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

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Ethernet private line service

Recommendation ITU-T G.8011.1/Y.1307.1

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Recommendation ITU-T G.8011.1/Y.1307.1

Ethernet private line service

Summary

Recommendation ITU-T G.8011.1/Y.1307.1 defines the service attributes and parameters for carrying Ethernet characteristic information over dedicated bandwidth, point-to-point connections, provided by SDH, PDH, ATM, MPLS, or OTH server layer networks. This type of service is referred to as Ethernet private line (EPL) service. This Recommendation is based on the Ethernet service framework as defined in Recommendation ITU-T G.8011/Y.1307.

Source

Recommendation ITU-T G.8011.1/Y.1307.1 was approved on 13 January 2009 by ITU-T Study Group 15 (2009-2012) under Recommendation ITU-T A.8 procedures.

Keywords

Ethernet, Ethernet service, private line.

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1 Scope

This Recommendation defines the service attributes and parameters for carrying Ethernet characteristic information over dedicated-bandwidth, point-to-point connections, provided by SDH, ATM, MPLS, PDH, ETY or OTH server layer networks. This type of services is referred to as Ethernet private line (EPL) service. This Recommendation is based on the Ethernet service framework as defined in [ITU-T G.8011] and is aligned with the EPL specified in [MEF 6.1].

2 References

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

[ITU-T G.707] Recommendation ITU-T G.707/Y.1322 (2003), *Network node interface for the synchronous digital hierarchy (SDH).*

[ITU-T G.709] Recommendation ITU-T G.709/Y.1331 (2003), *Interfaces for the Optical Transport Network (OTN).*

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

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

[ITU-T G.8010] Recommendation ITU-T G.8010/Y.1306 (2004), *Architecture of Ethernet layer networks.*

[ITU-T G.8011] Recommendation ITU-T G.8011/Y.1307 (2009), *Ethernet service characteristics.*

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

[ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (2007), *Characteristics of Ethernet transport network equipment functional blocks.*

[IEEE 802.3] IEEE 802.3-2005, *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 802.1X] IEEE 802.1X-2001, *IEEE Standard for Local and Metropolitan Area Networks – Port-based Network Access Control.*

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

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

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

3 Terms and 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 connection

3.4 Subnetwork

This Recommendation uses the following terms defined in [ITU-T G.8011]:

3.5 Block

3.6 Committed information rate (CIR)

3.7 Dedicated

3.8 Pass

3.9 Process (with respect to L2 control protocol frames)

3.10 Service instance

3.11 Spatial

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

3.12 Flow point

3.13 Flow termination

3.14 Termination flow point

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

3.15 Access link

3.16 Customer

3.17 EPL type 1

3.18 EPL type 2

3.19 Ethernet service

3.20 Ety-NNI

3.21 Ety-UNI

3.22 Traffic conditioning function

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ATM Asynchronous Transfer Mode

CBR Constant Bit Rate

CBS Committed Burst Size

CI Characteristic Information

CIR Committed Information Rate

CLPS	Connectionless Packet Switched
CO-CS	Connection-Oriented Circuit Switched
CO-PS	Connection-Oriented Packet Switched
DA	Destination Address
EC	Ethernet Connection
EIR	Excess Information Rate
EPL	Ethernet Private Line
ETH	Ethernet MAC layer network
ETH_CI	Ethernet MAC Characteristic Information
ETY	Ethernet physical layer network
Ety-NNI	Ethernet over Transport NNI
Ety-UNI	Ethernet UNI
ETYn	Ethernet physical layer network of order *n*
EVC	Ethernet Virtual Connection
FCS	Frame Check Sequence
FDFr	Flow Domain Fragment
GFP	Generic Framing Procedure
LACP	Link Aggregation Control Protocol
LCAS	Link Capacity Adjustment Scheme
MAC	Media Access Control
MEF	Metro Ethernet Forum
MEG	Maintenance Entity Group
MEP	Maintenance End Point
MIP	Maintenance Intermediate Point
MPLS	Multi-Protocol Label Switching
MTU	Maximum Transmission Unit
NNI	Network to Network Interface
OAM	Operations, Administration, Maintenance
OTH	Optical Transport Hierarchy
OTN	Optical Transport Network
PA	(Ethernet) Preamble
PDH	Plesiochronous Digital Hierarchy
PHY	Physical device
SA	Source Address
SDH	Synchronous Digital Hierarchy
SDU	Service Data Unit
SFD	Start of Frame Delimiter

SN Subnetwork

SNCP Subnetwork Connection Protection

STP Spanning Tree Protocol

UNI User Network Interface

5 Conventions

None.

6 Ethernet Private Lines

This Recommendation defines an Ethernet private line (EPL) service. This definition 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] and the base definitions for EPL are imported from [MEF 6.1] to ensure alignment. This Recommendation adds further explanation to some of these attributes, to clearly show the relationship with [ITU-T G.8010]. In addition, several ITU specific attributes are defined to provide a superset definition.

6.1 Description

An EPL service is a point-to-point service between two demarc points, as illustrated in Figure 6-1. The service is provided over connection oriented server layer networks with a committed information rate (CIR). Note that if a CO-PS server layer is used, traffic management is required to ensure that the CIR is maintained. The level of transparency of an EPL can be either:

Type 1 – Frame-based characteristic information (see example in Annex A)

Type 2 – Character-based characteristic information (see example in Annex B)

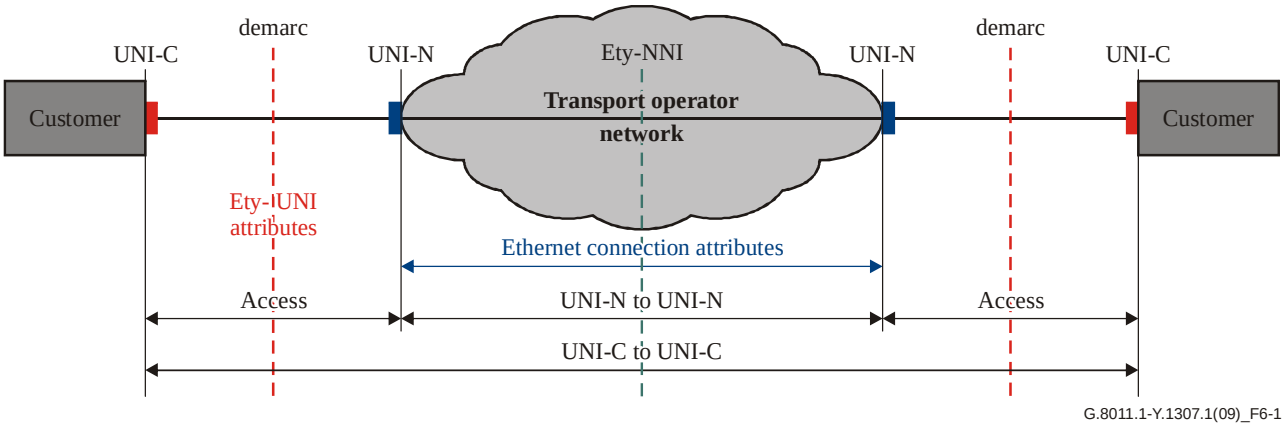

Figure 6-1 – Ethernet private line

6.1.1 EPL type 1

The generic method to support the transport of Ethernet MAC frames (ETH service) between two Ethernet UNIs is to terminate the Ethernet physical section layer (ETY), extract the Ethernet MAC frames (ETH_CI), and transport them over the SDH, PDH, ETY, ATM, MPLS, or OTH network. This is referred to as EPL Type 1 and described below. An example of EPL Type 1 is shown in Annex A.

In addition, EPL Type 1 can be further subdivided into Type 1a and Type 1b based on the handling on Layer 2 control protocols. A handling based on MEF options is Type 1a, but a more strict L2CP

tunnelling similar to the previous version of this Recommendation (2004) is Type 1b. Both options are now defined in [MEF 6.1].

6.1.2 EPL type 2

A second type of service with lower latency characteristics is defined for the 8B/10B encoded 1 Gbit/s Ethernet interface signal. The 8B/10B symbol stream (ETC_CI) within the interface signal is encoded and transported through the transport network, instead of the Ethernet MAC frames. This is referred to as EPL type 2, and is described in Annex B.

Note that the Ethernet MAC frame is not extracted in this type of service. It essentially provides transparency at the ETY layer.

6.2 EPL Type 1 service architecture

The components used to support an EPL Type 1 service are shown in Figure 6-1:

– the Ety-UNIs (UNI-N, UNI-C)

– the Ety-NNI

– the Ethernet virtual connection

– the access link

The EPL Type 1 service uses an Ety-UNI and is supported over Ethernet-over-PDH, Ethernet-over-SDH, and Ethernet-over-OTH Ety-NNIs. EPL Type 1 service can also use Ethernet-over-ATM with CIR and Ethernet-over-MPLS with CIR NNIs. The UNI and NNI are specified in [ITU-T G.8012].

Figure 6-2 shows the basic architecture of the EPL Type 1 service. The ETY layer is terminated at the UNI-N and the ETH frames are forwarded over a single ETH_FP to the server layer.

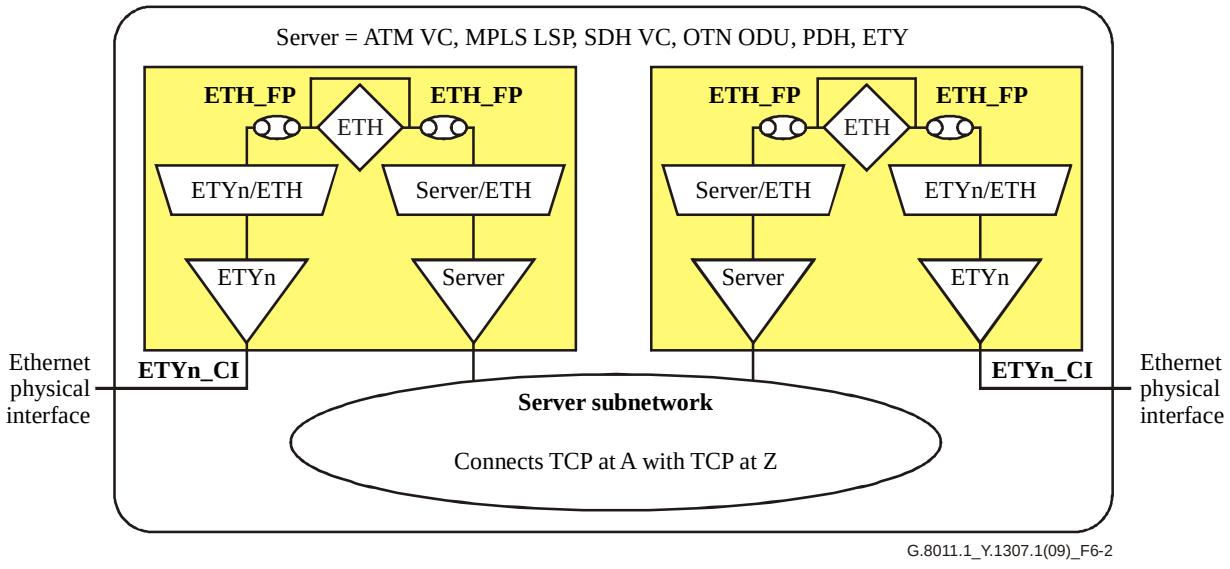

Figure 6-2 – Ethernet private line type 1 architecture

7 Ethernet virtual connection (EVC) attributes for EPL type 1

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

Table 7-1 – EVC service attributes

EVC service attribute	Service attribute parameters and values
EVC type	**MUST** be point-to-point.
EVC ID	An arbitrary string, unique across the MEN, for the EVC supporting the service instance.
UNI list	**MUST** list the two UNIs associated with the EVC. The UNI type **MUST** be Root for each UNI.
Maximum number of UNIs	**MUST** be 2.
EVC MTU size	**MUST** be <= 2000.
CE-VLAN ID preservation	**MUST** be Yes.
CE-VLAN CoS preservation	**MUST** be Yes.
Unicast service frame delivery	**MUST** Deliver unconditionally.
Multicast service frame delivery	**MUST** Deliver unconditionally.
Broadcast service frame delivery	**MUST** Deliver unconditionally.
Layer 2 control protocols processing (only applies for L2CPs passed to the EVC)	**MUST** specify in accordance with Table 8-2.
Service performance	**MAY** support none, one, or more than one CoS. If supported, a CoS ID, and values for frame delay, frame delay variation, frame loss ratio, and availability **MUST** be specified for each CoS.
Ingress bandwidth profile per EVC	**OPTIONAL.** If supported, **MUST** specify <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be allowed if any other ingress bandwidth profile is applied at this UNI.
Egress bandwidth profile per EVC	**MUST NOT** specify.
Link type	Dedicated.
Traffic separation	Customer: Spatial. Service instance: Spatial.
Connectivity monitoring	Sub-layer monitoring: On demand, proactive, none Inherent monitoring: Proactive.
Survivability	None, server specific.

7.1 EVC type

The connectivity of EPL is point-to-point.

7.2 EVC ID

An arbitrary string.

7.3 UNI list

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

7.4 Maximum number of UNIs

The maximum number of UNIs allowed is 2, per [MEF 6.1].

7.5 EVC maximum transmission unit size

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

7.6 Preservation

This attribute indicates the preservation of specific components of the ETH_CI provided by the ETH layer network that is used to transport the Ethernet service. Preservation means that the parameter value will be the same on ingress and egress to the EC. The two parameters are the ingress VLAN ID and class of service (priority) of the ETH_CI. Both are preserved in EPL.

7.7 Service frame delivery

All Ethernet MAC data frames are transported regardless of their destination address.

7.8 Layer 2 control protocols

This attribute indicates which layer 2 control protocols will be tunnelled by the EVC and which will be discarded. The layer 2 control protocols are listed in Table 8-2. Only the tunnel and discard directives in the L2CP requirements are relevant for the EVC – irrespective of the UNI applicability.

7.9 Performance

This parameter indicates the overall performance of the Ethernet connection (EC or EVC), as defined in [MEF 6.1].

7.10 Bandwidth profile

The EPL service is characterized by two rate parameters, i.e., CIR and CBS, however all must be specified <CIR, CBS, EIR, EBS, CM, CF>. The EPL traffic conditioning function requirement is minimal. A circuit will be allocated inside the network based on the flow CIR. An Ethernet flow may exceed its assigned rate at its own risk. A customer may implement shaping in order to avoid frame loss due to statistical variations in traffic.

As noted in clause 7.14, the possibility of reduced bandwidth during LCAS-based restoration is for further study.

7.11 Link type

This type of link is referred to as dedicated as defined in clause 7.11.1 of [ITU-T G.8011].

7.12 Traffic separation

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

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

7.13 Connectivity monitoring

Connectivity monitoring can either be proactive (sub-layer monitoring, inherent monitoring) or on-demand, using [b-ITU-T Y.1731]. In some network implementations, the connectivity monitoring can rely on the server layer connectivity monitoring (inherent monitoring). It is also optional to perform no monitoring.

7.14 Survivability

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

– no protection;

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

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

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

The applicability of survivability by means of LAG is for further study.

8 EPL Type 1 UNI attributes

8.1 ETH_UNI attributes

This clause describes service UNI attributes that modify the behaviour of a particular instance of an Ethernet service at the demarc of the UNI to characterize the service. There is a UNI defined at each of the ETH and ETY layers. These are summarized in Table 8-1.

Table 8-1 – EPL type 1 UNI service attributes

	UNI service attribute	Service attribute parameters and values
ETH	UNI Identifier	Arbitrary text string to identify the UNI.
	MAC Layer	IEEE 802.3-2005.
	UNI MTU Size	**MUST** be between 1522 and 2000.
	Service multiplexing	**MUST** be No.
	UNI EVC ID	A string formed by the concatenation of the UNI ID and the EVC ID.
	CE-VLAN ID for untagged and priority tagged service frames	1-4094, but irrelevant. All untagged and priority tagged service frames at the UNI **MUST** map to the same EVC as is used for all other service frames.
	CE-VLAN ID/EVC Map	All service frames at the UNI **MUST** map to a single point-to-point EVC.
	Maximum number of EVCs	**MUST** be 1.
	Bundling	**MUST** be No.
	All to one bundling	**MUST** be Yes.
	Ingress bandwidth profile per UNI	**MUST NOT** specify.
	Ingress bandwidth profile per CoS ID	**OPTIONAL.** If supported, **MUST** specify <CIR, CBS, EIR, EBS, CM, CF>. **MUST NOT** be allowed if any other ingress bandwidth profile is applied at this UNI.
	Egress bandwidth profile per CoS ID	**MUST NOT** specify.
	Egress bandwidth profile per UNI	**MUST NOT** specify.
	Layer 2 control protocol processing	**MUST** specify in accordance with Table 8-2.
	UNI type	**N/A**
	Connectivity monitoring	**OPTIONAL.** All Y.1731 commands supported.

Table 8-1 – EPL type 1 UNI service attributes

	UNI service attribute	Service attribute parameters and values
ETY	Physical medium	IEEE 802.3-2005 PHY per [ITU-T G.8012].
	Speed	10 Mbit/s, 100 Mbit/s, 10/100 Mbit/s auto-negotiation, 10/100/1000 Mbit/s auto-negotiation, 1 Gbit/s, or 10 Gbit/s.
	Mode	**MUST** be full duplex.

8.1.1 UNI ID

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.

8.1.2 MAC layer

The EPL type 1 UNI supports all 802.3 MAC frames. From a service viewpoint, the FCS is passed through at the ETY_UNI. If the FCS is bad (i.e., the frame is errored) at the ETY_UNI, the frame is dropped.

8.1.3 Maximum MTU size

The maximum MAC frame size supported at the UNI is at least 1522, as defined in clause 7.4 of [MEF 10.1], but no larger than 2000 (as specified in IEEE 802.3ap).

8.1.4 Multiplexed access

This attribute indicates if the access to the Ethernet transport service is multiplexed (i.e., contains multiple service instances) or not. EPL does not use multiplexed access.

8.1.5 UNI EVC ID

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.

8.1.6 C-VLAN ID mapping

At the UNI there is a mapping of each customer VLAN ID to at most one EC. For EPL, all VLAN IDs are mapped into the same EC. VLAN ID mapping is not supported.

8.1.7 Maximum number of EVCs

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

8.1.8 Bundling

No, per [MEF 6.1].

8.1.9 All-to-one bundling

For EPL, bundling is all-to-one.

8.1.10 Bandwidth profile

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

8.1.11 Layer 2 control protocol processing

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

There are two L2CP requirement options defined. Option A is similar in functionality to the original MEF EPL definition and Option B is similar to the definition in the previous version of this Recommendation (2004).

Table 8-2 – L2CP ingress (sink) processing requirements for the EPL service

Protocol	MAC DA	L2CP requirement		UNI applicability
		Option A	Option B	
STP/RSTP/MSTP	01-80-C2-00-00-00	**MUST** Tunnel	**MUST** Tunnel	All UNIs in the EVC
PAUSE	01-80-C2-00-00-01	**SHOULD** Discard	**SHOULD** Discard	All UNIs in the EVC
LACP/LAMP	01-80-C2-00-00-02	**SHOULD** Peer or Discard	**SHOULD** Tunnel	Option A: Per UNI Option B: All UNIs in the EVC
Link OAM	01-80-C2-00-00-02	**SHOULD** Peer or Discard	**SHOULD** Tunnel	Option A: Per UNI Option B: All UNIs in the EVC
Port Authentication	01-80-C2-00-00-03	**SHOULD** Peer or Discard	**SHOULD** Tunnel	Option A: Per UNI Option B: All UNIs in the EVC
E-LMI	01-80-C2-00-00-07	**SHOULD** Peer or Discard	**MUST** Tunnel	Option A: Per UNI Option B: All UNIs in the EVC
LLDP	01-80-C2-00-00-0E	**SHOULD** Discard	**MUST** Tunnel	All UNIs in the EVC
All Bridges	01-80-C2-00-00-10	**SHOULD** Discard	**MUST** Tunnel	All UNIs in the EVC
GARP/MRP Block	01-80-C2-00-00-20 through 01-80-C2-00-00-2F	**MUST** Discard or Tunnel	**MUST** Tunnel	All UNIs in the EVC

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

Table 8-3 – L2CP egress (source) processing requirements for the EPL service

Protocol	MAC DA	L2CP requirement		UNI applicability
		Option A	Option B	
PAUSE	01-80-C2-00-00-01	**SHOULD** None	**MAY** Generate	All UNIs in the EVC

NOTE – If there is no UNI/NNI process implementing the 802.3ah Link OAM, then the valid action becomes pass for the ingress table. For the egress table, it becomes none. As a consequence, if the customer is sending OAM frames across the access link, these frames will be received by the customer equipment at the other end of the private line. For example, such a situation may occur when there is no support for 802.3ah OAM on the provider edge devices, while there is support for 802.3ah OAM on the two end customer devices (i.e., at the end of each access link).

8.1.12 Connectivity monitoring

For EPL, connectivity monitoring is achieved via Ethernet OAM mechanisms defined in [b-ITU-T Y.1731]/standard IEEE 802.1ag, and is optional. If specified, the MEG levels at the customer service layer are:

1) Tunnelled.

2) Tunnelled with UNI-N MIP.

3) Peered at UNI-N.

4) Blocked at UNI-N.

Specifically, it will be blocked at the UNI-N if there is an up MEP at an equal or higher level, or a down MEP at a higher level.

The appropriate CFM protocol processing at the UNI-N can be summarized in Table 8-4. There are two L2CP requirement options defined. Option A is similar in functionality to the original MEF EPL definition and option B is similar to the definition in the previous version of this Recommendation (2004). Note that for option A the action applies per UNI, but for Option B it applies to all UNIs in the EVC.

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

CFM Protocol	MAC DA	MEG level	Action	
			Option A	Option B
UNI ME, CC	01-80-C2-00-00-3X or Unicast	Specify.	**SHOULD** Peer or Discard	**MUST** Tunnel
UNI ME, LT	01-80-C2-00-00-3Y	Specify.	**SHOULD** Peer or Discard	**MUST** Tunnel
UNI ME, LB	Unicast.	Specify.	**SHOULD** Peer or Discard	**MUST** Tunnel
Test ME	Unicast.	Specify.	**SHOULD** Peer or Discard	**MUST** Tunnel
Subscriber ME	Unicast.	Specify.	**SHOULD** Peer or Discard	**MUST** Tunnel

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

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

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

8.2 ETY UNI attributes

The ETY_UNI is a PHY characterized by speed, mode, and medium. These attributes are described in [ITU-T G.8011]. The attributes that apply to EPL are specified as follows:

8.2.1 Medium

This attribute indicates the medium of Ethernet PHY layer that is used to transport the Ethernet service. The values are defined in clause 8 of [ITU-T G.8012].

8.2.2 Speed

This attribute indicates the speed of Ethernet PHY layer that is used to transport the Ethernet service. There are four values defined by [ITU-T G.8012]: 10 Mbit/s, 100 Mbit/s, 1 Gbit/s and 10 Gbit/s.

8.2.3 Mode

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

9 EPL type 1 NNI attributes

9.1 ETH_NNI attributes

Table 9-1 – NNI service attributes

	NNI service attribute	Service attribute parameters and values
ETH	MAC service	IEEE 802.3-2005 frame format
	NNI ID	Arbitrary text string to identify each NNI instance
	NNI EC ID	Arbitrary text string to identify each EC instance
	VLAN mapping	Not applicable
	Bundling	Not applicable
	Bandwidth profile	CIR, CBS
	Layer 2 control protocol processing	Specified in Tables 8-2 and 8-3
	NNI type	N/A
Server	Server layer	SDH, PDH, OTH, ETY, ATM, MPLS, ETH

9.1.1 MAC service

The EPL type 1 NNI supports all 802.3 MAC frames. All ETH_CI is passed.

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 NNI EC identification

As per clause 8.1.5.

9.1.4 VLAN mapping

Not applicable.

9.1.5 Bundling

Not applicable.

9.1.6 Bandwidth profile

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

9.1.7 Layer 2 control protocol processing

L2 protocols are only visible at the NNI if it is an ETY. In this case, the L2 control protocols can be passed, peered, blocked, or none (per [ITU-T G.8011]). All L2 protocols as listed in [ITU-T G.8011] Table 8-2 are passed. Note that the action taken at the NNI should be consistent with action taken at the UNI.

9.2 Server layer adaptation

The server layers for EPL Type 1 are specified in Table 9-2.

Table 9-2 – EPL Type 1 server layers

Server layer technology
SDH
OTH
PDH
MPLS
ATM
ETY

Annex A

EPL type 1 network models

(This annex forms an integral part of this Recommendation)

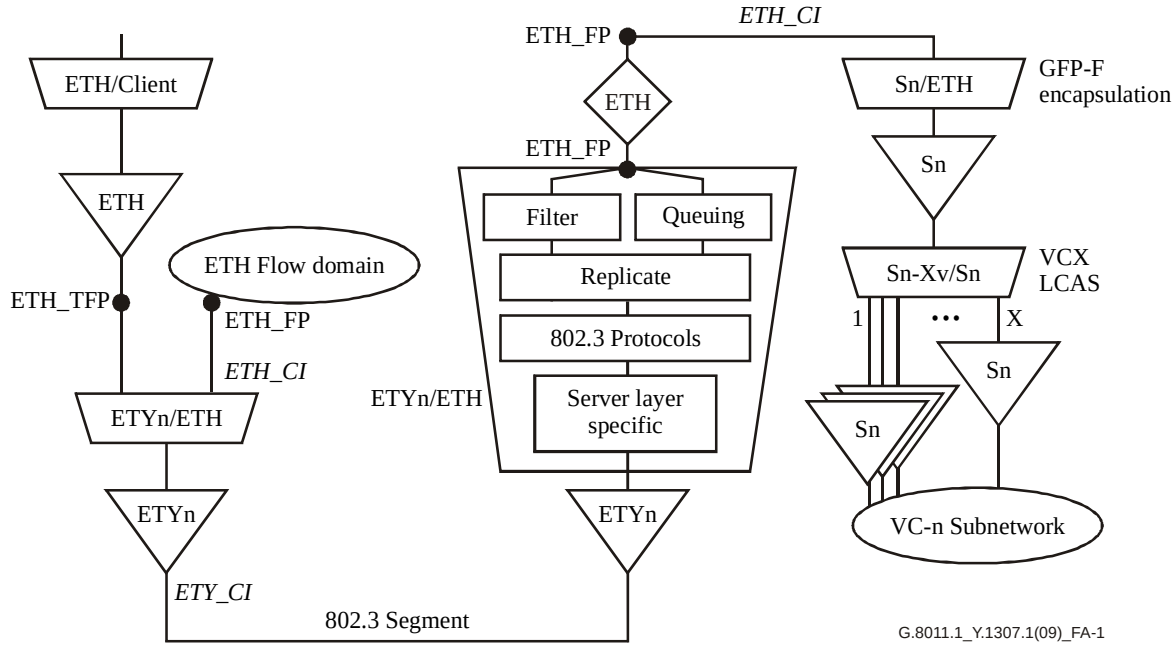

Figure A.1 – EPL access link with type 1 mapping into SDH

An [ITU-T G.8010] model of an EPL type 1 is provided in Figure A.1. It shows:

– the adaptation of a MAC client to the ETH layer,
– the ETH trail termination (TT) function,
– an ETH flow domain,
– the adaptation of ETH_CI to the ETY layer,
– the ETY TT function,
– an 802.3 access link to a provider edge device,
– the corresponding ETY TT function,
– the ETY/ETH adaptation function (including the component functions),
– a traffic conditioning (TC) function,
– the adaptation of ETH_CI into an SDH path via GFP-F encapsulation,
– the trail termination functions of a VC-n subnetwork,
– the adaptation into virtually concatenated and LCAS controllable VC-ns,
– a VC-n subnetwork.

Note that the replicate and filter blocks shown in Figure A.1 may be null functions for an EPL.

Annex B

EPL type 2

(This annex forms an integral part of this Recommendation)

B.1 EPL Type 2 service characteristics

The EPL Type 2 service is essentially an ETY layer service and does not process the Ethernet MAC frames (ETH layer). As a result, many service attributes defined in [ITU-T G.8011] do not apply to this service.

The EVC attributes that apply to EPL type 2 are shown in Table B.1:

Table B.1 – EPL type 2 EVC service attributes

EVC service attribute	Service attribute parameters and values
EVC Type	**MUST** be point-to-point
EVC ID	An arbitrary string, unique across the MEN, for the EVC supporting the service instance.
UNI List	**MUST** list the two UNIs associated with the EVC. The UNI type **MUST** be Root for each UNI.
Maximum number of UNIs	**MUST** be 2
EVC MTU size	**N/A**
CE-VLAN ID preservation	**N/A**
CE-VLAN CoS preservation	**N/A**
Unicast service frame delivery	**N/A**
Multicast service frame delivery	**N/A**
Broadcast service frame delivery	**N/A**
Layer 2 control protocols processing	**N/A**
Service performance	**N/A**
Ingress bandwidth profile per EVC	**N/A**
Egress bandwidth profile per EVC	**N/A**
Link type	Dedicated
Traffic separation	Customer: Spatial Service instance: Spatial
Connectivity monitoring	**N/A**
Survivability	Server specific

Survivability can be provided using the server layer protection/restoration mechanisms.

The UNI attributes that apply to EPL type 2 are shown in Table B.2:

Table B.2 – EPL type 2 UNI service attributes

	UNI service attribute	Service attribute parameters and values
ETY	Physical medium	IEEE 802.3-2005 PHY per [ITU-T G.8012]
	Speed	10 Mbit/s, 100 Mbit/s, 10/100 Mbit/s auto-negotiation, 10/100/1000 Mbit/s auto-negotiation, 1 Gbit/s, or 10 Gbit/s
	Mode	**MUST** be full duplex

The service is at the full rate of the specific Ethernet physical signal. Subrate services are not supported.

B.2 1 Gbit/s EPL type 2 service

Figure B.1 shows the architectural model of this service. The Ethernet coding sublayer is terminated and the decoded signal is mapped into a VC-4-7v using GFP-T mapping.

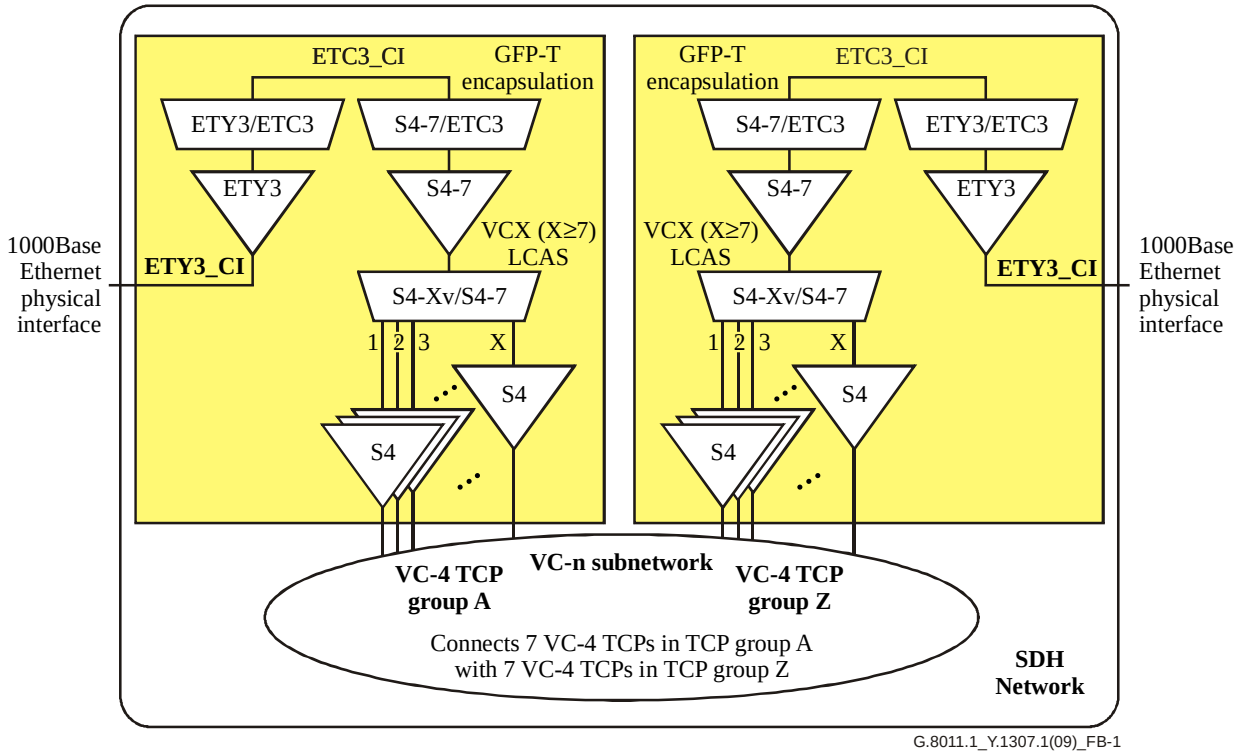

Figure B.1 – EPL type 2 architecture for a 1 Gbit/s Ethernet signal

Annex C

Special case of bit transport for 10 Gbit/s Ethernet

(This annex forms an integral part of this Recommendation)

10 Gbit/s Ethernet is defined in:

– IEEE 802.3ae-2002: 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: Amendment: Media Access Control (MAC) Parameters, Physical Layers, and Management Parameters for 10 Gb/s Operation.

The 10GBASE-W signal is basically a STM-64 with a VC-4-64c and the Ethernet MAC mapped into the VC-4-64c using a 64B/66B coding.

NOTE 1 – The transport and path overhead used by the 10GBASE-W is compatible with that specified in [ITU-T G.707], however, the 10GBASE-W signal uses only a subset of this overhead.

The 10GBASE-W signal is specified to use a clock accuracy of ±20 ppm. With this client signal accuracy, the 10GBASE-W binary signal can be transported as a CBR10G signal via an OTH network as specified in [ITU-T G.709] (Figure C.1). ODU2 path monitoring is deployed to assess the quality of service. The functional architecture is shown in Figure C.1.

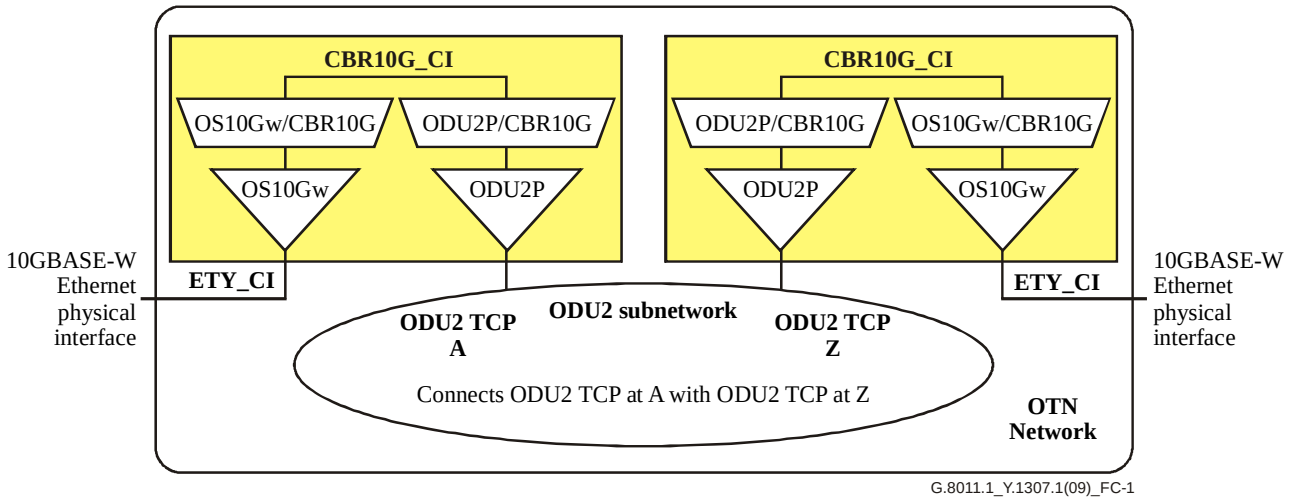

Figure C.1 – Ethernet private line architecture for the case of an OTH network (10G WAN case)

The VC-4-64c of the 10 GbE WAN signal can also be transported over a SDH network in case the clock requirements are met (see Appendix XII of [ITU-T G.707]). VC-4-64c tandem connection monitoring can be deployed to assess the quality of service. The functional architecture is shown in Figure C.2.

NOTE 2 – If interface signal clock accuracy is ±20 ppm, the 10GBASE-W signal can be transported through an SDH network, but excessive pointer adjustments may occur.

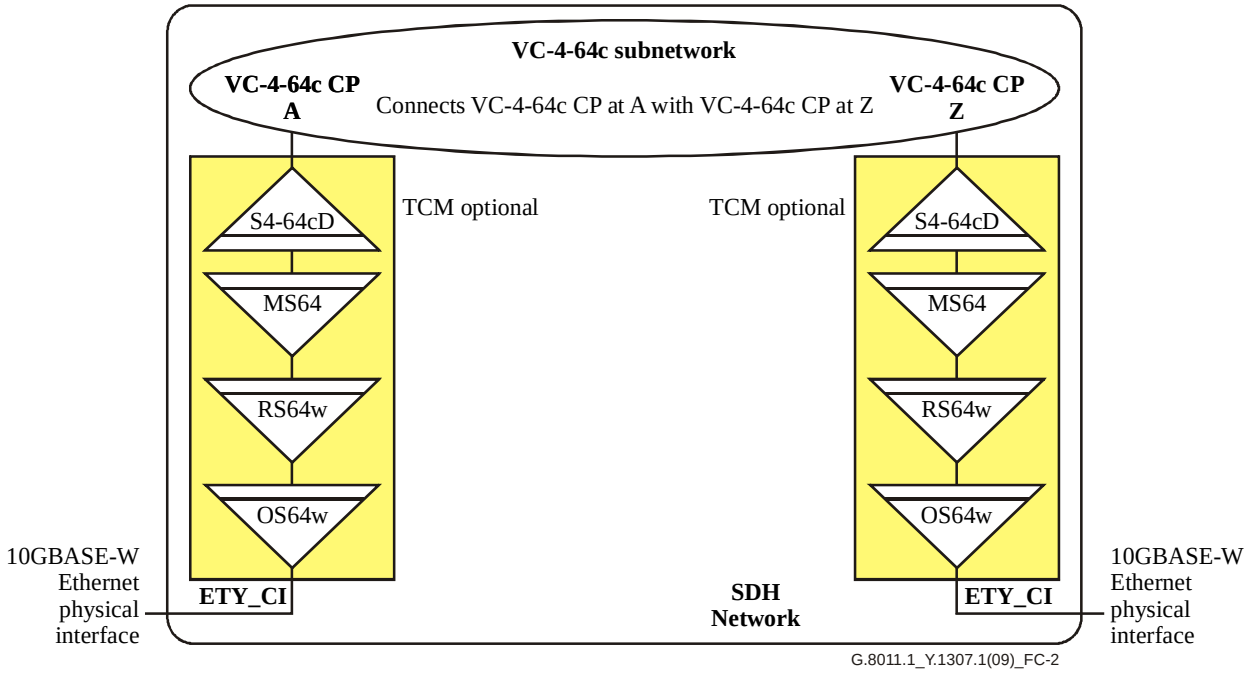

Figure C.2 – Ethernet private line architecture for the case of an SDH network (10GBASE-W signal's clock accuracy complies with the SDH clock accuracy requirements)

Bibliography

[b-ITU-T G.8001] Recommendation ITU-T G.8001/Y.1354 (2008), *Terms and definitions for Ethernet frames over Transport*.

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

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