-C2-00-00-3Y	MUST Peer, Tunnel or Discard	All UNIs in the EC
Service OAM, UNI ME, LB	Unicast	MUST Peer, Tunnel or Discard	All UNIs in the EC
Service OAM – subscriber MD	Unicast, multicast	MUST Peer or Tunnel	All UNIs in the EC

For the EPLAN service, the egress behaviour has the same protocols except for PAUSE, as indicated in Table 8-3:

Table 8-3 – Engress (source) L2CP UNI processing for the EPLAN subtypes 1 and 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 UNI type

Not applicable.

8.1.13 Connectivity monitoring

For EPLAN connectivity monitoring is achieved via Ethernet OAM mechanisms defined in [ITU-T Y.1731]/[IEEE 802.1ag] 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 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 have already been covered 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 EPLAN are specified as follows:

8.2.1 Physical medium

This attribute indicates the IEEE 802.3 medium of the Ethernet PHY device that is used to transport the Ethernet service. The valid values are a superset of those defined in section 7.2 of [MEF 10.1], and are defined by [ITU-T G.8012].

8.2.2 Speed

This attribute indicates the speed of the Ethernet PHY device that is used to transport the Ethernet service. The valid values are subset of those defined in section 7.2 of [MEF 10.1], and are 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 the Ethernet PHY device that is used to transport the Ethernet service. As defined in section 7.2 of [MEF 10.1] only full duplex is supported.

9 EPLAN NNI attributes

This clause describes service NNI attributes that modify the behaviour of a particular instance of an Ethernet service at the demarc of the NNI to characterize the service. It is optional that a NNI is defined for an EPLAN service. NNI service attributes are summarized in Table 9-1.

Table 9-1 – NNI service attributes

Layer	NNI service attribute	Service attribute parameters and values
ETH	MAC service	IEEE 802.3-2008 frame format.
	NNI identifier	Arbitrary text string to identify each NNI instance.
	NNI EC ID	Arbitrary text string to identify each EC instance.
	Multiplexed link	No.
	VLAN ID mapping	Not applicable.
	Bundling	MUST be No.
	Bandwidth profile	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 NNI.
	Layer 2 control protocol processing	Block, process, pass per protocol on ingress Generate or none per protocol on egress.
	NNI type	Not applicable.
Server	Server layer	Specify.

9.1 ETH_NNI attributes

9.1.1 MAC service

This attribute indicates support for the IEEE 802.3-2002 frame format.

Other MAC frame sizes are for further study.

9.1.2 Operator NNI identifier

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 EC ID

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

9.1.4 Multiplexed link

EPLAN does not use multiplexed NNI link.

9.1.5 VLAN ID mapping

At the NNI there can be a mapping of each service provider VLAN ID to at most one EC.

For EPLAN, VLAN mapping is not supported.

9.1.6 Bundling

No.

9.1.7 Bandwidth profile

The bandwidth profile at the ETH_NNI is specified in clause 7.10.

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-TG.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

Not applicable.

9.2 Server layer adaptation

The set of attributes defined at the server layer NNI are as follows.

9.2.1 Server layer

This attribute indicates the type of server layer that is used to transport the Ethernet service. There are several options defined in [ITU-T G.8012] (e.g., SDH, PDH, OTH, ETY, ATM, etc.). The value is specified.

ITU-T Y-SERIES RECOMMENDATIONS

GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

GLOBAL INFORMATION INFRASTRUCTURE	
General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899
INTERNET PROTOCOL ASPECTS	
General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	**Y.1300–Y.1399**
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
IPTV over NGN	Y.1900–Y.1999
NEXT GENERATION NETWORKS	
Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Numbering, naming and addressing	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Future networks	Y.2600–Y.2699
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899
Carrier grade open environment	Y.2900–Y.2999

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

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	**Transmission systems and media, digital systems and networks**
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Terminals and subjective and objective assessment methods
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	**Global information infrastructure, Internet protocol aspects and next-generation networks**
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2010