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Digital networks – General aspects

Ethernet services framework

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ITU-T Recommendation G.8011/Y.1307

Ethernet Services Framework

Summary

This Recommendation 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 G.8010/Y.1306. The attribute sets introduced in this framework (EC, UNI and NNI) are intended to be used to create numerous specific Ethernet services.

Keywords

Ethernet, Ethernet service, framework

Introduction

This Recommendation provides the introduction to a framework for defining network-oriented characteristics of Ethernet services in the transport network. The intent is for G.8011/Y.1307 to be a service independent framework for Ethernet services based on the architecture of Ethernet over Transport in G.8010/Y.1306. The draft Recommendation presents attributes that will be used in the Recommendation G.8011.x/Y.1307.x series to define each Ethernet service in the G.8011.x/Y.1307.x series. The companion Recommendation G.8012/Y.1308 provides an introduction to the Ethernet interfaces that would also be used to define services.

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

CONTENTS

ITU-T Recommendation G.8011/Y.1307

Ethernet Service Framework

1 Scope

This Recommendation defines a framework to describe a set of Ethernet services. 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 draft Recommendation G.8010/Y.1306.

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

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

For example, G.8011.1/Y.1307.1 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 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 Recommendation G.809 (2001), *Functional architecture of connectionless layer networks.*

– IEEE 802-2001, IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - *Overview and Architecture.*

– IEEE 802.3-2002, IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements – *Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.*

– IEEE 802.1D-1998, IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Common specifications - *Part 3: Media Access Control (MAC) Bridges*

– IEEE 802.1X-2001, IEEE Standard for Local and metropolitan area networks – *Port-based Network Access Control*

– IEEE 802.1Q-2003, IEEE standard for local and metropolitan area networks: *Virtual Bridged Local Area Networks.*

– ITU-T Recommendation G.8010/Y.1306, *Architecture of Ethernet layer networks*, 2003.

– ITU-T Recommendation G.8011.1/Y.1307.1, *Ethernet Private Line Service*, 2004.

– ITU-T Recommendation G.8012/Y.1308, *Ethernet UNI and Ethernet NNI*, 2004.

– ITU-T Recommendation G.8021/Y.1341, *Characteristics of Ethernet transport network equipment functional blocks*, 2004.

– MEF 1, *Ethernet Services Model – Phase 1*, 2003.

3 Definitions

This Recommendation uses the following terms defined in Recommendation G.8010/Y.1306:

3.1 ETH link

3.2 Traffic Conditioning function

This Recommendation uses the following terms defined in Recommendation G.809:

3.3 Flow domain

3.4 Flow domain flow

3.5 Flow Point

3.6 Flow termination

3.7 Link flow

3.8 Network flow

3.9 Termination flow point

This Recommendation uses the following terms defined in Recommendation G.8012:

3.10 UNI

3.11 NNI

This Recommendation defines the following terms:

3.12 Ethernet service

An Ethernet service supports an Ethernet flow as defined in G.8010/Y.1306. It is defined by the topology of the Ethernet network and a corresponding set of attributes associated with the Ethernet connection (EC), the UNI ports, and NNI ports.

3.13 Customer

The entity that has ownership authority over a set of flow points. The customer may have one or more service instances.

3.14 Ethernet Service Instance

An Ethernet service instance is a particular instantiation of an Ethernet service supported by a particular flow domain (as defined in G.8010/Y.1306) with a defined set of characteristics as well as at least two UNIs.

3.15 Access Link

The Access Link is the connection between the customer equipment and carrier equipment at the edge of the transport network that is realised through a UNI introduced in G.8011/Y.1307 and defined for Ethernet in G.8012/Y.1308.

3.16 Ethernet Connection

The ETH connection or ETH connectivity (described in G.8010/Y.1306 section 6.6) between the UNI-Ns that are part of the same Network Ethernet Service Instance.

3.17 Ethernet Service Area

Identifies the portion of a network that supports an Ethernet service instance.

4 Abbreviations

This Recommendation uses the following abbreviations:

CO-CS Connection oriented circuit switched

CO-PS Connection oriented packet switched

CLPS Connectionless packet switched

CBR Constant bit rate

CBS Committed burst size

CIR Committed information rate

CI Characteristic information

EBS Excess burst size

EIR Excess information rate

EC Ethernet connection

EVC Ethernet virtual connection

ETH Ethernet MAC layer network

ETY Ethernet PHY layer network

FD Flow domain

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
LF	Link flow
MAC	Media access control
MSTP	Multiple spanning tree protocol
NF	Network flow
NNI	Network network interface
PHY	Physical device
RSTP	Rapid spanning tree protocol
STP	Spanning tree protocol
TFP	Termination flow point
UNI	User Network Interface
VLAN	Virtual local area network

5 Conventions

The diagrammatic convention for Ethernet services described in this Recommendation is that of Recommendation G.8010.

Further, the use of ETH link in this Recommendation is that of Recommendation G.8010. Specifically, ETH link is a generalization that collectively refers to ETH flow point pool link and ETH flow point pool component link.

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 G.8010/Y.1306.

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 on top, ETH layer in the middle and ETY layer on 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 flow domain (FD) 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 G.8012/Y.1308.

The relationship between the Ethernet service areas illustrated in Figure 6-1 (and the following two figures 6-2 and 6-3), and the maintenance entities (ME) described in G.8010/Y.1306 is shown in Table 6-1:

Table 6-1/G.8011/Y.1307 – 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.

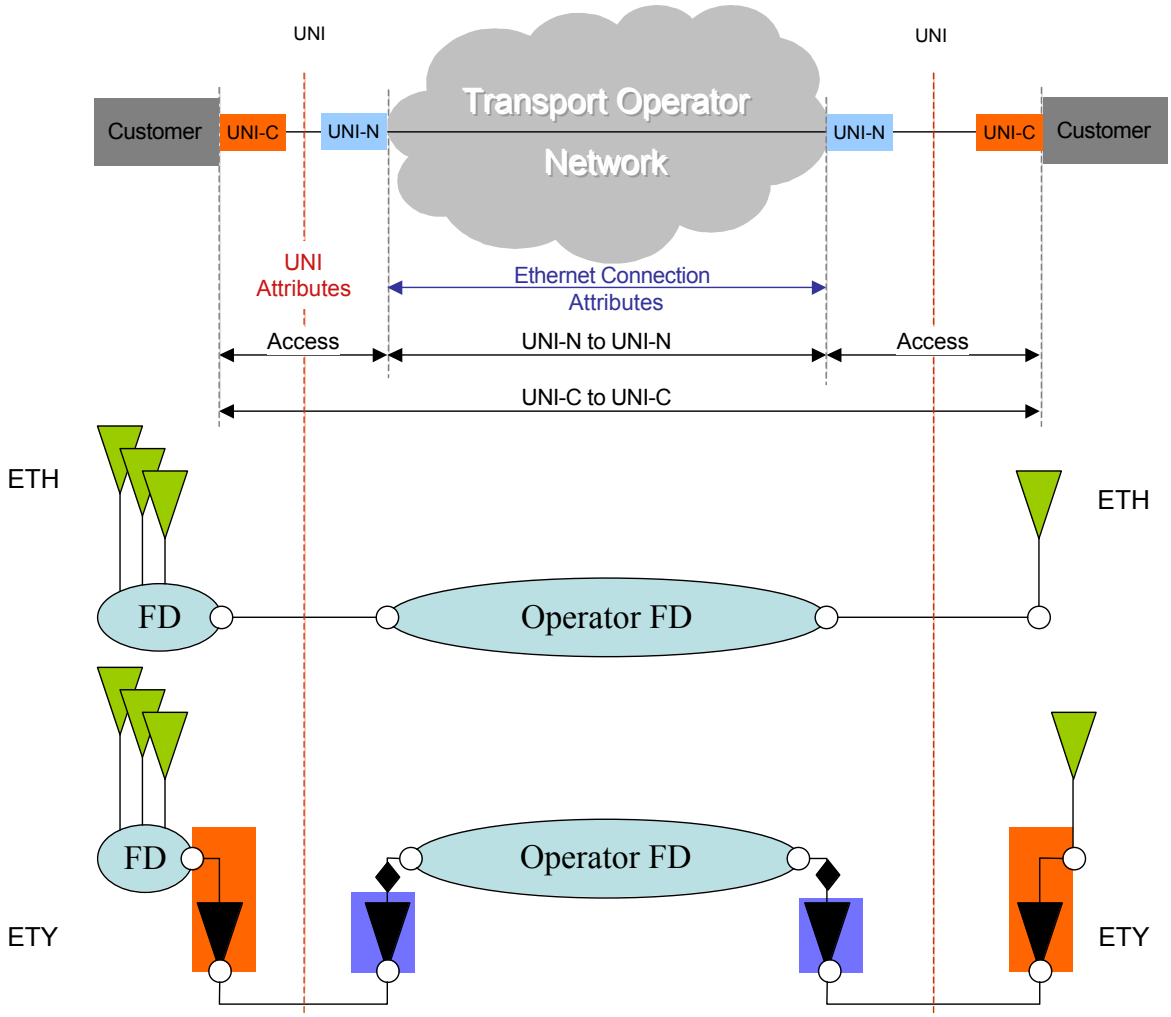


Figure 6-1/G.8011/Y.1307 - Single Provider view of Ethernet Service Areas

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 G.8012/Y.1308.

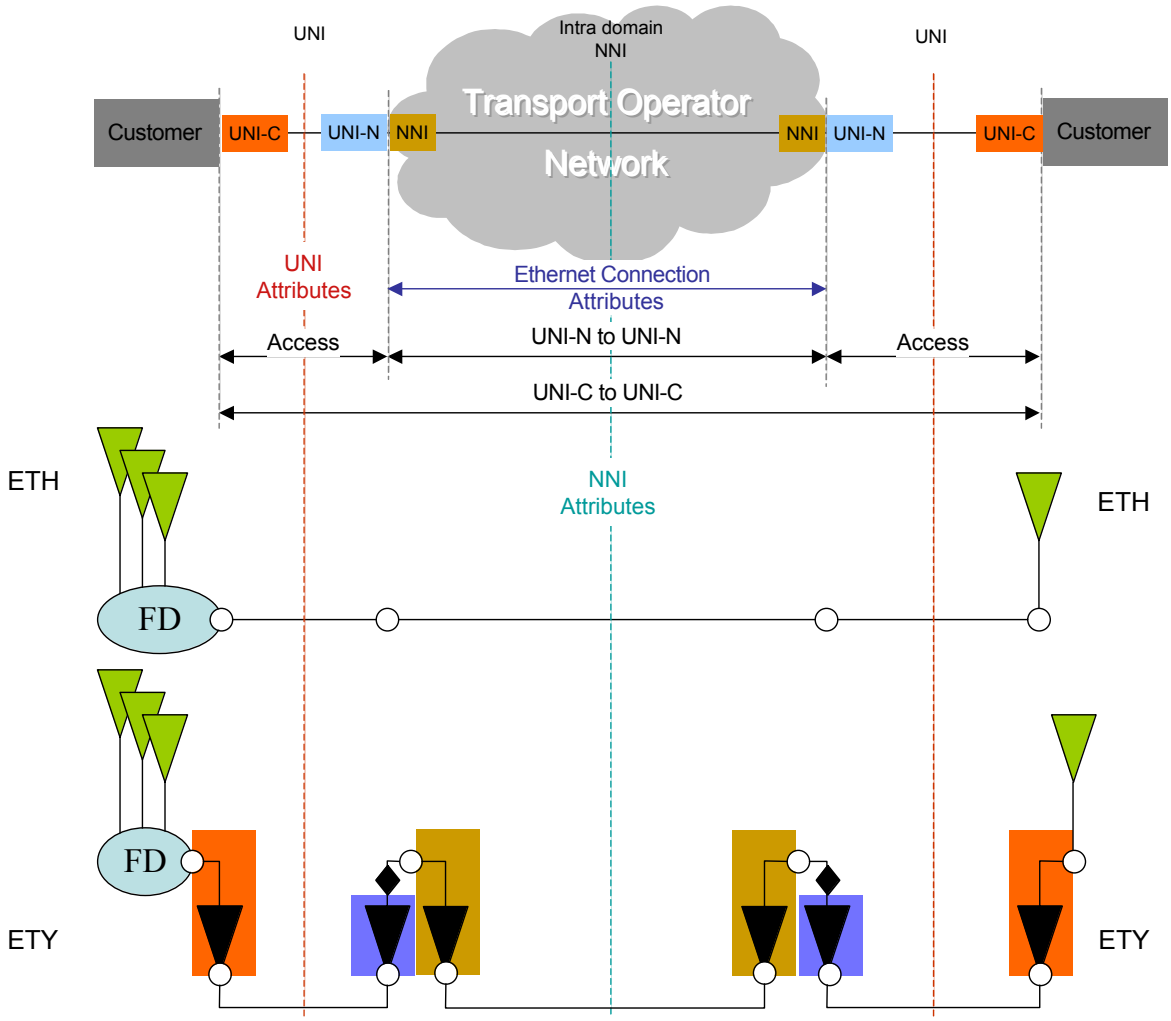


Figure 6-2/G.8011/Y.1307 – Single Provider with NNI view of Ethernet Service Areas

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 G.8012/Y.1308.

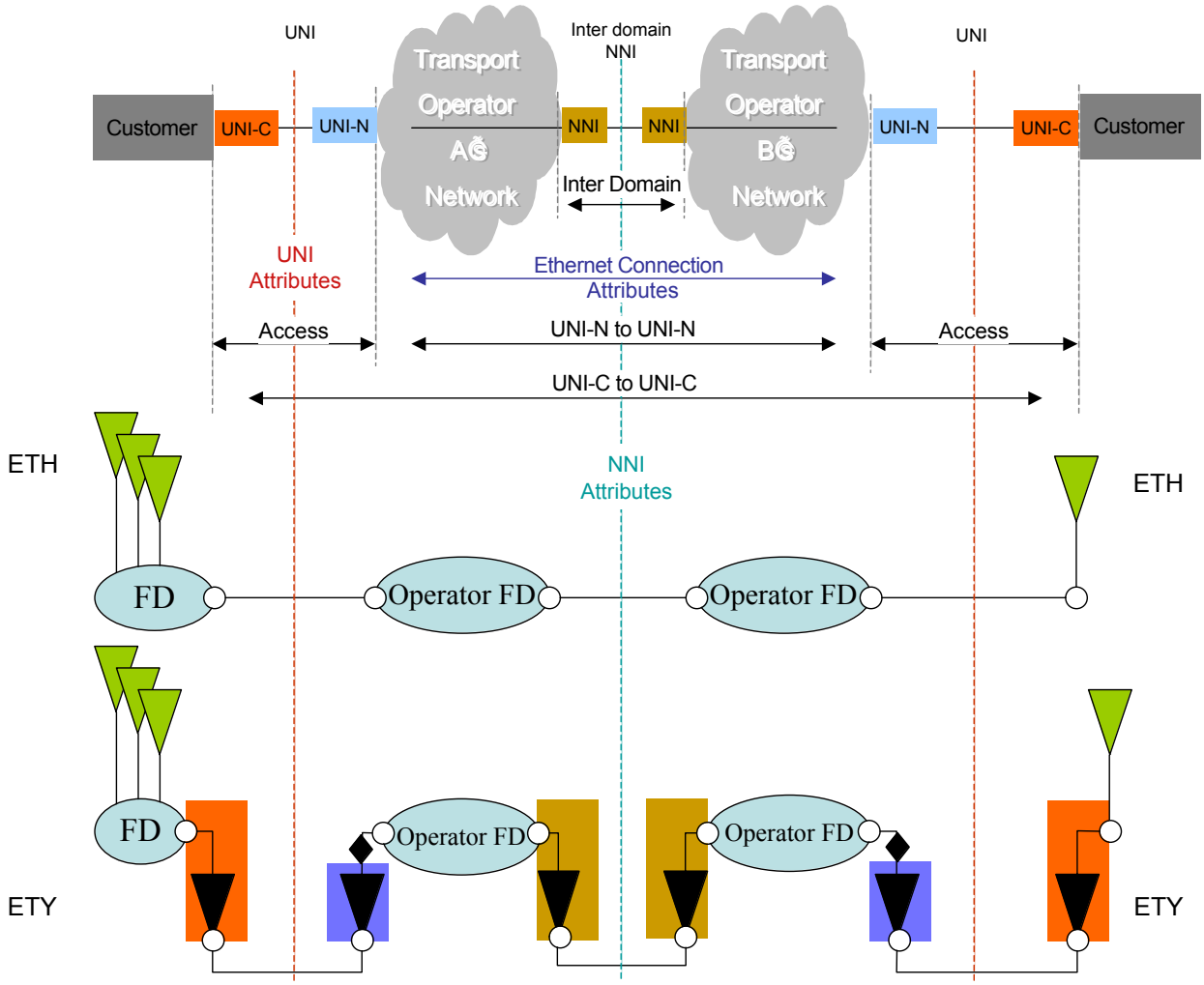


Figure 6-3/G.8011/Y.1307 – Multi Provider with NNI view of Ethernet Service Areas

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 flow domains 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 connection) are also shown in Figures 6-1, 6-2 and 6-3.

The remainder of this Recommendation defines Ethernet connection attributes for the support of Ethernet services for UNI-N to UNI-N (section 7), Ethernet UNI-N port attributes (section 8), and Ethernet NNI port attributes for intra and inter carrier handoff (section 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 Recommendation G.8012/Y.1308. The equipment functions of these interfaces are defined in Recommendation G.8021/Y.1341.

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. The result is that this Recommendation allows classification of many Ethernet services. For example, G.8011.1/Y.1307.1 selects appropriate attributes to describe the first service.

6.3 Ethernet services views

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

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. Further, this Ethernet connection is between the UNI-Ns.

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. This will not be covered by this Recommendation.

Descriptions of services, defined by the MEF, from the customer point of view are summarized in Appendix I.

This Recommendation is complementary to the definitions of Ethernet Services from the customer viewpoint looking into the network (e.g., MEF Services Model – MEF 1). For example, the MEF EVC may be carried over an EC as described by the ITU. A comparison between the ITU network view and the MEF customer view is shown in Appendix II.

7 Ethernet Connection attributes

This section describes Ethernet Connection (or EC) attributes that characterize a particular instance of an Ethernet service. The area of applicability of these EC attributes is identified in Figure 6-1 as being equivalent to the ETH connection or ETH connectivity (per section 6.6 of Recommendation G.8010/Y.1306). The set of EC attributes is defined in the following sections and they are summarized in Table 7-1.

Table 7-1: EC service attributes

EC Service Attribute	Service Attribute Parameters and Values
Network connectivity	Pt-pt, mp-mp, pt-mp (for further study)
Transfer characteristics	Address – deliver conditionally or unconditionally Drop Precedence – drop randomly, drop conditionally, or not applicable Class of Service - for further study
Link type	Dedicated, shared
Traffic separation	Service instance: Spatial, logical Customer: Spatial, logical
Connectivity monitoring	Sub-layer monitoring: on demand, proactive, none Inherent monitoring: proactive
Bandwidth profile	specify
UNI list	Arbitrary text string to identify associated UNIs
Preservation	VLAN ID – yes or no CoS – yes or no
Survivability	None, server specific

The relationship of these attributes to Recommendation G.8010/Y.1306 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 Network Connectivity

This attribute indicates the connectivity between Ethernet endpoints in the transport service. There are three options, as described in the following subsections: pt-pt, mp-mp, pt-mp.

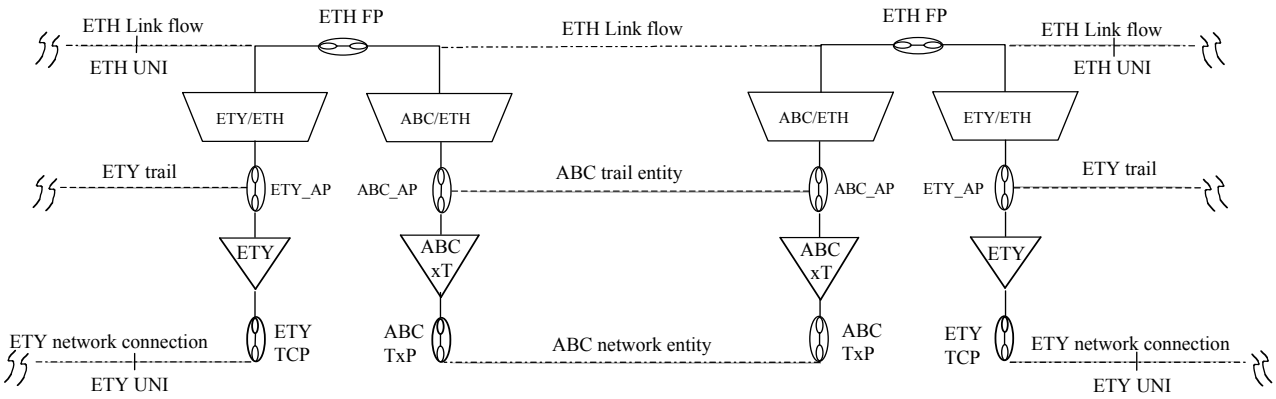
7.1.1 Point-to-point

Connectivity of a point to point (pt-pt) service is between only 2 points. The pt-pt topology is supported by:

- a (component) link within the provider network (non-extendible), or
- a flow domain 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 flow 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/G.8011/Y.1307 Network portion of the point-to-point topology

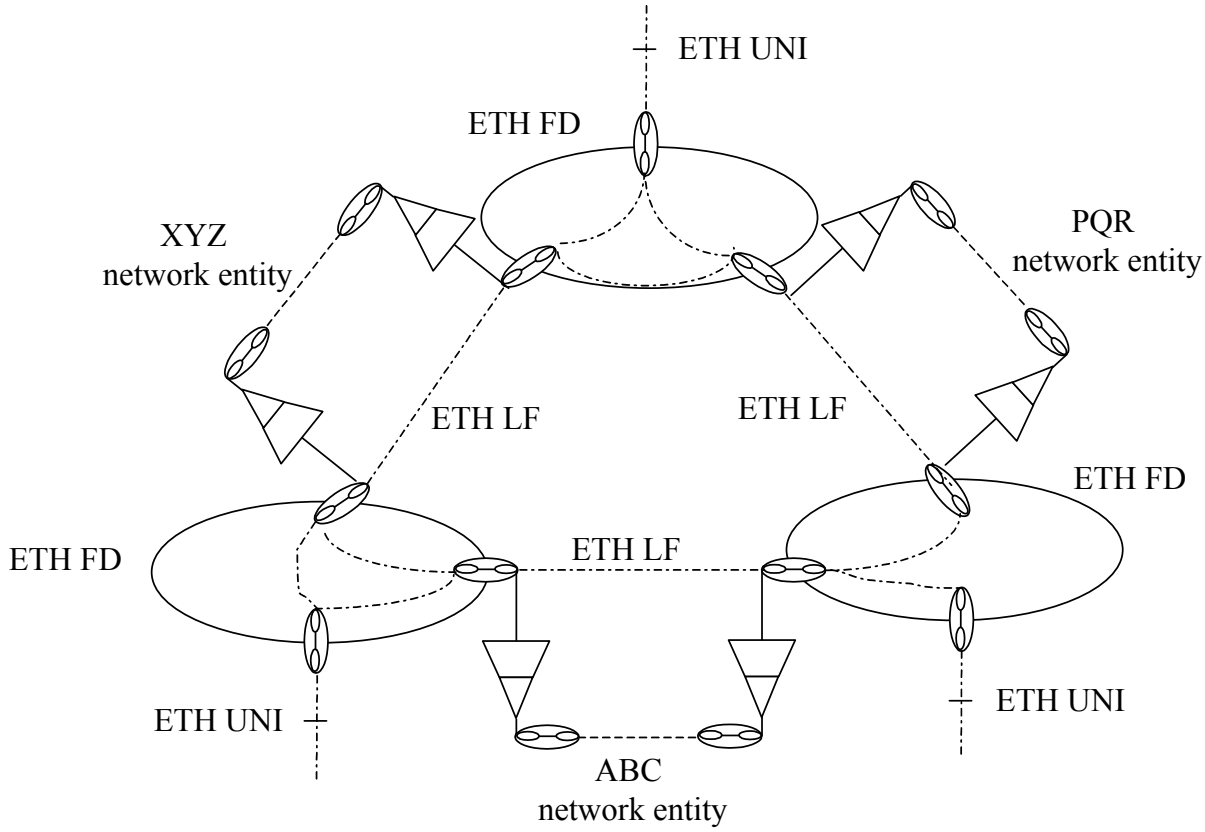
7.1.2 Multipoint-to-multipoint

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 flow domains 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 flow domain has only two flow points in use. In this case it supports a pt-pt service as described in 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/G.8011/Y.1307 Network portion of the multipoint-to-multipoint topology

7.1.3 Point-to-multipoint

Connectivity is from one point to many points.

The details are for further study.

7.2 Transfer characteristics

This attribute indicates the transfer characteristics of the ETH_CI There are three parameters.

7.2.1 Address

This parameter indicates the disposition of the ETH_CI based on the destination address. The options are: deliver conditionally and deliver unconditionally.

The conditions will be defined in the service specific Recommendations.

7.2.2 Drop Precedence

This parameter indicates the dropping of the ETH_CI based on the priority of the Ethernet frame. The options are: drop conditionally (i.e., drop based on precedence or priority), drop randomly (i.e., tail drop when the queue is full), and not applicable (i.e., no frames are dropped).

7.2.3 Class of Service

This parameter indicates the queuing of the ETH_CI based on the priority of the Ethernet frame.

The details are for further study.

7.3 Link type

This 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.

7.3.1 Dedicated

A dedicated link type indicates that all ETH links supporting the EC 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 EC; an EC 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.

7.3.2 Shared

A shared link type indicates that one or more ETH links supporting the EC 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 CI of other service instances.

7.4 Traffic separation

This 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 7-2:

Table 7-2: Traffic separation

Customer	Service Instance

Customer	Service Instance
Spatial	Spatial
Spatial	Logical
Logical	Logical

7.4.1 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 (flow domains, FPP links, access groups) (section 6.3.2.5.1/G.8010/Y.1306).

Logical

Logical separation between the traffic of service instances allows components (flow domains, FPP links, access groups) to be shared by multiple customers (section 6.3.2.5.1/G.8010/Y.1306).

7.4.2 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 (flow domains, FPP links, access groups) (section 6.3.2.5.1/G.8010/Y.1306)..

Logical

Logical separation between customer traffic allows components (flow domains, FPP links, access groups) to be shared by multiple service instances (section 6.3.2.5.1/G.8010/Y.1306).

7.5 Connectivity Monitoring

Ethernet OAM requirements are defined in Y.1730 and the mechanisms for connection monitoring will be described in future Recommendations.

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.

The applicability to this Recommendation is for further study.

7.6 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 0. EIR and EBS are related in the same way as CIR and CBS.

The bandwidth profile parameters constitute an input to a traffic conditioning function defined in G.8010/Y.1306.

The terms CIR, CBS, EIR and EBS and the applicability to this Recommendation is for further study. The relationship of bandwidth profile to CoS and the applicability to multipoint-to-multipoint services is for further study.

The definition of CIR, CBS, ERI and EBS will be provided in a Y series Recommendation. A description of CIR and CBS is currently provide in Appendix II of G.8011.1/Y.1307.1.

7.7 UNI list

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

7.8 Preservation

This attribute indicates the preservation of specific components of the ETH_CI provided by the ETH layer network that is used to transport the Ethernet service. That is the parameter value will be the same on ingress and egress to the EC. There are two parameters: VLAN ID and class of service (CoS).

7.8.1 VLAN ID

This parameter indicates the preservation of the ingress VLAN ID of the ETH_CI. The options are: yes or no.

7.8.2 Class of Service

This class of service (CoS) parameter indicates the preservation of the ingress priority of the ETH_CI. The options are: yes or no.

7.9 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 G.8012/Y.1308 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 section 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. These are summarized in the following Table:

Table 8-1: UNI service attributes

Layer	UNI Service Attribute	Service Attribute Parameters and Values
ETH	MAC service	IEEE 802.3-2002 Frame format
	Multiplexed Access	Yes, no
	UNI ID	Arbitrary text string to identify each UNI instance
	UNI EC ID	Arbitrary text string to identify each EC instance
	VLAN mapping	Specify
	Bundling	Yes, no, all-to-one
	Bandwidth profile	For further study
	Layer 2 Control Protocol Processing	Block, process, pass per protocol on ingress Generate or none per protocol on egress
ETY	PHY Speed	10 Mbit/s, 100 Mbit/s, 1 Gbit/s or 10 Gbit/s
	PHY Mode	Full duplex, half duplex or auto-negotiation
	PHY Medium	IEEE 802.3-2002 Physical Interface

The relationship of these attributes to Recommendation G.8010/Y.1306 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.

8.1 ETH UNI

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

8.1.1 MAC service

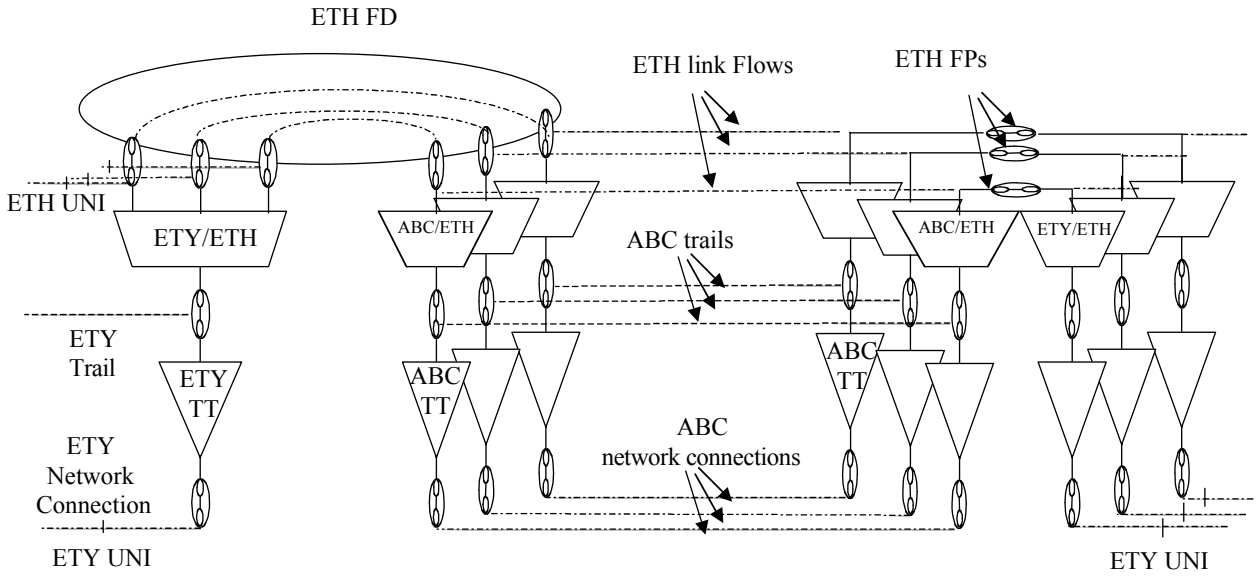
This attribute indicates support for the IEEE 802.3-2002 frame format.

Other MAC frame sizes are for further study.

8.1.2 Multiplexed access

This attribute 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.



Note - for simplicity connection oriented technology ABC is shown on all server trails. Different technologies can also be used on each.

Figure 8-1/G.8011/Y.1307 Network portion of the Multiplexed Access Line topology

In the case of Multiplexed Access 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 linkflow identifiers for flow isolation (e.g., C-VLAN tag) need to be specified.

8.1.3 UNI identification

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

8.1.4 UNI EC identification

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

8.1.5 VLAN ID mapping

At the UNI there is a mapping of each customer VLAN ID to at most one EC. In most cases, this mapping of VLAN ID to EC ID must be specified as part of the service. However, in the simple case with no multiplexed access (see 8.1.2) there is a all-to-one mapping.

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

8.1.6 Bandwidth profile

For further study.

8.1.7 Bundling

There are three bundling options: yes, no and all-to-one.

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 Multiplexed Access

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 Multiplexed access.

8.1.8 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 *Process, Block or Pass* the control frame on ingress, and whether to *generate* or have an action of *none* on egress. Note that the ingress action 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 section 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 Recommendation G.8021.

The layer 2 control protocols defined by IEEE 802.1 (distinguished by their MAC destination address) are listed in Table 8-2 for ingress and Table 8-3 for egress.

Table 8-2/G.8011/Y.1307 – Ingress (sink) 802.1 L2 Control protocols

destination address	Valid Action	L2 Control Protocol
01-80-C2-00-00-00		STP, MSTP, RSTP
01-80-C2-00-00-01		MAC Control (PAUSE)
01-80-C2-00-00-02		Slow protocols
01-80-C2-00-00-03		802.1X Port Authentication
01-80-C2-00-00-04		reserved address
01-80-C2-00-00-05		reserved address
01-80-C2-00-00-06		reserved address
01-80-C2-00-00-07		reserved address
01-80-C2-00-00-08		reserved address
01-80-C2-00-00-09		reserved address
01-80-C2-00-00-0A		reserved address
01-80-C2-00-00-0B		reserved address
01-80-C2-00-00-0C		reserved address
01-80-C2-00-00-0D		reserved address
01-80-C2-00-00-0E		reserved address
01-80-C2-00-00-0F		reserved address
01-80-C2-00-00-10		Bridge management
01-80-C2-00-00-20		GARP – GMRP address
01-80-C2-00-00-21		GARP – GVRP address
01-80-C2-00-00-22		GARP – reserved address
01-80-C2-00-00-23		GARP – reserved address
01-80-C2-00-00-24		GARP – reserved address
01-80-C2-00-00-25		GARP – reserved address
01-80-C2-00-00-26		GARP – reserved address
01-80-C2-00-00-27		GARP – reserved address
01-80-C2-00-00-28		GARP – reserved address
01-80-C2-00-00-29		GARP – reserved address
01-80-C2-00-00-2A		GARP – reserved address
01-80-C2-00-00-2B		GARP – reserved address
01-80-C2-00-00-2C		GARP – reserved address
01-80-C2-00-00-2D		GARP – reserved address
01-80-C2-00-00-2E		GARP – reserved address
01-80-C2-00-00-2F		GARP – reserved address

For Tables 8-2 and 8-3, note that IEEE 802.1D defines the address and its usage. For this Recommendation, the address is normative while its usage (in the third column) is provided for clarity. For complete details on the protocols, refer to the appropriate IEEE 802 standard.

Table 8-3/G.8011/Y.1307 – Egress (source) 802.1 L2 Control protocols

destination address	Valid Action	L2 Control Protocol
01-80-C2-00-00-00		STP, MSTP, RSTP
01-80-C2-00-00-01		MAC Control (PAUSE)
01-80-C2-00-00-02		Slow protocols
01-80-C2-00-00-03		802.1X Port Authentication
01-80-C2-00-00-04		reserved address
01-80-C2-00-00-05		reserved address
01-80-C2-00-00-06		reserved address
01-80-C2-00-00-07		reserved address
01-80-C2-00-00-08		reserved address
01-80-C2-00-00-09		reserved address
01-80-C2-00-00-0A		reserved address
01-80-C2-00-00-0B		reserved address
01-80-C2-00-00-0C		reserved address
01-80-C2-00-00-0D		reserved address
01-80-C2-00-00-0E		reserved address
01-80-C2-00-00-0F		reserved address
01-80-C2-00-00-10		Bridge management
01-80-C2-00-00-20		GARP – GMRP address
01-80-C2-00-00-21		GARP – GVRP address
01-80-C2-00-00-22		GARP – reserved address
01-80-C2-00-00-23		GARP – reserved address
01-80-C2-00-00-24		GARP – reserved address
01-80-C2-00-00-25		GARP – reserved address
01-80-C2-00-00-26		GARP – reserved address
01-80-C2-00-00-27		GARP – reserved address
01-80-C2-00-00-28		GARP – reserved address
01-80-C2-00-00-29		GARP – reserved address
01-80-C2-00-00-2A		GARP – reserved address
01-80-C2-00-00-2B		GARP – reserved address
01-80-C2-00-00-2C		GARP – reserved address
01-80-C2-00-00-2D		GARP – reserved address
01-80-C2-00-00-2E		GARP – reserved address
01-80-C2-00-00-2F		GARP – reserved address

The layer 2 control protocols defined by IEEE 802.3 (distinguished by a combination of MAC address, Ethertype and subtype) are listed in Table 8-4 for ingress (sink) and Table 8-5 for egress (source).

Table 8-4/G.8011/Y.1307 – Ingress (sink) 802.3 L2 Control protocols

Destination Address	Ethertype	Subtype	Valid Action	L2 Control Protocol
01-80-C2-00-00-01 or unicast of port attached to link	88-08	0x0001		MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02		Slow protocols – LACP, LAMP
01-80-C2-00-00-02	88-09	0x03		Slow protocols – 802.3ah OAM

A list of reserved Ethertypes/subtypes is not shown for the set of protocols in Table 8-4 and 8-5. However, it should be noted that additional protocols identified by new Ethertype/subtypes may be defined later by IEEE.

Table 8-5/G.8011/Y.1307 – Egress (source) 802.3 L2 Control protocols

Destination Address	Ethertype	Subtype	Valid Action	L2 Control Protocol
01-80-C2-00-00-01 or unicast of port attached to link	88-08	0x0001		MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02		Slow protocols – LACP, LAMP
01-80-C2-00-00-02	88-09	0x03		Slow protocols – 802.3ah OAM

The valid actions are described in the following subsections. 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 G.8011.1/Y.1307.1). In addition, an implementation may support one or more of the listed valid actions for a particular protocol.

8.1.8.1 Ingress actions

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).

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

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).

Non-intrusive monitoring

For further study.8.1.8.2 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.

Non-intrusive monitoring

For further study.

8.2 ETY UNI

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

8.2.1 PHY speed

This attribute indicates the speed of Ethernet PHY device that is used to transport the Ethernet service. There are four values defined by G.8012/Y.1308: 10 Mbit/s, 100 Mbit/s, 1 Gbit/s or 10 Gbit/s.

8.2.2 PHY mode

This attribute indicates the mode of Ethernet PHY device that is used to transport the Ethernet service. There are three values defined by G.8012/Y.1308: full duplex, half duplex or auto-negotiation.

8.2.3 PHY 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 defined by G.8012/Y.1308.

9 Ethernet NNI Attributes

This section 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 the following Table 9-1.

Table 9-1: NNI service attributes

Layer	NNI Service Attribute	Service Attribute Parameters and Values
ETH	MAC service	IEEE 802.3-2002 Frame format
	NNI ID	Arbitrary text string to identify each NNI instance
	NNI EC ID	Arbitrary text string to identify each EC instance
	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
Server	Server layer	Specify

The relationship of these attributes to Recommendation G.8010/Y.1306 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 802.3-2002 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 EC identification

The NNI EC ID is an arbitrary string administered by the Service Provider that is used to identify an EC at the NNI. It is intended for management and control purposes.

9.1.4 VLAN ID mapping

For further study.

9.1.5 Bundling

For further study.

9.1.6 Bandwidth profile

For further study.

9.1.7 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 section 8.1.8.

The layer 2 control protocols are listed in Table 8-2 and 8-4 for ingress and Table 8-3 and Table 8-5 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 G.8011.1/Y.1307.1).

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 Recommendation G.8012/Y.1308 (e.g., SDH, PDH, OTH, ETY, ATM, etc.). The value is specified.

ANNEX A

Relationship of G.8011/Y.1307 attributes to G.8010/Y.1306

A.1 Introduction

This annex describes the direct relationship of the attributes defined in this Recommendation and the architecture of Recommendation G.8010/Y.1306.

A.2 Ethernet connection attributes

All Ethernet Connection Services are built by interconnecting ETH links. The service or EC attributes are related to a set of ETH links, or an ETH flow domain. They define restrictions on interconnection, or on the attributes of links to be used. The relationship of these attributes to G.8010/Y.1306 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	Network connectivity	P2p, mp2mp, p2mp
Address – Determines whether FDs use filtering when interconnecting links Priority – Determines whether all Queuing process should differentiate based on priority (P bits)	Transfer characteristics	Address – deliver conditionally or unconditionally Priority – drop randomly or conditionally
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
Bandwidth associated with ETH component links	Bandwidth profile	specify
List of addresses of FP (not defined in G.8010/Y.1306)	UNI list	Arbitrary text string to identify associated UNIs
Allowing of mux/demux of VLAN tag in srv/ETH adaptation	Preservation	VLAN – yes or no CoS – yes or no
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 futher study.

A.3 Interface attributes

Table A-2 shows the relation between Recommendation G.8010/Y.1306 and the UNI and NNI attributes defined in this Recommendation. Note that many of the architectural functions listed are in Figure 15 of G.8010/Y.1306.

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
ETH_CI	ETH_FP	MAC service	MAC service	ETH
ETH multiplexing	ETY/ETH-m adaptation function used	Multiplexed Access	Bundling	
		Bundling		
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			
Traffic conditioning	ETH_TC function	Bandwidth profile	Bandwidth profile	
Flow point mapping	ETH_FP to/from FDF	VLAN mapping	VLAN mapping	
Address of FP (not defined in G.8010/Y.1306)	FP	UNI ID	NNI ID	
Address of FDFr (not defined in G.8010/Y.1306)	FDFr	UNI EC ID	NNI EC ID	
Server Layer Technology	Adaptation and TT for server layer used	PHY speed/mode/medium	Server layer	ETY or Server

ANNEX B

Distributed UNI

B.1 Introduction

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

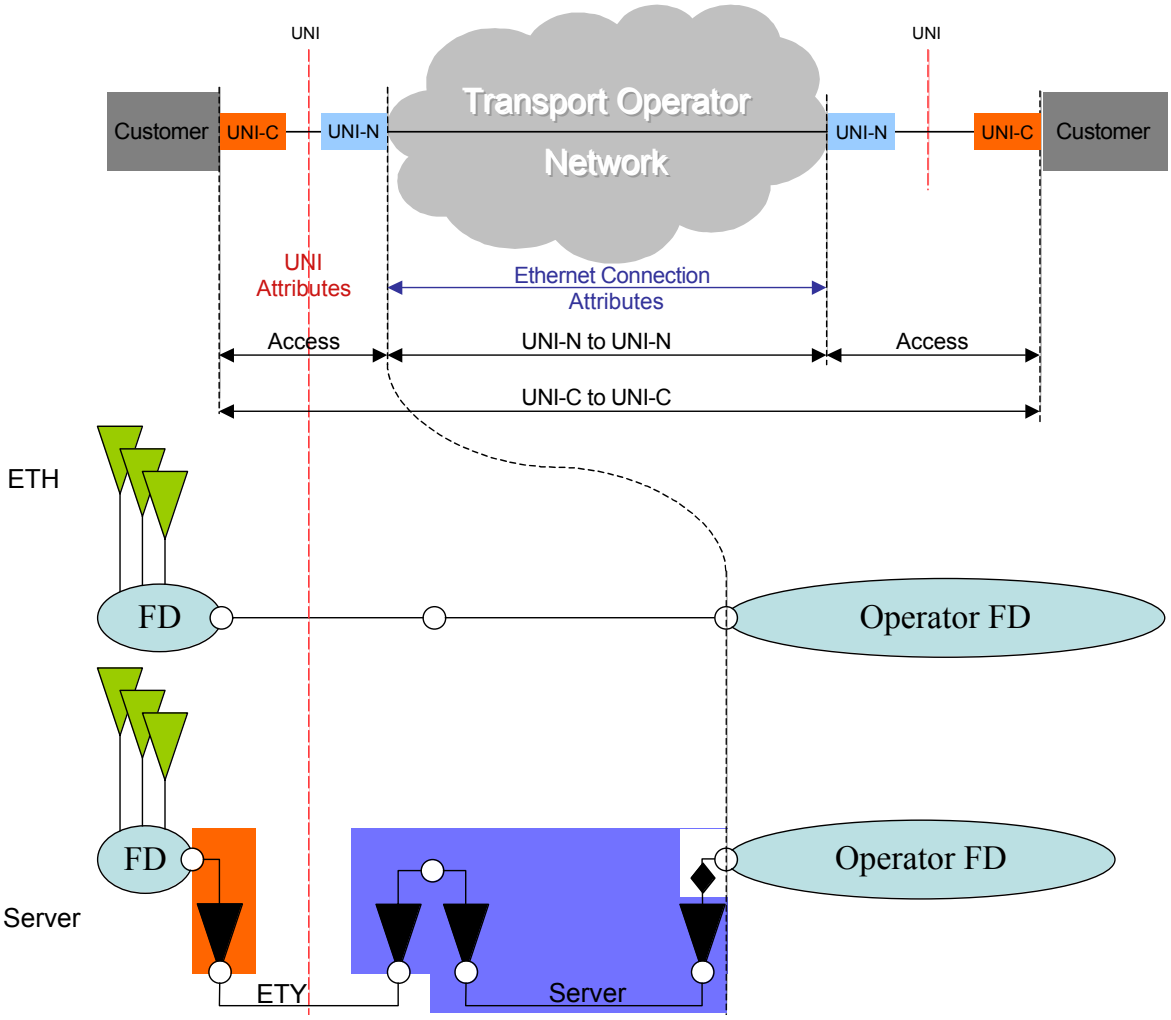


Figure B-1/G.8011/Y.1307 – Single Provider view of Ethernet Service Areas with distributed UNI-N

APPENDIX I

Customer View Ethernet Services

I.1 Introduction

The Metro Ethernet Forum (MEF) is defining Ethernet services in a series of three documents called 'MEF Phase 1':

Ethernet Services Model

Ethernet Services Definitions

Ethernet Traffic Management Specifications

These documents describe services from the customer equipment (or customer edge – CE) point of view. From this perspective, the MEF cannot determine any technical difference, beyond possible differences in performance, between an Ethernet virtual private line and a dedicated Ethernet private line.

This appendix provides a brief introduction to the MEF Phase I documents as of April 2004, so that they may be compared with draft Recommendation G.8011/Y.1307. This description is tutorial and is not meant to replace the MEF specifications. Currently, only the 'Ethernet Services Model, Phase I' is approved by the MEF as MEF 1.

I.2 Ethernet Services Model

The attributes of Ethernet services observable from UNI to UNI are defined in this document, as is a framework to define services. The framework lays out the format of the next document.

The scope of phase 1 is limited as follows:

- The services considered are only those based on Ethernet.
- From the Subscriber equipment point of view, the protocol operating at the UNI between the Subscriber's equipment and the Metro Ethernet Network is a Standard Ethernet protocol (PHY and MAC).
- The services considered are limited to services between two or more UNIs.

It is assumed that the configuration of both the Service Provider and Subscriber equipment to create and access a service is done administratively.

I.2.1 UNI

A UNI can have a number of characteristics that will be important to the way that the CE sees a service. One of the key aspects of a service description will be the allowable mix of UNIs with different characteristics. The MEF UNI attributes are defined in Table 5 of MEF 1.

I.2.2 EVC

A fundamental aspect of Ethernet Services is the Ethernet Virtual Connection (EVC). An EVC is an instance of an association of two or more UNIs. These UNIs are said to be "in the EVC." A given UNI can support more than one EVC via the Service Multiplexing attribute

There are two types of EVCs – point-to-point and multipoint-to-multipoint. In a Point-to-Point EVC, exactly two UNIs MUST be associated with one another. In a Multipoint-to-Multipoint EVC, two or more UNIs MUST be associated with one another.

The MEF EVC attributes are defined in Table 6 of MEF 1.

I.3 Ethernet Services Definitions

This document defines generic service constructs called Ethernet Service Types used to create Ethernet services over a Metro Ethernet Network (MEN). This document specifies the Ethernet Service Attributes and parameters that are used with the different Ethernet Service Types, but does not define how the service attributes may be implemented.

The services described in this document are from a subscriber perspective and are defined based on the service attributes that might appear in a Service Level Agreement (SLA) or Service Level Specification (SLS). The services are instantiated at an Ethernet UNI, and are agnostic of the underlying network infrastructure.

The MEF has defined two generic *service types* called Ethernet Line (E-Line) Service for point-to-point connections and Ethernet LAN (E-LAN) Service for multipoint connections. Both of these *service types* include a set of service attributes with associated parameters. By setting different values for the service attribute parameters, many different *Ethernet services* can be created.

I.4 Ethernet Traffic Management

This document defines the Traffic and Performance service attributes and parameters that may be specified as part of an Ethernet service level specification (SLS). The service attributes and parameters defined in Phase I of this document only apply to Ethernet Service Frames.

Phase I of this specification defines three Bandwidth Profile service attributes:

- Ingress Bandwidth Profile Per Ingress UNI
- Ingress Bandwidth Profile Per EVC
- Ingress Bandwidth Profile per CoS Identifier

Each Bandwidth Profile consists of <CIR, CBS, EIR, EBS, CM, CF> traffic parameters which are defined in this document. Multiple bandwidth profiles may be applied at the UNI. However, only a single type of bandwidth profile may be applied to a given Service Frame at the UNI.

APPENDIX II

Customer View vs. Network View of Ethernet Services

II.1 Introduction

This Recommendation describes Ethernet services from the network perspective. Ethernet services may also be described from the customer perspective.

The network viewpoint may be used by a carrier to define its network and manage the services and facilities within that network. A carrier may choose to expose these services to its customers in SLAs or choose to use them internally.

The customer viewpoint of a service is simply viewing the carrier network from the customer side. None of the network configuration, topology or management is visible to the customer. However, performance measurements may be used to infer carrier network specifics.

It is important to note that both views are valid for all Ethernet services, though they both need not be used. In the majority of cases, where customer and network view services are both used it is important to understand that they are complementary.

II.2 MEF – G.8011/Y.1307 comparison

II.2.1 Services types

Using the MEF as an example, the MEF Ethernet service types (i.e., E-LINE and E-LAN) that are defined in MEF Phase I documents (as of April 2004) can be implemented using infrastructure Ethernet services defined in draft Recommendation G.8011/Y.1307.

MEF	ITU-T G.8011/Y.1307
E-Line	Point-to-point (line)
	Point-to-multipoint
E-LAN	Multipoint-to-multipoint (LAN)

Figure II.1/*G.8011/Y.1307* – Comparison of MEF & ITU-T Ethernet Services

This can be further expanded by the many service definitions that the MEF suggests is possible. The first service definition is explored in an Appendix to G.8011.1.

II.2.2 Attributes

The attributes of the MEF and ITU-T service definitions can be mapped with the view that an MEF service can be carried on an ITU-T service. The mapping for EVC to EC is proposed in Table II.2 and the mapping of UNIs is proposed in Table II.3.

There is an important distinction between the attributes that result from the customer vs. network view. The MEF Ethernet virtual connection (EVC) is defined at the service layer and is between demarcs (see Figure 6-1) including the UNI. As a result, its attributes are completely agnostic to the underlying infrastructure. The ITU-T Ethernet Connection (EC) is defined at the service and infrastructure layer and specifically between UNI-Ns (see Figure 6-1). As a result, its attributes define both service aspects and network specific details.

Table II.2/*G.8011/Y.1307* – Comparison of MEF EVC & G.8011/Y.1307 EC attributes

MEF EVC Service Attribute	G.8011/Y.1307 EC attribute
EVC Type	Network Connectivity
	Link type
UNI List	UNI list
CE-VLAN ID Preservation	Preservation - VLAN
CE-VLAN CoS Preservation	Preservation - CoS
Unicast Service Frame Delivery	Transfer characteristics - address
Multicast Service Frame Delivery	
Broadcast Service Frame Delivery	
(Note a)	Transfer characteristics – drop precedence
Layer 2 Control Protocol Processing (only applies for L2CP passed to the EVC)	UNI L2 Control protocol processing
EVC Performance	*(Note 1)*
(Note b)	Traffic separation – customer, service instance
(Note c)	Connectivity monitoring
(Note c)	Survivability

MEF notes:

a. Not specified by MEF, but handled implicitly by EVC performance.
b. Handled implicitly by EVC performance parameters that prevent the sharing of resources.
c. No equivalent

G.8011 notes:
1. Not defined in G.8011/Y1307. Depends on server layer.

Table II.3/*G.8011/Y.1307* – Comparison of MEF & G.8011 Ethernet UNI attributes

MEF UNI Service Attribute	G.8011/Y.1307 UNI attribute
UNI Identifier	UNI ID
Physical Medium	PHY medium
Speed	PHY Speed
Mode	PHY Mode
MAC Layer	MAC Service
Service Multiplexing	Multiplexed access
UNI EVC ID	UNI EC ID
CE-VLAN ID / EVC Map	VLAN Mapping
Maximum number of EVCs	*(Note 1)*
Bundling	Bundling
All to One Bundling	Bundling
Ingress Bandwidth Profile Per Ingress UNI	EC Bandwidth Profile
Layer 2 Control Protocol Processing	L2 Control protocol processing *(Note 2)*
Notes: 1. EPL is defined as point-to-point service. 2. These are the ingress actions. Valid actions per protocol on ingress and egress are defined in Tables 8-2, 8-3, 8-4 and 8-5/G.8011/Y.1307.	

The end result is that a service defined from a customer perspective with MEF EVC and UNI attributes can be deployed over a network infrastructure service defined with G.8011/Y.1307 EC and UNI attributes.