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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 service characteristics

Recommendation ITU-T G.8011/Y.1307

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Recommendation ITU-T G.8011/Y.1307

Ethernet service characteristics

Summary

Recommendation ITU-T G.8011/Y.1307 describes a framework for defining network-oriented characteristics of Ethernet services. The framework is based on the modelling of Ethernet layer networks described in Recommendation ITU-T G.8010/Y.1306. The attribute sets introduced in this framework (Ethernet connection (EC), user-to-network interface (UNI) and network-to-network interface (NNI)) are intended to be used to create numerous specific Ethernet services.

Source

Recommendation ITU-T G.8011/Y.1307 was approved on 13 January 2009 by ITU-T Study Group 15 (2009-2012) under Recommendation ITU-T A.8 procedures.

Keywords

Ethernet, Ethernet connection, Ethernet service, framework, network-to-network interface, user-to-network interface.

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1 Scope

This Recommendation defines a framework to describe a set of Ethernet services based on [MEF 10.1]. The framework consists of a set of attributes for each of Ethernet connection, Ethernet UNI and Ethernet NNI. The resulting services that can be defined do not refer to a particular network technology implementation and are supported by the Ethernet layer architecture model presented in [ITU-T G.8010].

Since the ITU-T focus is on service provider aspects, this Recommendation describes client Ethernet services from the network point of view.

This Recommendation provides the framework to define different services to carry an Ethernet link connection. The Ethernet subnetwork for each of the services introduced in this Recommendation is defined in a companion set of Recommendations ITU-T G.8011.x/Y.1307.x.

For example, [ITU-T G.8011.1] specifies the details only for point-to-point Ethernet private line services. Other services will be specified in more detail in future Recommendations in the ITU-T G.8011.x/Y.1307.x series.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.809] Recommendation ITU-T G.809 (2003), *Functional architecture of connectionless layer networks*.

[ITU-T G.8001] Recommendation ITU-T G.8001/Y.1354 (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.8011.1] Recommendation ITU-T G.8011.1/Y.1307.1 (2004), *Ethernet 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 (2007), *Characteristics of Ethernet transport network equipment functional blocks*.

[IEEE 802] IEEE 802 (2001), *IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture*.

[IEEE 802.1AB] IEEE 802.1AB (2005), *IEEE Standard for Local and Metropolitan Area Networks – Station and Media Access Control Connectivity Discovery*.

[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 (2001), *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*.

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

3 Definitions

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

3.1 ETH link

3.2 Flow domain fragment

3.3 Link

3.4 Link connection

3.5 Subnetwork

3.6 Traffic conditioning function

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

3.7 Flow point

3.8 Flow termination

3.9 Termination flow point

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

3.10 Access link

3.11 Customer

3.12 Ethernet connection (EC) or Ethernet virtual connection (EVC)

NOTE – In most cases, EC is functionally equivalent to the EVC defined by [MEF 10.1].

3.13 Ethernet service

3.14 Ethernet service area

3.15 Ethernet service instance

3.16 NNI

3.17 UNI

4 Abbreviations

This Recommendation uses the following abbreviations:

CBR	Constant Bit Rate
CBS	Committed Burst Size
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
EBS	Excess Burst Size
EC	Ethernet Connection
EIR	Excess Information Rate
ETH	Ethernet MAC Layer Network
ETY	Ethernet PHY Layer Network
EVC	Ethernet Virtual Connection
FDFr	Flow Domain Fragment
FP	Flow Point
GARP	Generic Attribute Registration Protocol
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
LBR	LoopBack Reply
LC	Link Connection
LTM	Link Trace Message
LTR	Link Trace Reply
MAC	Media Access Control
MEG	Maintenance Entity Group
MEP	Maintenance End Point
MIP	Maintenance Intermediate Point
MSTP	Multiple Spanning Tree Protocol
NNI	Network-to-Network Interface
PHY	Physical device

RSTP	Rapid Spanning Tree Protocol
SN	Subnetwork
STP	Spanning Tree Protocol
TFP	Termination Flow Point
UNI	User-to-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].

Further, 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 services

This Recommendation does not define Ethernet services, but provides a framework from which services can be defined. This framework is based on the Ethernet transport architecture described in [ITU-T G.8010]. Unlike the previous version of this Recommendation, the base Ethernet services attributes are imported from [MEF 10.1], to ensure alignment. This Recommendation adds further explanation to some of these attributes to clearly show the relationship to [ITU-T G.8010]. In addition, several ITU specific attributes are defined to provide a superset of attributes.

6.1 Ethernet service areas

Ethernet service areas identify the various portions of a network that support an Ethernet service instance. A simple model of an Ethernet network (for a single carrier's network) is shown in Figure 6-1. Three Ethernet service areas are identified: access (UNI-C to UNI-N), edge-to-edge (the Ethernet connection from UNI-N to UNI-N), and end-to-end (UNI-C to UNI-C).

Figure 6-1 also shows a three-tier relationship. The three tiers (equipment at the top, ETH layer in the middle and ETY layer at the bottom) allow a clear identification of how the equipment functions map onto the ETH and ETY layers. Note that the customer equipment is shown as a flow point on the right and a subnetwork (SN) on the left of the diagram, to illustrate that both are possible.

It is further shown that the UNI reference point occurs in the middle of the access link, or more precisely that the UNI is a reference point whose functionality is split into customer (UNI-C) and network (UNI-N) components. Additional UNI details are defined in [ITU-T G.8012].

The relationship between the Ethernet service areas illustrated in Figure 6-1 (and in Figures 6-2 and 6-3), and the maintenance entities (ME) described in [ITU-T G.8010] is shown in Table 6-1:

Table 6-1 – Ethernet areas and maintenance entities

Ethernet area	Maintenance entity
Access link	Access link
End-to-end	UNI-C to UNI-C
Edge-to-edge	UNI-N to UNI-N

Note that a ME is point to point whilst the Ethernet service may be multipoint to multipoint. Therefore, in general, an Ethernet service area will contain multiple ME instances.

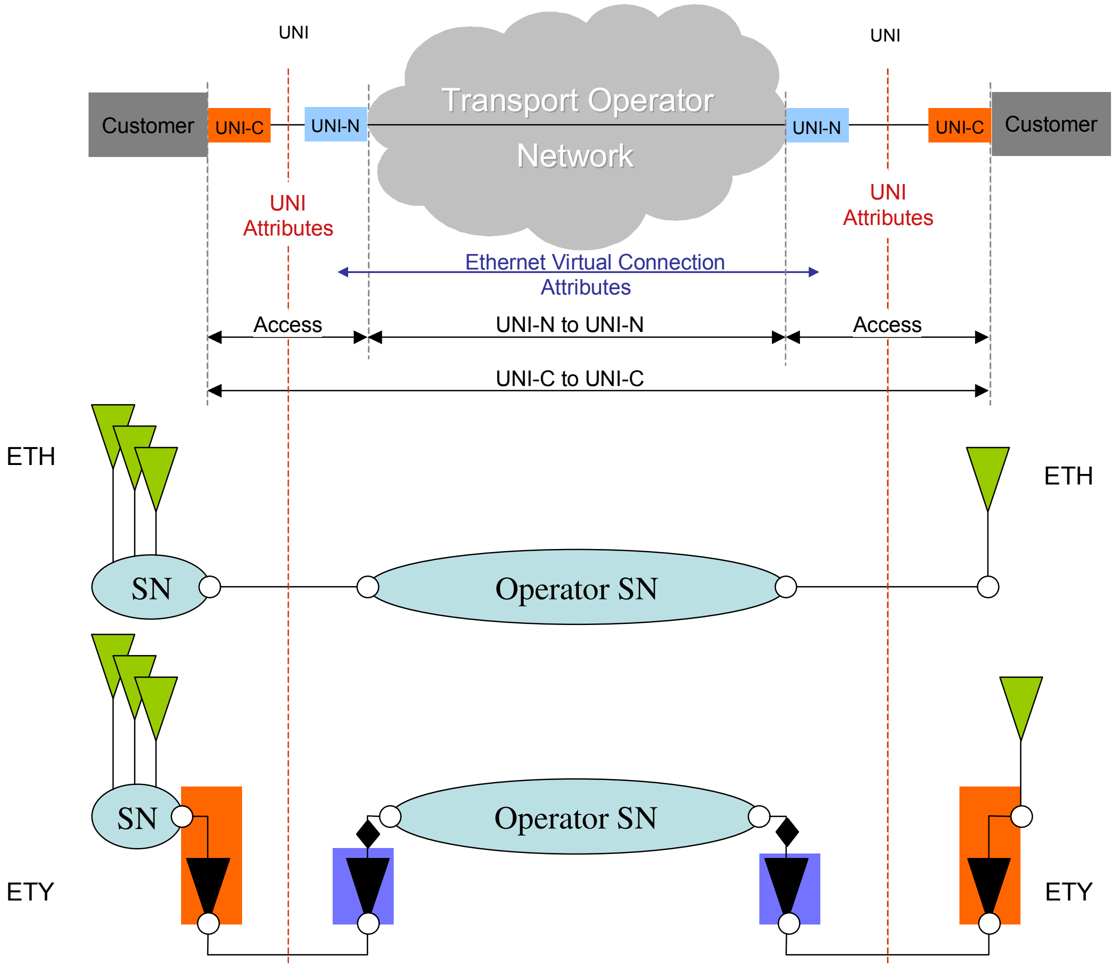


Figure 6-1 – Single-provider view of Ethernet service areas

Figure 6-2 shows a simple network where the service provider's network is a single link. It introduces the NNI link, which is the link between the UNI-Ns and the NNI reference point.

Similar to the UNI, a demarcation occurs in the middle of the NNI link, or more precisely the NNI is a reference point whose functionality is split in half – either between different providers or within the same provider. Additional NNI details are defined in [ITU-T G.8012].

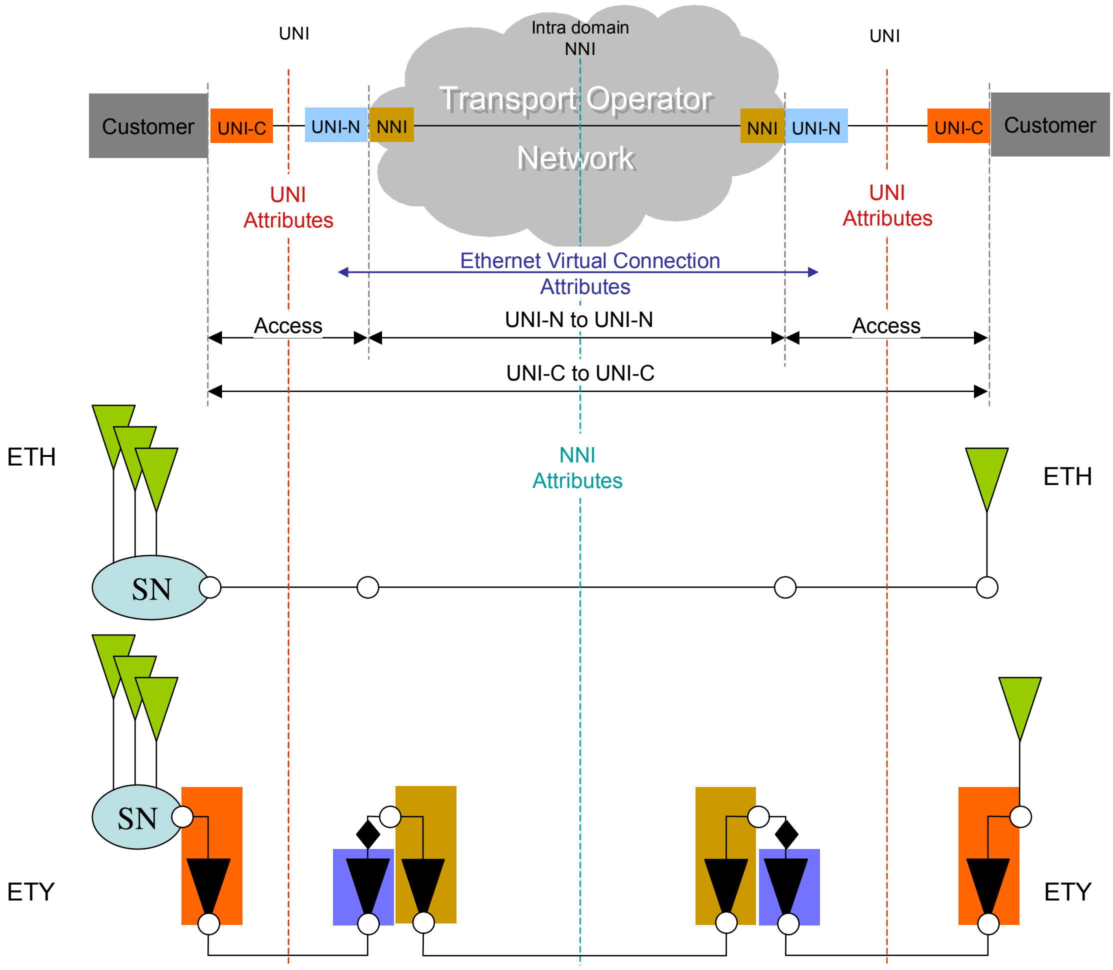


Figure 6-2 – Single-provider with NNI view of Ethernet service areas

Figure 6-3 shows the case of two interconnected operators and illustrates the implications to the NNI. Notably, this is an inter-domain NNI as defined in [ITU-T G.8012].

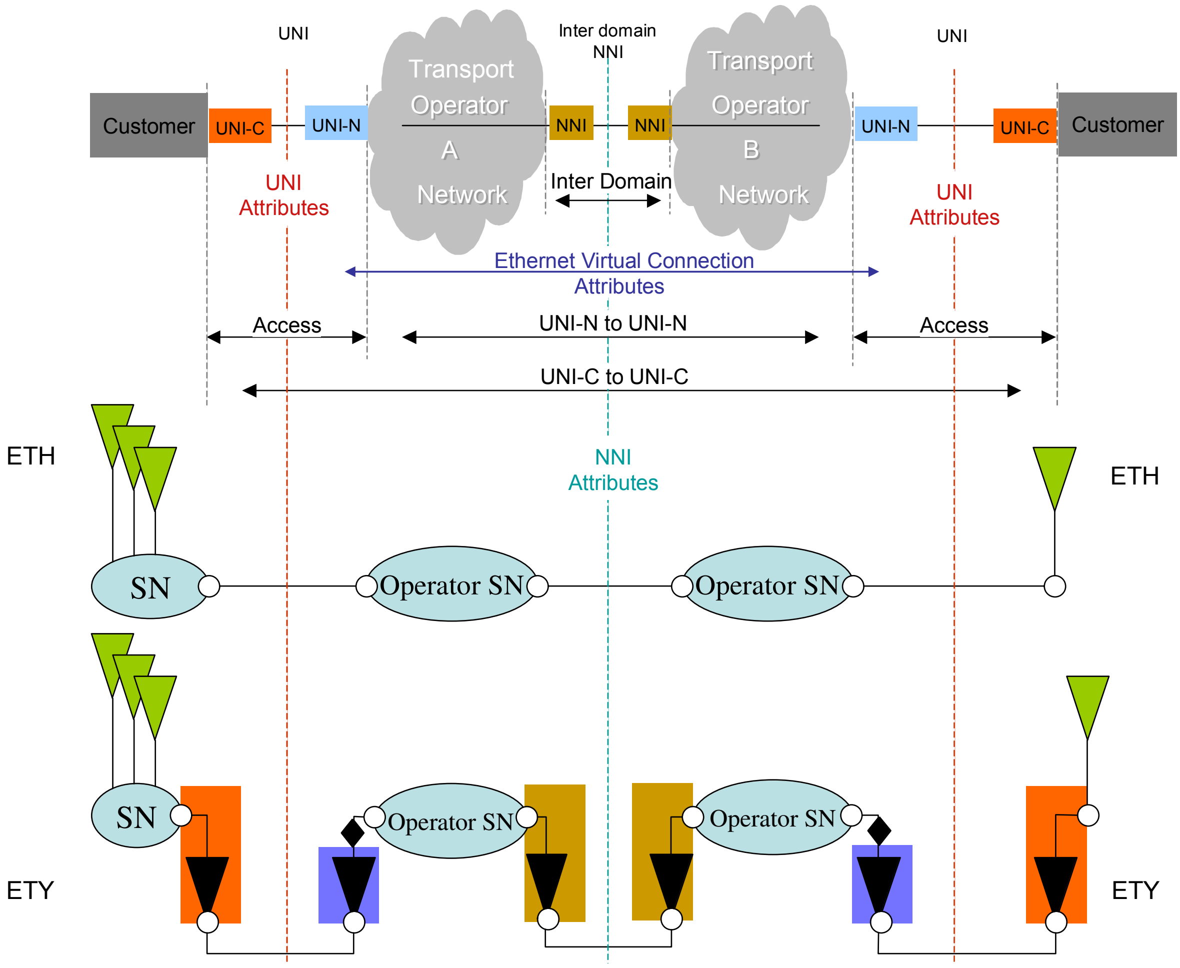


Figure 6-3 – Multi provider with NNI view of Ethernet service areas

Additional network views are shown in Annex B. Note that more complex networks beyond those described are for further study.

6.2 Ethernet service aspects

An Ethernet service provider provides Ethernet services between the UNI reference points shown in Figure 6-1, using the topology of the Ethernet network. This topology may be composed of a simple Ethernet link or alternatively one or more subnetworks and the links between them. Four sets of attributes can be derived from the Ethernet service areas figures to form a framework to define a specific Ethernet service. These four attribute sets (UNI-C port, UNI-N port, NNI port and Ethernet virtual connection) are also shown in Figures 6-1, 6-2 and 6-3.

The remainder of this Recommendation defines Ethernet virtual connection attributes for the support of Ethernet services for UNI-N to UNI-N (clause 7), Ethernet UNI-N port attributes (clause 8), and Ethernet NNI port attributes for intra- and inter-carrier handoff (clause 9). The attributes for the UNI-C port are for further study. Details on the structures and mappings of the UNI and NNI to specific server layers are specified in [ITU-T G.8012]. The equipment functions of these interfaces are defined in [ITU-T G.8021].

Note that in most cases, EC is functionally equivalent to the EVC defined by [MEF 10.1]. The only subtle difference would be for connectivity monitoring – this attribute is not defined for the EVC in MEF, but is defined in this Recommendation. The MEF specifies 802.1ag and ITU specifies [ITU-T Y.1731]. As a result, this Recommendation will use the term EVC as equivalent to both the MEF EVC and the G.8001 EC[1].

This Recommendation does not describe performance characteristics of the services such as availability, latency, latency variation, traffic conditioning parameters, etc.

The permitted values for the sets of attributes will be specified for each of the Ethernet services that are defined in other Recommendations, as listed in Table 6-2. The result is that this Recommendation allows classification of many Ethernet services. For example, [ITU-T G.8011.1] selects appropriate attributes to describe the first service.

Table 6-2 – Ethernet services Recommendations

Ethernet service	Recommendation
Ethernet Private Line (EPL)	ITU-T G.8011.1/Y.1307.1
Ethernet Virtual Private Line (EVPL)	ITU-T G.8011.2/Y.1307.2
Ethernet Virtual Private LAN (EVPLAN)	FFS (ITU-T G.8011.3/Y.1307.3)
Ethernet Virtual Private Rooted Multipoint Service (EVPRM)	FFS (ITU-T G.8011.4/Y.1307.4)
Ethernet Private LAN (EPLAN)	FFS (ITU-T G.8011.5/Y.1307.5)

6.3 Ethernet services views

It is important to understand the perspective of an Ethernet service. The full lists of attributes and their values may differ depending on whether the service is viewed from the network looking out or from the customer looking in.

The end result is that a service defined from the customer's perspective with MEF EVC and UNI attributes can be deployed over a network infrastructure service defined with ITU-T G.8011 EVC and UNI attributes. This is especially true since the attributes of this Recommendation are based on MEF.

6.3.1 Network view

This Recommendation presents the framework for a series of Ethernet services from the perspective of the network or service provider. As a result, various topology, service and performance characteristics are visible that may not be visible from other views. This can result in a wide variety of services based on these parameters.

In addition, each service will have attributes that describe the behaviour of the network connection. These attributes may be simple (e.g., connectivity – pt-pt) or may be a grouping of attribute elements (e.g., characteristics – address, priority, etc.). It should be noted that in the network view, for example, the Ethernet connection set of attributes (per Figure 6-1) will have a number of infrastructure specific attributes. That is, the EVC is not network agnostic.

[1] NOTE – The G.8011-2004 Ethernet connection (EC) definition excluded the UNI-N. This was a significant difference from the MEF. This Recommendation clarifies that the EVC starts in the UNI-N. Exactly where the start of the EVC is located depends on the underlying server layer.

6.3.2 Customer view

Ethernet services can also be described from the perspective of the customer. Such a description does not provide any details about how a service is realized. That is, the EVC is network agnostic. This will not be covered by this Recommendation.

This Recommendation is complementary to the definitions of Ethernet services from the customer viewpoint looking into the network. For example, the MEF EVC may be carried over an EVC as described by ITU.

7 Ethernet virtual connection attributes

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 base set of ITU-T G.8011 EVC attributes is the same as the Ethernet virtual connection (EVC) attributes defined in [MEF 10.1]. Several additional EVC attributes are also defined in this clause. Additional clarification for the base attributes and a definition of the additional attributes are described in the following clauses, and they are summarized in Table 7-1.

Table 7-1 – EVC service attributes

EVC service attribute	Service attribute parameters and values	MEF 10.1 reference
EVC type	Point-to-point, multipoint-to-multipoint, or rooted-multipoint	6.1
EVC ID	An arbitrary string, unique across the MEN, for the EVC supporting the service instance	6.2
UNI list	A list of <UNI Identifier, UNI Type> pairs	6.3
Maximum number of UNIs	Integer. **MUST** be 2 if EVC type is point-to-point. **MUST** be greater than or equal to 2 otherwise.	6.4
EVC maximum transmission unit size	2000 ≥ Integer ≥ 1522.	6.10
CE-VLAN ID preservation	Yes or No	6.6.1
CE-VLAN CoS preservation	Yes or No	6.6.2
Unicast service frame delivery	Discard, deliver unconditionally, or deliver conditionally. If deliver conditionally is used, then the conditions **MUST** be specified.	6.5.1.1
Multicast service frame delivery	Discard, deliver unconditionally, or deliver conditionally. If deliver conditionally is used, then the conditions **MUST** be specified.	6.5.1.2
Broadcast service frame delivery	Discard, deliver unconditionally, or deliver conditionally. If deliver conditionally is used, then the conditions **MUST** be specified.	6.5.1.3
Layer 2 control protocols processing	A list of Layer 2 control protocols labelled tunnel or discard.	6.7
EVC performance	Performance objectives for frame delay performance, frame delay variation performance, frame loss ratio performance, and availability performance and associated class of service identifier(s) as defined in clause 6.8 of MEF 10.1	6.8, 6.9

Table 7-1 – EVC service attributes

EVC service attribute	Service attribute parameters and values	MEF 10.1 reference
Ingress bandwidth profile per EVC	No, or parameters for each EVC	7.11.2.2, 7.11.1
Egress bandwidth profile per EVC	No, or parameters for each EVC	7.11.3.2, 7.11.1
Link type	Dedicated, shared	ITU-T
Traffic separation	Service instance: Spatial, logical Customer: Spatial, logical	ITU-T
Connectivity monitoring	Sub-layer monitoring: on demand, proactive, none Inherent monitoring: proactive	ITU-T
Survivability	None, server specific	ITU-T

The relationship of these attributes to [ITU-T G.8010] is shown in Annex A.

The values for these attributes will be specified for each of the Ethernet services defined in the G.8011.x/Y.1307.x series of Recommendations.

7.1 EVC type

This EVC type attribute indicates the connectivity between Ethernet endpoints in the transport service. There are three options, as defined in clause 6.1 of [MEF 10.1]: pt-pt, mp-mp, pt-mp. The following clauses show how these are modelled.

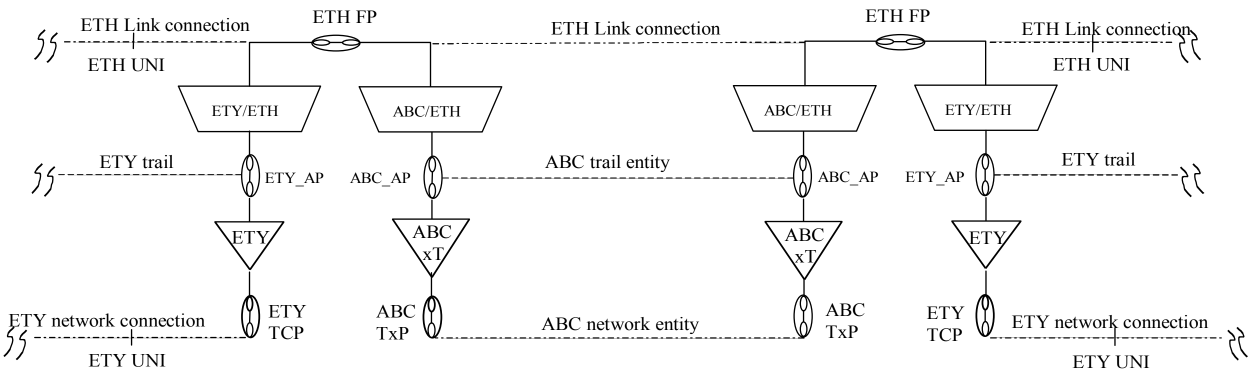
7.1.1 Point-to-point

Connectivity of a point-to-point (pt-pt) service is between only two points. The pt-pt topology is supported by:

- a (component) link within the provider network (non-extendible), or
- a subnetwork with only two flow points in use (extendible).

The topology for the network portion of the non-extendible pt-pt service is shown in Figure 7-1.

The ETH link connection may be supported by a server layer technology that is connection oriented (circuit switched or packet switched) or connectionless.



ABC - a connection oriented circuit switched or connection oriented packet switched or connectionless technology
ABC- xT, x = T, connection oriented trail termination for technology ABC
ABC- xT, x = F, connectionless flow termination for technology ABC
ABC trail entity = ABC trail for connection oriented technology, ABC connectionless trail for connectionless technology
ABC network entity = ABC network connection for connection oriented technology, ABC network flow for connectionless technology

Figure 7-1 – Network portion of the point-to-point topology

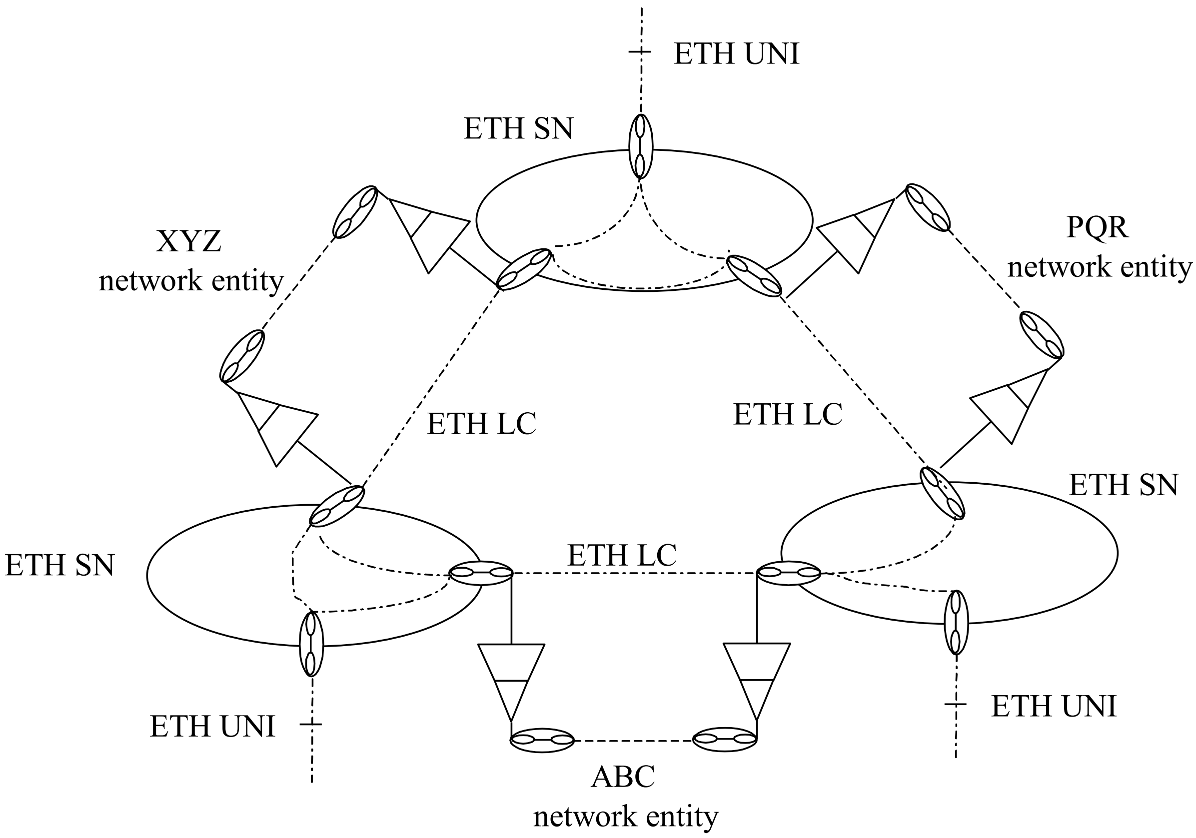
7.1.2 Multipoint-to-multipoint

Connectivity of a multipoint to multipoint (mp-mp) service is between two or more points.

The topology for the network portion for LAN services consists of one or more subnetworks with ETH links between them, as shown in Figure 7-2.

Each of the ETH links may be supported by a server layer technology that is connection oriented (circuit switched or packet switched) or connectionless. Additional ETH termination points can be added/deleted to/from this service topology.

A special case of the mp-mp construct is where the subnetwork has only two flow points in use. In this case, it supports a pt-pt service as described in clause 7.1.1.



ABC, PQR, XYZ are server layer networks (can all be the same or different).
They may be CO-CS, CO-PS, CLPS

Figure 7-2 – Network portion of the multipoint-to-multipoint topology

7.1.3 Rooted-multipoint

Connectivity of a rooted multipoint (rooted mp) service is between one rooted point and more leaf points.

For E-Tree service, each leaf point can only exchange data with the root point, while a root point can exchange data with each leaf point and other root points.

The topology for the network portion for E-Tree services consists of one or more subnetworks with ETH links between them, as shown in Figure 7-3.

Each of the ETH links may be supported by a server layer technology that is connection oriented (circuit switched or packet switched) or connectionless. Additional ETH termination points can be added or deleted to/from this service topology.

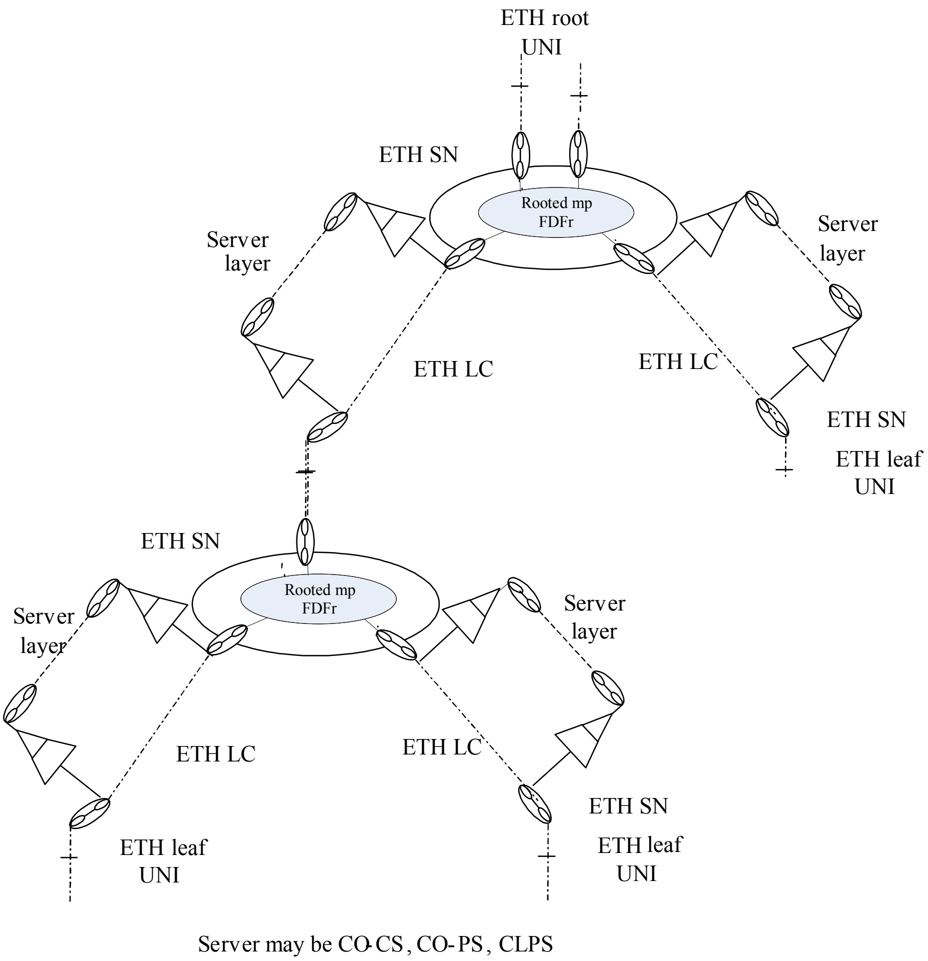


Figure 7-3 – Network portion of the point-to-multipoint topology

7.2 EVC ID

An arbitrary string as defined in clause 6.2 of [MEF 10.1].

7.3 UNI list

A tuple of UNI ID and UNI type, as defined in clause 6.3 of [MEF 10.1].

7.4 Maximum number of UNIs

The maximum number of UNIs allowed in the UNI list, as defined in clause 6.4 of [MEF 10.1].

7.5 EVC maximum transmission unit size

The maximum MAC frame size supported at the UNI is at least 1522, as defined in clause 6.10 of [MEF 10.1], but no larger than 2000 (as specified in IEEE 802.3-2008).

7.6 Preservation

The preservation attributes indicate the preservation of specific components of the ETH_CI provided by the ETH layer network that is used to transport the Ethernet service. That is, the parameter value will be the same on ingress and egress to the EC.

7.6.1 CE-VLAN ID preservation

The VLAN ID parameter, as defined in clause 6.6.1 of [MEF 10.1], indicates the preservation of the ingress VLAN ID of the ETH_CI.

7.6.2 CE-VLAN CoS preservation

This class of service (CoS) parameter, as defined in clause 6.6.2 of [MEF 10.1], indicates the preservation of the ingress priority of the ETH_CI. The options are: yes or no.

7.7 Service frame delivery

This attribute indicates the transfer characteristics of the ETH_CI.

Data frames can be separated into three groups as defined in clause 6.5.1 of [MEF 10.1]: unicast, multicast and broadcast. The parameters per group indicate the disposition of the ETH_CI based on the destination address. The options, as defined in clause 6.5.2 of [MEF 10.1], are: discard, deliver conditionally and deliver unconditionally.

The conditions will be defined in the service specific Recommendations.

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 7-2.

Table 7-2 – EVC L2 control protocols

Protocol	MAC DA
STP/RSTP/MSTP	01-80-C2-00-00-00
PAUSE	01-80-C2-00-00-01
LACP/LAMP	01-80-C2-00-00-02
Link OAM	01-80-C2-00-00-02
Port Authentication	01-80-C2-00-00-03
E-LMI	01-80-C2-00-00-07
LLDP	01-80-C2-00-00-0E
All Bridges	01-80-C2-00-00-10
GARP Block	01-80-C2-00-00-20 through 01-80-C2-00-00-2F

This attribute is related to the L2 control protocol attribute of the UNI – the settings of both will determine the handling across the network. Note that if a layer 2 control protocol is to be tunnelled, then all UNIs in the EVC **MUST** be configured to pass the layer 2 control protocol to the EVC. (See clause 8.1.11)

7.9 Performance

This parameter indicates the overall performance of the Ethernet connection (EC or EVC), as defined in clause 6.9 of [MEF 10.1], including dropping of the ETH_CI based on the priority or class of service of the Ethernet frame as defined in clause 6.8 of [MEF 10.1].

7.10 Bandwidth profile

Bandwidth profile is applicable per service instant, defined in clause 7.11 of [MEF 10.1]. It is applicable both at the UNI and the NNI interfaces. It defines an upper bound on the volume of the expected service frames belonging to a particular service instance.

Bandwidth profile defines four traffic parameters. Those parameters are: committed information rate (CIR), committed burst size (CBS), excess information rate (EIR), and excess burst size (EBS). CIR and CBS are related in such a way that CBS must be defined when CIR is set at a value that is greater than 0. EIR and EBS are related in the same way as CIR and CBS.

CIR is defined as the maximum information rate the network is committed to transfer under normal conditions. Performance metrics in terms of frame delay and loss are applicable only to those frames that are within the CIR. CBS defines a limit on the maximum number of information units available for a burst of ingress service frames sent at the interface speed to remain CIR-conformant.

EIR is the maximum information rate by which a user can exceed its CIR. EBS defines a limit on the maximum number of information units available for a burst of ingress service frames sent at the interface speed to remain EIR-conformant. Performance metrics in terms of frame delay and loss are not applicable to the frames that are within the service EIR.

The bandwidth profile traffic parameters are enforced using a metering algorithm as part of the traffic conditioning. Two additional parameters relevant to the operation of the metering algorithms are introduced. Those parameters are, the coupling flag (CF) and the colour mode (CM). CF and CM are referred to as bandwidth profile parameters. They allow for a choice between the different modes of operations for the metering algorithm. CF and CM take the values 0 or 1, only.

Ingress service frames are disposed of based on their conformance to CIR and EIR. Higher discard precedence is assigned to frames that are conformant to EIR (i.e., yellow coloured frames) than that assigned to frames that are conformant to CIR (i.e., green coloured frames). Yellow frames are expected to be dropped first when congestion is encountered at the service layer. Frames that are non-conformant to either CIR or EIR (i.e., red frames) are dropped at the interface.

7.11 Link type

This ITU service attribute indicates the characteristics of the server layer that is used to transport the Ethernet service. There are two options: dedicated and shared.

This attribute describes the bandwidth competition that an Ethernet service instance will encounter within the network. The use of the link type attribute in the context of a customer is for further study.

7.11.1 Dedicated

A dedicated link type indicates that all ETH links supporting the EVC have the following characteristics:

- Each ETH link is exclusively allocated to transport the ETH_CI of a single service instance.
- The ETH_CI transported by an ETH link does not compete for resources with the CI of other service instances.

This attribute is referring to an EVC; an EVC does not necessarily map onto a single link. As a result, if the link type is dedicated it follows that all links supporting the EC must be dedicated and have the corresponding characteristics.

7.11.2 Shared

A shared link type indicates that one or more ETH links supporting the EVC have the following characteristics:

- The ETH link is allocated to transport the ETH_CI of one or more service instances.
- The ETH_CI transported by an ETH link competes for resources with the CI of other service instances.

7.12 Traffic separation

This ITU service attribute indicates the separation within the service providers network that is a direct result of the manner in which it is transported. This is applicable to both a service instance and a customer. There are two options: spatial and logical.

The permitted combinations of customer and service instance separation are shown in Table 7-3:

Table 7-3 – Traffic separation

Customer	Service instance
Spatial	Spatial
Spatial	Logical
Logical	Logical

7.12.1 Service instance separation

This attribute indicates the separation between the traffic of service instances within the service provider's network.

Spatial

Spatial separation between the traffic of service instances is achieved by using dedicated components (subnetworks, links, access groups) (see clause 6.3.2.5.1 of [ITU-T G.8010]).

Logical

Logical separation between the traffic of service instances allows components (subnetworks, links, access groups) to be shared by multiple customers (see clause 6.3.2.5.1 of [ITU-T G.8010]).

7.12.2 Customer separation

This attribute indicates the separation between customer traffic within the service provider's network.

Spatial

Spatial separation between customer traffic is achieved by using dedicated components (subnetworks, links, access groups) (see clause 6.3.2.5.1 of [ITU-T G.8010]).

Logical

Logical separation between customer traffic allows components (subnetworks, links, access groups) to be shared by multiple service instances (see clause 6.3.2.5.1 of [ITU-T G.8010]).

7.13 Connectivity monitoring

Connectivity monitoring can be achieved via Ethernet OAM mechanisms defined in [b-ITU-T Y.1731].

The options utilized by operators for sub-layer monitoring are expected to be: on demand, proactive and none. For inherent monitoring the only expected option is proactive.

Table 7-4 shows the mapping of proactive and on demand to the ITU-T Y.1731 messages that are specified at the UNI (see 8.1.13). In addition, performance monitoring messages are included in this same list with the connectivity monitoring messages.

Table 7-4 – Connectivity monitoring

Attribute	Type	Function	ITU-T Y.1731 message
Pro-active	Status	Continuity check & Connectivity check	CCM.CC
	Performance	Interruption	CCM.CC, CCM.RDI
		Frame loss	CCM.LM
	Maintenance	Alarm suppression	AIS
		Locked indication	LCK
		Remote defect indication	CCM.RDI
		Client signal fail	
On-demand	Status	Connectivity check	LBM/LBR
	Performance	Frame loss	LMM/LMR
		Frame delay	DMM/DMR, 1DM
		Frame delay variation	DMM/DMR, 1DM
		Throughput	LBM/LBR, TST
	Fault localization	Channel connectivity	LBM/LBR
		Flow connectivity	LTM/LTR
	Discovery	Flow connectivity	LTM/LTR

7.14 Survivability

The transport network can provide survivability for each service. The survivability alternatives for protection and restoration are related to the server layer technology used. As a result the appropriate server layer as defined in [ITU-T G.8012] would be specified. Any additional relevant details on the server layer survivability would be listed in the definition of the service.

The options are: none or specify

The use of other protocols for survivability, such as STP, is for further study.

Note that ETY survivability is for further study.

8 Ethernet UNI attributes

This clause describes service UNI attributes that characterize a particular instance of an Ethernet service at the demarc of the UNI noted in Figure 6-1. There is a UNI defined at each of the ETH and ETY layers. The base set of ITU-T G.8011 UNI attributes is the same as the UNI attributes defined in [MEF 10.1]. Several additional UNI attributes are also defined in this clause. Additional clarification for the base attributes and a definition of the additional attributes are described in the following clauses, and they are summarized in Table 8-1.

Table 8-1 – UNI service attributes

Layer	UNI service attribute	Service attribute parameters and values	[MEF 10.1] reference
ETH	UNI identifier	Any string	7.1
	MAC layer	IEEE 802.3 – 2005	7.3
	UNI maximum transmission unit size	2000 ≥ Integer ≥ 1522.	7.4
	Service multiplexing	Yes or No	7.5
	UNI EVC ID	A string formed by the concatenation of the UNI ID and the EVC ID	7.6.2
	CE-VLAN ID for untagged and priority tagged service frames	A number in 1, 2, …, 4094.	7.6.1
	CE-VLAN ID/EVC map	Map	7.7
	Maximum number of EVCs	Integer ≥ 1	7.8
	Bundling	Yes or No	7.9
	All to one bundling	Yes or No	7.10
	Ingress bandwidth profile per ingress UNI	No, or parameters	7.11.2.1, 7.11.1
	Ingress bandwidth profile per class of service identifier	No, or parameters for each class of service identifier	7.11.2.3, 7.11.1
	Egress bandwidth profile per egress UNI	No, or parameters	7.11.3.1, 7.11.1
	Egress bandwidth profile per class of service identifier	No, or parameters for each class of service identifier	7.11.3.3, 7.11.1
	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	7.13
	UNI type	Leaf or root	ITU-T
	Connectivity monitoring	MEG levels, Y.1731 messages	ITU-T
ETY	Physical medium	A Standard Ethernet PHY	7.2
	Speed	10 Mbit/s, 100 Mbit/s, 10/100 Mbit/s Auto-negotiation, 1 Gbit/s, or 10 Gbit/s	7.2
	Mode	Full duplex	7.2

The relationship of these attributes to [ITU-T G.8010] is shown in Annex A.

The values for these attributes will be specified for each of the Ethernet services that are defined in the ITU-T G.8011.x/Y.1307.x series of Recommendations.

8.1 ETH UNI

The set of attributes defined at the ETH UNI are as follows.

8.1.1 UNI identification

The UNI ID, as defined in clause 7.1 of [MEF 10.1], is an arbitrary string administered by the service provider that is used to identify the UNI. It is intended for management and control purposes.

8.1.2 MAC layer

This attribute, as defined in clause 7.3 of [MEF 10.1], indicates support for the IEEE 802.3-2005 frame format.

8.1.3 Maximum MTU size

The maximum MAC frame size supported at the UNI is at least 1522, as defined in clause 7.4 of [MEF 10.1], but not larger than 2000 (as specified in IEEE 802.3-2008).

8.1.4 Service multiplexing

This attribute, as defined in clause 7.5 of [MEF 10.1], indicates if the access to the Ethernet transport service is multiplexed (i.e., contains multiple service instances) or not. The options are: yes or no.

The topology illustrated in Figure 8-1 consists of N point-to-point connections presented to a single physical interface.

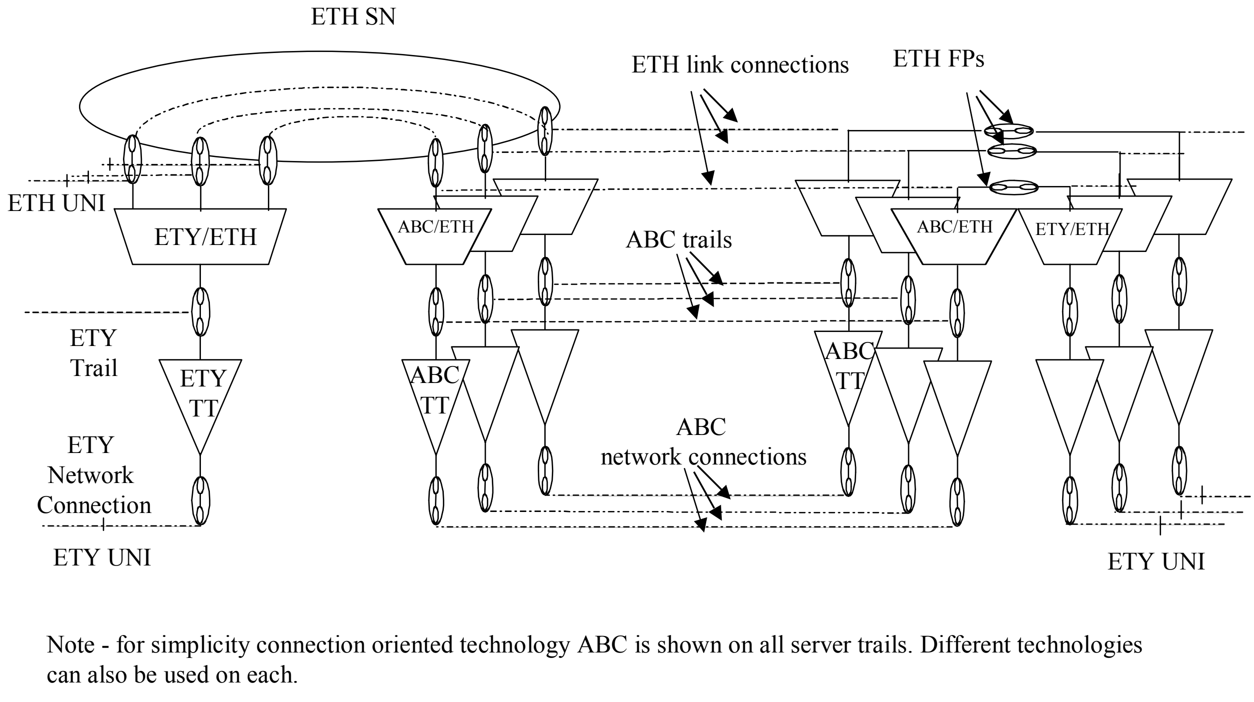


Figure 8-1 – Network portion of the service multiplexing line topology

In the case of service multiplexing at the service UNI (demarc), one ETH link is used between the provider and the customer to transport ETH_CI of multiple customers' service instances. Since logical separation is used on the ETH linkconnection identifiers for flow isolation (e.g., C-VLAN tag) need to be specified.

On ingress, the onus is on customer equipment to shape the service instance that will be multiplexed to ensure sufficient fairness to avoid congestion of the access link. The network can ensure service instance bandwidth on the ETH link with traffic conditioning.

8.1.5 UNI EVC identification

The UNI EVC ID, as defined in clause 7.6.2 of [MEF 10.1], is an arbitrary string administered by the service provider that is used to identify an EVC at the UNI. It is intended for management and control purposes.

8.1.6 C-VLAN ID mapping

At the UNI, there is a mapping of each customer VLAN ID to at most one EVC, as defined in clause 7.7 of [MEF 10.1]. In most cases, this mapping of VLAN ID to EVC ID must be specified as part of the service. However, in the simple case with no service multiplexing (see clause 8.1.4) there is an all-to-one mapping.

Note that more than one VLAN ID may point to the same EVC.

8.1.7 Maximum number of EVCs

The maximum number of EVCs supported at the UNI list as defined in clause 7.8 of [MEF 10.1].

8.1.8 Bundling

As defined in clause 7.9 of [MEF 10.1], when a UNI has the Bundling attribute set to yes, it is configurable so that more than one VLAN ID can map to an EC at the UNI. Note that bundling is compatible with service multiplexing

8.1.9 All-to-one bundling

As defined in clause 7.10 of [MEF 10.1], when a UNI has the All-to-one bundling attribute, all VLAN IDs map to a single EC at the UNI. It follows that such a UNI cannot have service multiplexing.

8.1.10 Bandwidth profile

Bandwidth profile defines traffic parameters that characterize the ETH_CI flow arrival pattern at the UNI or the NNI. Four parameters are defined, committed information rate (CIR), committed burst size (CBS), excess information rate (EIR), and excess burst size (EBS). CIR and CBS are related together in such a way that CBS must be defined when CIR is set at a value that is greater than zero. EIR and EBS are related in the same way as CIR and CBS.

The ingress and egress bandwidth profile parameters per COS and per UNI, as defined in clause 7.11 of [MEF 10.1], constitute an input to a traffic conditioning function defined in [ITU-T G.8010].

8.1.11 L2 control protocol processing

This attribute indicates the valid actions for each layer 2 (L2) control protocol frame on the ingress and egress to the UNI-N port (the application of these attributes to the UNI-C port is for further study). That is, whether to *discard, peer or pass* the control frame on ingress, and whether to *generate* or have an action of *none* on egress. Note that the ingress action (the only action defined by MEF, in clause 7.13 of [MEF 10.1]) will directly affect (but not completely govern) generation of layer 2 control protocols on the egress of carrier equipment (i.e., the ETH source function). The specific actions will be specified in the service Recommendations.

These attributes may also be applied to the NNI port as described in clause 9.1.8. The specific actions will be specified in the service Recommendations.

Note that these actions are performed by specific processes of a particular adaptation function within the UNI or NNI port. These processes are identified below as 802.1 layer 2 control protocols and 802.3 layer 2 control protocols. The assignment of these actions to functional blocks is described in [ITU-T G.8021].

The layer 2 control protocols are listed in Table 8-2 for ingress and Table 8-3 for egress.

Table 8-2 – Ingress (sink) 802.1 L2 control protocols

Protocol	MAC DA
STP/RSTP/MSTP	01-80-C2-00-00-00
PAUSE	01-80-C2-00-00-01
LACP/LAMP	01-80-C2-00-00-02
Link OAM	01-80-C2-00-00-02
Port Authentication	01-80-C2-00-00-03
E-LMI	01-80-C2-00-00-07
LLDP	01-80-C2-00-00-0E
All Bridges	01-80-C2-00-00-10
GARP Block	01-80-C2-00-00-20 through 01-80-C2-00-00-2F

For Tables 8-2 and 8-3, note that [IEEE 802.1D] defines the address and its usage.

Table 8-3 – Egress (source) 802.1 L2 control protocols

Protocol	MAC DA
STP/RSTP/MSTP	01-80-C2-00-00-00
PAUSE	01-80-C2-00-00-01
LACP/LAMP	01-80-C2-00-00-02
Link OAM	01-80-C2-00-00-02
Port Authentication	01-80-C2-00-00-03
E-LMI	01-80-C2-00-00-07
LLDP	01-80-C2-00-00-0E
All Bridges	01-80-C2-00-00-10
GARP Block	01-80-C2-00-00-20 through 01-80-C2-00-00-2F

The layer 2 control protocols defined by [IEEE 802.3] (distinguished by a combination of MAC address, Ethertype and subtype) are also listed in these tables. It should be noted that unlike the IEEE 802.1 defined ones, they cannot be solely identified by their DA.

The valid actions are described in the following subclauses. Note that not all valid actions make sense for every protocol in a particular service. Further, a particular action on one protocol may directly affect the possible actions for another protocol. According to [IEEE 802.3] and [IEEE 802.1D], a particular L2 control protocol need not have the same valid action treatment in the 802.3 and 802.1 tables. The valid actions, protocol consistency and any protocol interdependencies will be specified for each Ethernet service (e.g., see [ITU-T G.8011.1]). In addition, an implementation may support one or more of the listed valid actions for a particular protocol.

8.1.11.1 Ingress actions

Discard (Block)

When this ingress alternative is in force, the process(es) of UNI or NNI discards all ingress service frames carrying the layer 2 control protocol thus blocking its progression into the network. However, there is no processing of the protocol with this alternative. Note that when this alternative is in force for the layer 2 control protocol, the layer 2 control protocol is not present in an EC.

Note that a valid action of block in either the 802.1 or 802.3 ingress tables for a particular layer 2 protocol is sufficient for the protocol to be blocked in the UNI or NNI (though it still may be processed).

Peer (Process)

When this ingress alternative is in force, the process(es) of the UNI or NNI processes these frames according to the operation of the layer 2 control protocol. In the UNI case, from the customer point of view, the network is a single device that is running the layer 2 control protocol. The protocol is terminated at the interface, that is, it is processed and blocked from progression into the network. Note that when this alternative is in force for the layer 2 control protocol, the layer 2 control protocol is not present in an EC.

Note that a valid action of process in either the 802.1 or 802.3 ingress tables for a particular layer 2 protocol is sufficient for the protocol to be processed in the UNI or NNI. Also, for a process valid action in the 802.1 ingress table to be feasible, this implies the protocol is not blocked in the 802.3 ingress table.

Pass to EVC (Pass)

When this ingress alternative is in force, the process(es) of the UNI or NNI do not block or process these frames. This is the equivalent of taking no action on this protocol because the frame must be passed without being processed. Note that when a layer 2 control protocol is passed and forwarded at the ingress, the service frame at each egress interface must be identical to the corresponding ingress service frame. Since the layer 2 control protocols are all untagged, this means that at the egress interface they must also be untagged.

Note that in order for the layer 2 protocol to be passed to the EC from the UNI, the valid action must be "pass" in both ingress tables (and vice versa for the egress tables).

8.1.11.2 Egress actions

Generate

When this egress alternative is in force, the process(es) of the UNI or NNI generates frames according to the operation of the layer 2 control protocol. In the case of the UNI, from the customer point of view, the network is a single device that is running the layer 2 control protocol. Note that when this alternative is in force, it does not affect layer 2 control protocols that are in transit towards the egress interface from the EC.

None

When this egress alternative is in force, the UNI or NNI does not generate any egress service frames carrying the layer 2 control protocol. Note that when this alternative is in force, it does not affect layer 2 control protocols that are in transit towards the egress interface from the EC.

8.1.12 UNI type

This ITU service attribute is intended only for use in rooted multipoint services. The possible attribute values are leaf or root. The traffic between leaves should be dropped.

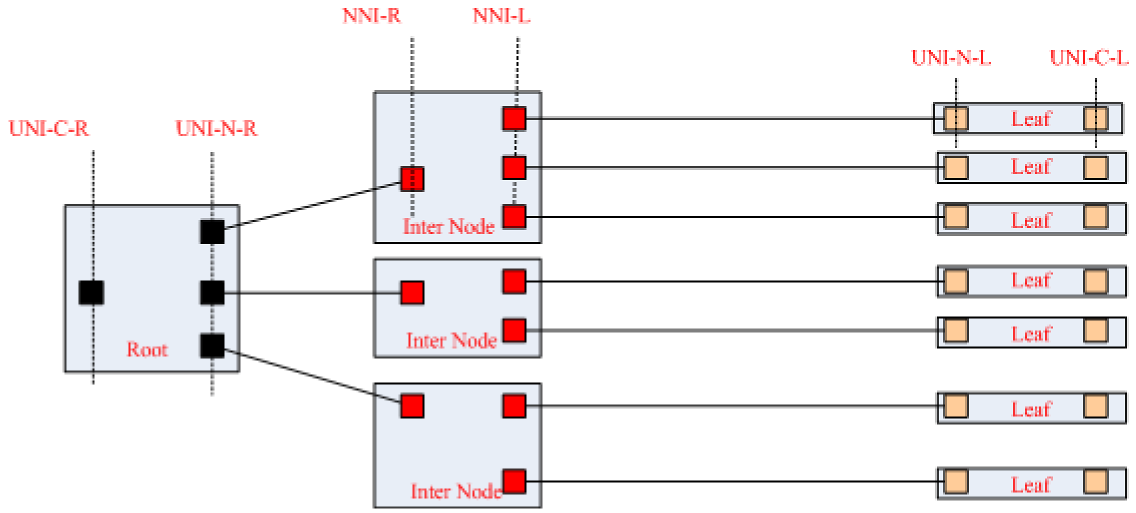


Figure 8-2 – UNI/NNI type

Figure 8-2 presents a single operator domain example for the UNI/NNI type configuration. The root UNI can be indicated as UNI-R and the leaf UNI as UNI-L.

8.1.13 Connectivity monitoring

This ITU service attribute indicates how connectivity monitoring is achieved via Ethernet OAM mechanisms defined in [b-ITU-T Y.1731]. Figure 8-3 shows several different network layers: customer service layer, network service layer and the link layer. Note that more complex networks are also possible (e.g., including an additional tunnel layer between the network and link layer) but not shown. Each layer can support 8 MEG levels. Note that depending upon the underlying server layer, the customer service layer and the network service layer may be only one layer (i.e., this is the case if there is no network encapsulation at the UNI). In this case, the subscriber MEG level should be greater than the EVC MEG level.

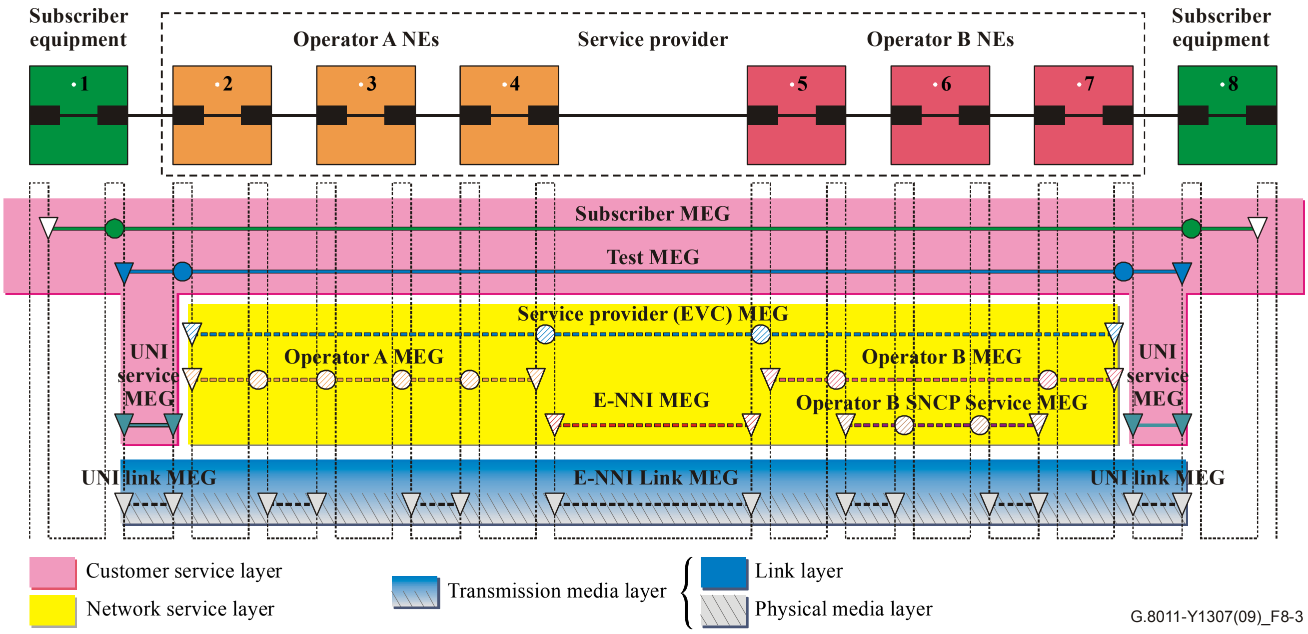


Figure 8-3 – Network layers and MEG levels

This attribute specifies the MEG level at the customer service layer:

1) Tunnelled.
2) Tunnelled with UNI-N MIP.
3) Peered at UNI-N.
4) Blocked at UNI-N.

The MEG levels could be treated either individually, by range (e.g., all ME < Subscriber ME) or in entirety.

On the subscriber MEG, the MEPs are configured on the UNI-C. The UNI-N could be configured as a MIP. However, for a continuity check message (CCM), there is no processing requirement at MIP, and thus a subscriber CCM should be tunnelled at the UNI-N. Similarly, all the OAM messages that only need MEP process should be tunnelled at the UNI-N.

Multicast LBM only involves the MEP, and thus should be tunnelled at the UNI-N. Unicast LBM targets to arbitrary MIP or MEP, including MIPs on UNI-N. If no MIP is configured in the UNI-N, LBM messages should be tunnelled; otherwise, there are two cases as follows:

1) If LBM targets to MIP/MEP which is outside of EVC, it should be tunnelled;
2) If LBM targets to MIP inside EVC, it should be processed. However, it may also be discarded.

LBR is always a unicast message targeted at a subscriber MEP. It should be tunnelled.

LTM messages need to be processed by both MIP and MEP. If no MIP is configured on UNI-N, LTM messages should be tunnelled; otherwise, they should be processed or discarded.

LTR is always a unicast message targeted at a subscriber MEP. It should be tunnelled.

The appropriate CFM protocol processing at the UNI-N can be summarized in Table 8-4.

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

CFM protocol	MAC DA	MEG level	Action
UNI ME, CC	01-80-C2-00-00-3X or Unicast		
UNI ME, LT	01-80-C2-00-00-3Y		
UNI ME, LB	Unicast		
Test ME	Unicast		
Subscriber ME	Unicast		

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

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

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

Figure 8-4 illustrates an example of the connectivity monitoring within the UNI.

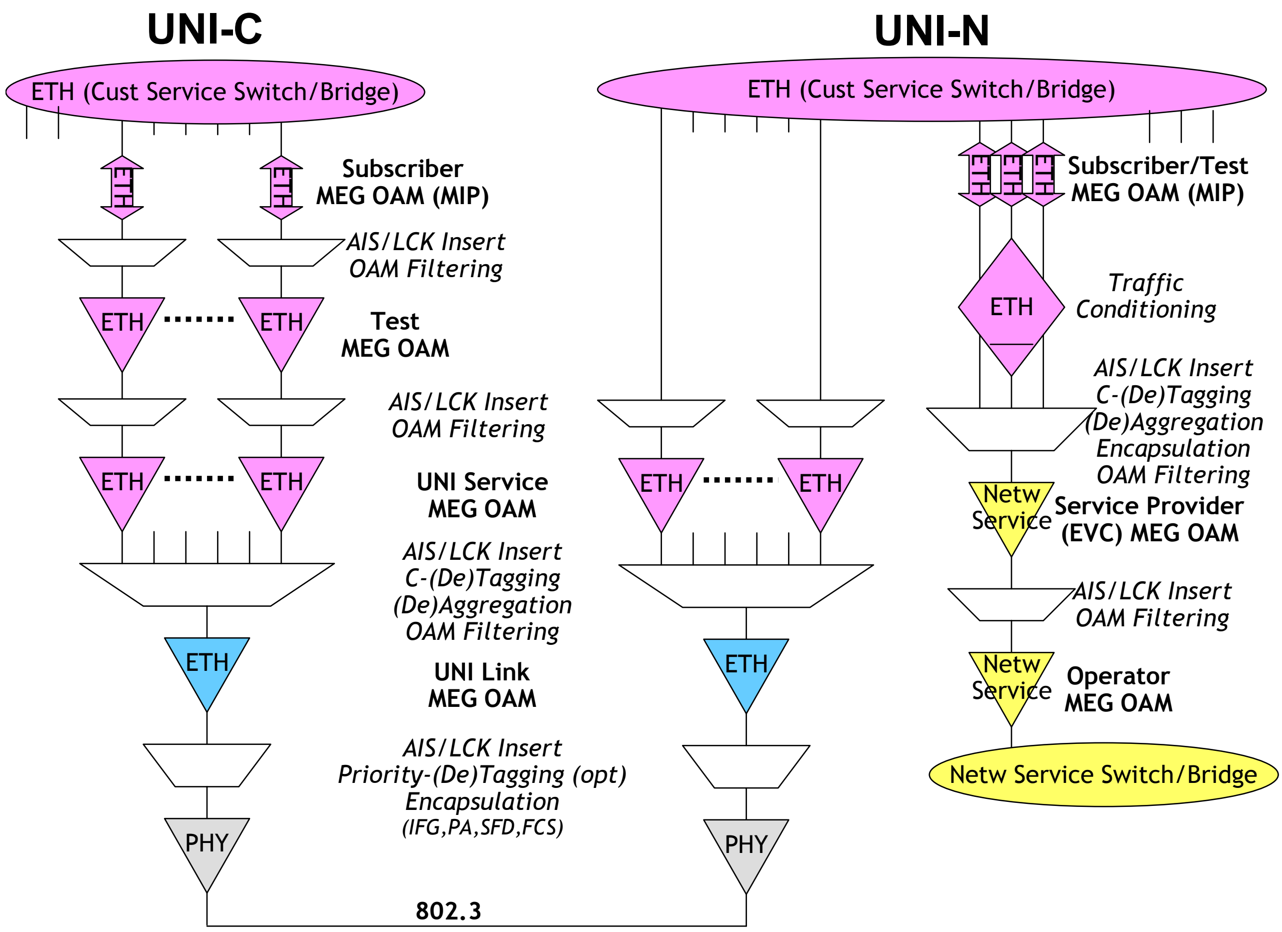


Figure 8-4 – Connectivity monitoring functions at the UNI

Specifically, the example shows a service multiplexed UNI with multiple customer VLANs aggregated into an 802.3 link on the UNI-C side and this is shown via a network service instance (EVC) on the UNI-N side. There is per customer VLAN OAM (subscriber MEG with MEP and UNI service MEG with MEP), as well as customer VLAN independent OAM (UNI link MEG with MEP). Traffic conditioning per service on the UNI-N (e.g., for a bundled service). Finally, the network service layer (e.g., ETY, SDH, …) is shown with per EVC OAM – both service provider (EVC) MEG with MEP and operator MEG with MEP.

Note that performance monitoring messages are included in this same list with the connectivity monitoring messages (see Table 7-4).

8.2 ETY UNI

The set of attributes at the ETY UNI are as follows.

8.2.1 Medium

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

8.2.2 Speed

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

9 Ethernet NNI attributes

This clause describes service NNI attributes that characterize a particular instance of an Ethernet service at the demarc line of the NNI noted in Figure 6-1. There is a NNI defined at each of the ETH and server layers. These 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 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	For further study
	Layer 2 control protocol processing	Block, process, pass per protocol on ingress Generate or none per protocol on egress
	NNI type	Hub or spoke
Server	Server layer	Specify

The relationship of these attributes to [ITU-T G.8010] is shown in Annex A.

The values for these attributes will be specified for each of the Ethernet services that are defined in the G.8011.x/Y.1307.x series of Recommendations.

9.1 ETH NNI

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

9.1.1 MAC service

This attribute indicates support for the IEEE 802.3-2008 frame format.

Other MAC frame sizes are for further study.

9.1.2 NNI identification

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

9.1.3 EVC identification

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

9.1.4 Multiplexed link

This attribute indicates if the NNI link is multiplexed (i.e., contains multiple service instances) or not. The options are: yes or no.

In the case of multiplexed link, one ETH link is used to transport ETH_CI of multiple customers' service instances. Since logical separation is used on the ETH link connection, identifiers for flow isolation (e.g., S-VLAN tag) need to be specified.

9.1.5 VLAN ID mapping

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

In the case of no multiplexed link (see clause 9.1.4), there is no S-VLAN ID and, therefore, this mapping is not applicable.

In the case of multiplexed link, the value of the S-VLAN ID mapped to EVC ID must be specified.

Note that more than only one S-VLAN ID can point to the same EVC.

9.1.6 Bundling

For further study.

9.1.7 Bandwidth profile

For further study.

9.1.8 L2 control protocol processing

This attribute element indicates the valid actions, for each layer 2 control protocol frame on the ingress and egress to the NNI port. That is, whether to *process, block or pass* the control frame on ingress, and whether to *generate* or have an action of *none* on egress. These valid actions are defined in clause 8.1.11.

The layer 2 control protocols are listed in Table 8-2 for ingress and Table 8-3 for egress.

Note that not all valid actions make sense for every protocol in a particular service. Further, a particular action on one protocol may directly affect the possible actions for another protocol. The valid actions, protocol consistency and any protocol interdependencies will be specified for each Ethernet service (e.g., see [ITU-T G.8011.1]).

9.1.9 NNI type

This ITU service attribute is intended only for use in rooted multipoint services. The possible attribute values are hub or spoke. The traffic between leaves should be dropped.

See Figure 8-2.

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.

Annex A

Relationship of G.8011/Y.1307 attributes to [ITU-T G.8010]

(This annex forms an integral part of this Recommendation)

A.1 Introduction

This annex describes the direct relationship of the attributes defined in this Recommendation and the architecture of [ITU-T G.8010].

A.2 Ethernet connection attributes

All Ethernet connection services are built by interconnecting ETH links. The service or EVC attributes are related to a set of ETH links, or an ETH subnetwork. They define restrictions on interconnection, or on the attributes of links to be used. The relationship of these attributes to [ITU-T G.8010] is shown in Table A.1.

Table A.1 – G.8011/Y.1307-G.8010/Y.1306 EC attribute relationship

G.8010/Y.1306 relationship	EC service attribute (Table 7-1)	Service attribute parameters and values
Connectivity within ETH VPNs	EVC type	p2p, mp2mp, rooted mp
Identifier of ETH VPN (not defined in [ITU-T G.8010])	EVC ID	Arbitrary text string to identify associated EVC
List of addresses of FP (not defined in [ITU-T G.8010])	UNI list	UNI ID + UNI type
Allowing of mux/demux of VLAN tag in srv/ETH adaptation	Preservation	VLAN – yes or no CoS – yes or no
Address – Determines whether FDs use filtering when interconnecting links Priority – Determines whether all Queuing process should differentiate based on priority (P bits)	Service frame delivery	Discard, deliver unconditionally, or deliver conditionally
Determines whether FDs use filtering when interconnecting links	L2CP processing	Discard, or tunnel
Performance associated with ETH link connections	Performance	Specify
Bandwidth associated with ETH link connections	Bandwidth profile	Specify
Determines the mapping of ETH_CI to ETH links	Link type	Dedicated, shared
Determines that no ETH level muxing can be used to mux service instances from different traffic (customer or service instance) and that the server layer has to be a CO-CS layer per customer (If spatial then service muxing is allowed at the access link)	Traffic separation	Customer: spatial, logical Service instance: spatial, logical
Classification of the ME supervision technique used	Connectivity monitoring	Proactive, on demand, none

Table A.1 – G.8011/Y.1307-G.8010/Y.1306 EC attribute relationship

G.8010/Y.1306 relationship	EC service attribute (Table 7-1)	Service attribute parameters and values
Server layer survivability. ETY is for further study.	Survivability	None, specify
NOTE – An attribute to support transit priority (queuing process in adaptation function) is for further study.		

A.3 Interface attributes

Table A.2 shows the relation between [ITU-T G.8010] and the UNI and NNI attributes defined in this Recommendation. Note that many of the architectural functions listed are in Figure 15 of [ITU-T G.8010].

Table A.2 – G.8011/Y.1307-G.8010/Y.1306 UNI/NNI attribute relationship

G.8010/Y.1306 description	G.8010/Y.1306 architectural function	UNI attributes (Table 8-1)	NNI attributes (Table 9-1)	Layer
Address of FP (not defined in [ITU-T G.8010])	FP	UNI ID	NNI ID	ETH
Address of FDFr (not defined in [ITU-T G.8010])	FDFr	UNI EC ID	NNI EC ID	
ETH_CI	ETH_FP	MAC layer	MAC service	
Flow point mapping	ETH_FP to/from FDF	VLAN mapping	VLAN mapping	
ETH multiplexing	ETY/ETH-m adaptation function used	Service multiplexing	Bundling	
		Bundling		
Traffic conditioning	ETH_TC function	Bandwidth profile	Bandwidth profile	
802.3 L2 protocol generation and termination	802.3 protocols process in Srv/ETH adaptation	Layer 2 control protocol processing	Layer 2 control protocol processing	
GARP & reserved - address filtering	Filter process in Srv/ETH adaptation			
FFS	FFS	UNI type	NNI type	
OAM insertion	MIP/MEP	Connectivity monitoring	Connectivity monitoring	
Server layer technology	Adaptation and TT for server layer used	PHY speed/mode/medium	Server layer	ETY or server

Annex B

Distributed UNI

(This annex forms an integral part of this Recommendation)

B.1 Introduction

This Recommendation introduced a simple network model in clause 6 while indicating that more complex models are possible. The UNI shown in Figure 6-1 is a simple or collapsed case. This annex introduces additional models that are possible.

B.2 Distributed UNI-N

This case introduces an access network or private line inside the operator network that 'extends' the UNI link towards the demarc. The distributed UNI would result in the UNI-N function that is shown in Figure B.1. The functions and attributes of the UNI-N are distributed between the device closest to the demarc and the device closest to the operator's network.

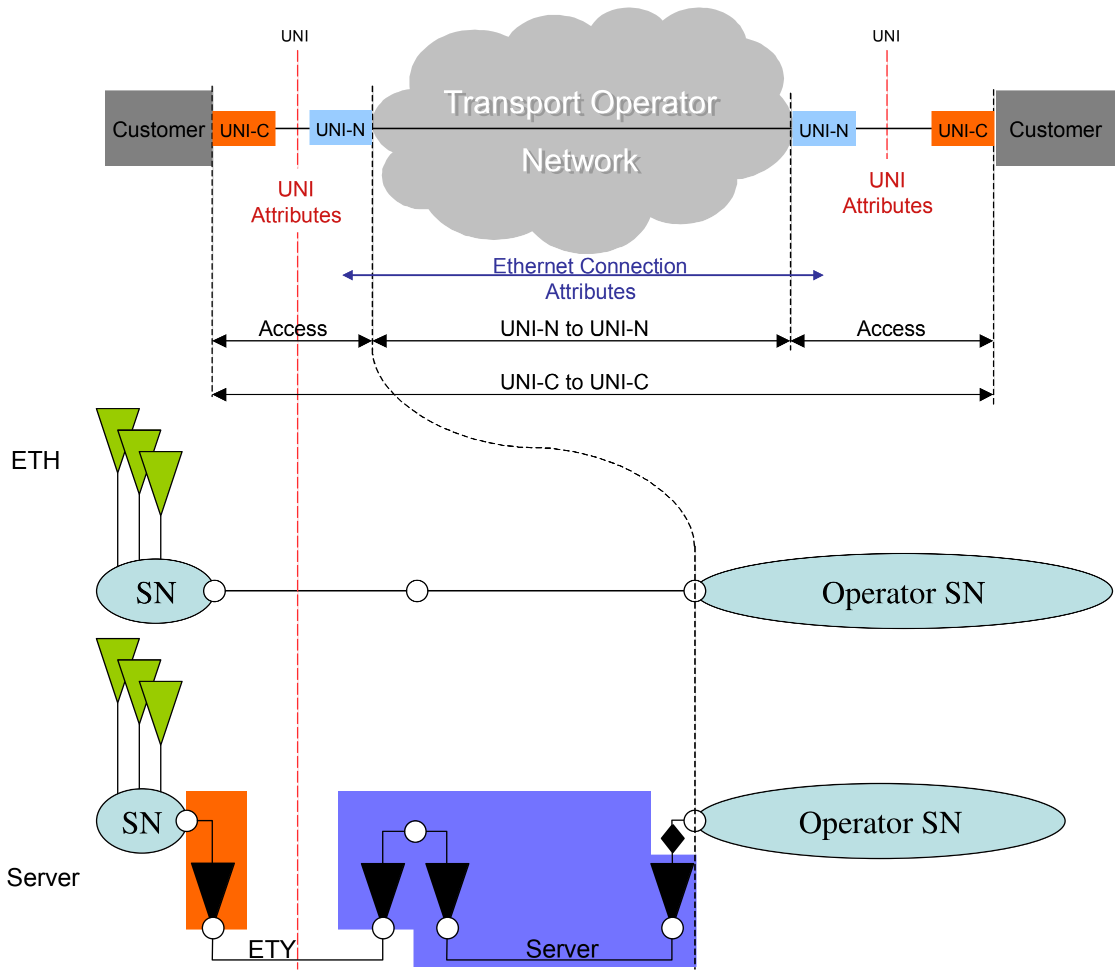


Figure B.1 – Single-provider view of Ethernet service areas with distributed UNI-N

Appendix I

Notes concerning terminology

(This appendix does not form an integral part of this Recommendation)

As often occurs with newer technologies, terminology associated with it evolves over time. Such is the case concerning the architecture of Ethernet layer networks, which is discussed in [ITU-T G.8010]. Although studies on this are not yet complete within ITU, several terms have been changed in this Recommendation in anticipation of this evolution in terminology. The following table summarizes the changes that have been made throughout.

Term in [ITU-T G.8010]	Replacement term envisaged
Flow domain	Subnetwork
Flow domain flow	Flow domain fragment
Network flow	
Link flow	Link connection
Component link	
Flow point pool link	Link
FPP link	Link

Bibliography

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

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