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

Digital networks – General aspects

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

Internet protocol aspects – Transport

Ethernet private line service

ITU-T Recommendation G.8011.1/Y.1307.1

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ITU-T Recommendation G.8011.1/Y.1307.1

Ethernet private line service

Summary

This Recommendation 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 ITU-T Rec. G.8011/Y.1307.

Source

ITU-T Recommendation G.8011.1/Y.1307.1 was approved on 22 August 2004 by ITU-T Study Group 15 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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

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

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CONTENTS

ITU-T Recommendation G.8011.1/Y.1307.1

Ethernet private line service

1 Scope

This Recommendation defines the service attributes and parameters for carrying Ethernet characteristic information over dedicated bandwidth, point-to-point connections, provided by SDH, ATM, MPLS, PDH, ETY 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 ITU-T Rec. G.8011/Y.1307.

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.707/Y.1322 (2003), *Network node interface for the Synchronous Digital Hierarchy (SDH)*.

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

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

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

– ITU-T Recommendation G.8010/Y.1306 (2004), *Architecture of Ethernet layer network*s.

– ITU-T Recommendation G.8011/Y.1307 (2004), *Ethernet over Transport – Ethernet services framework.*

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

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

– 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 802.3ae-2002, *IEEE Standard for Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications-Media Access Control (MAC) Parameters, Physical Layer and Management Parameters for 10 Gb/s Operation*.

– IEEE 802.3ah-2004, *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 – Media Access Control Parameters. Physical Layers and Management Parameters for Subscriber Access Networks.

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

3 Terms and definitions

3.1 This Recommendation uses the following terms defined in ITU-T Rec. G.8010/Y.1306:

a) ETH link.

3.2 This Recommendation uses the following terms defined in ITU-T Rec. G.8011/Y.1307:

a) Access link;

b) Block;

c) Committed Information Rate (CIR);

d) Customer;

e) Dedicated;

f) Ethernet service;

g) Network access point;

h) Pass;

i) Process (with respect to L2 control protocol frames);

j) Service instance;

k) Spatial.

3.3 This Recommendation uses the following terms defined in ITU-T Rec. G.809:

a) Flow domain;

b) Flow domain flow;

c) Flow Point;

d) Flow termination;

e) Link flow;

f) Network flow;

g) Termination flow point;

h) Traffic conditioning function.

3.4 This Recommendation uses the following terms defined in ITU-T Rec. G.8012/Y.1308.

a) Ety-NNI;

b) Ety-UNI.

3.5 This Recommendation defines the following terms:

3.5.1 EPL Type 1: An EPL Type 1 service carries the ETH_CI traffic units between two Ethernet UNIs.

3.5.2 EPL Type 2: An EPL Type 2 service carries the information from the 8B/10B symbol stream between two Ethernet UNIs.

3.5.3 N/R = not relevant: clause/subclause, which is not relevant to this Recommendation.

4 Acronyms and abbreviations

This Recommendation uses the following abbreviations:

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
ETH_FP	Ethernet Flow Point
ETY	Ethernet PHY layer
Ety-NNI	Ethernet NNI
Ety-UNI	Ethernet UNI
ETYn	Ethernet physical layer network or order *n*
EVC	Ethernet Virtual Circuit
FCS	Frame Check Sequence
FD	Flow Domain
GFP	Generic Framing Procedure
LACP	Link Aggregation Control Protocol
LCAS	Link Capacity Adjustment Scheme
MAC	Media Access Control
MEF	Metro Ethernet Forum
MPLS	Multi-Protocol Label Switching
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

SNCP Sub-Network Connection Protection

STP Spanning Tree Protocol

UNI User Network Interface

5 Conventions

None.

6 Ethernet private lines

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).

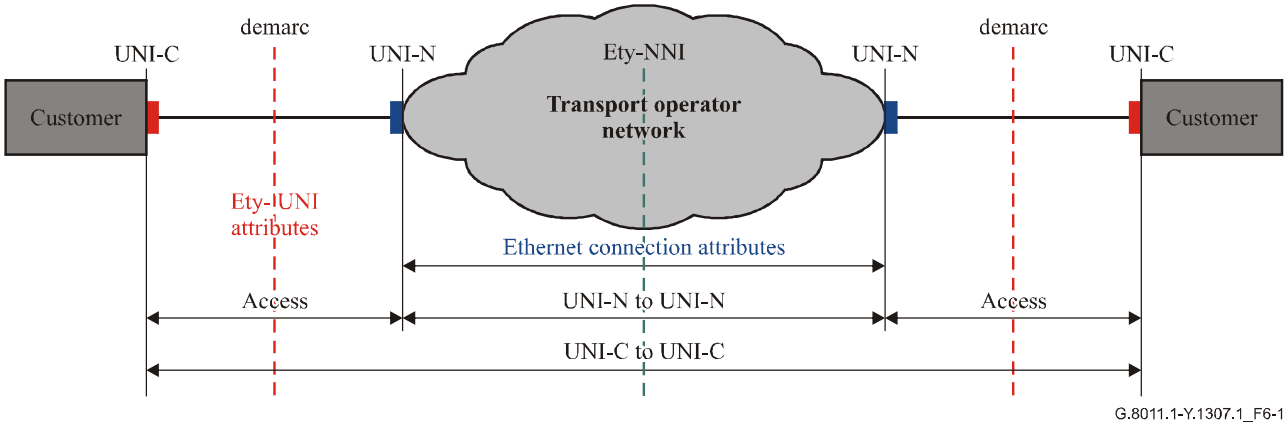

Figure 6-1/G.8011.1/Y.1307.1 – Ethernet private line

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.

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 connection;

– the Access link.

The EPL Type 1 service uses a 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 Rec. G.8012/Y.1308.

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.

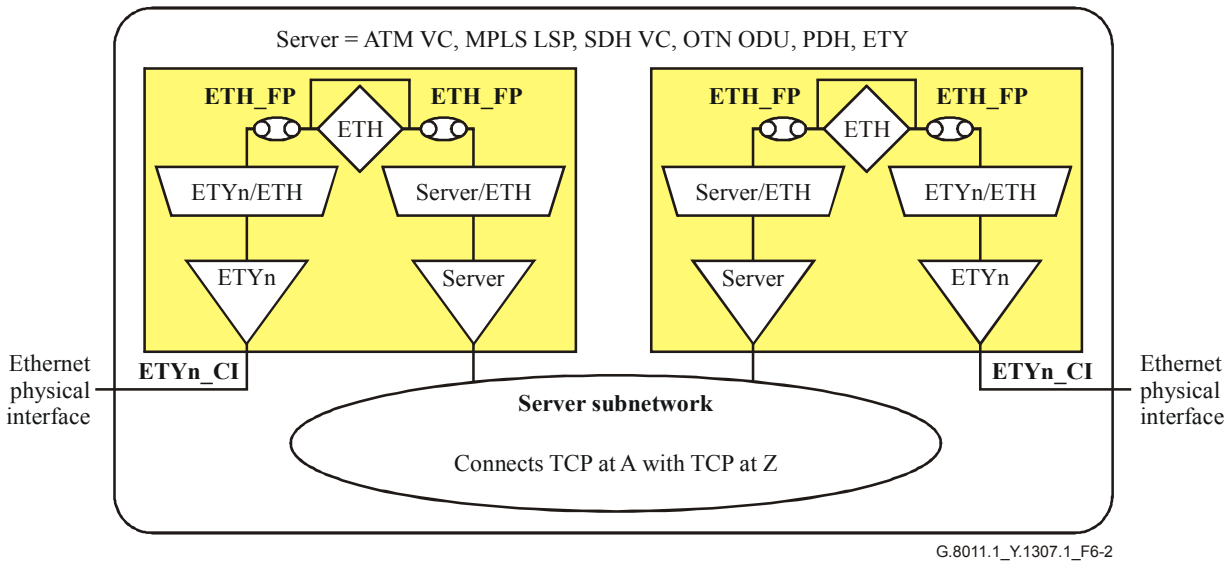

Figure 6-2/G.8011.1/Y.1307.1 – Ethernet private line type 1 architecture

7 EPL type 1 service characteristics

ITU-T Rec. G.8011/Y.1307 defines connections, UNI and NNI attributes for Ethernet services. In the case of an EPL service, some of these attributes have fixed values or a limited allowed range of parameters.

7.1 Ethernet Connection (EC) attributes

The Ethernet connection attributes are described in the following subclauses and are summarized in Table 7-1. Interworking with bridge control frames and MAC control frames is described in Tables 8-2, 8-3, 8-4, 9-2, and 9-3.

Table 7-1/G.8011.1/Y.1307.1 – EC service attributes

EC service attribute	Service attribute parameters and values
Network connectivity	Point-to-point
Transfer characteristics	Address – deliver unconditionally Drop precedence – not applicable
Link type	Dedicated
Customer separation	Spatial
Service instance separation	Spatial
Connectivity monitoring	Sub-layer monitoring: On demand, proactive, none Inherent monitoring: Proactive
Bandwidth profile	CIR, CBS
UNI list	Arbitrary text string to identify associated UNIs
Preservation	VLAN – yes CoS – yes
Survivability	None, Server specific

7.1.1 Network connectivity

The connectivity of EPL is point-to-point.

7.1.2 Transfer characteristics of ETH_CI

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

7.1.3 Link type

This type of link is referred to as dedicated as defined in 7.3.1/G.8011/Y.1307.

7.1.4 Customer separation

EPL uses spatial separation between customer traffic as defined in 7.4.2/G.8011/Y.1307.

7.1.5 Service instance separation

EPL uses spatial separation as defined in 7.4.1/G.8011/Y.1307.

7.1.6 Connectivity monitoring

Connectivity monitoring can either be proactive (sub-layer monitoring, inherent monitoring) or on-demand, using tools to be specified in future Recommendations under study in SG 13. 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.

7.1.7 Bandwidth profile

The EPL service is characterized by two rate parameters, i.e., CIR and CBS. 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. See Appendix II for more details. As noted in 7.1.10, the possibility of reduced bandwidth during LCAS-based restoration is for further study.

7.1.8 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.

7.1.9 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.

7.1.10 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.

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/G.8011.1/Y.1307.1 – UNI service attributes

	UNI service attribute	Service attribute parameters and values
ETH	MAC service	IEEE 802.3-2002 Frame format
	Multiplexed access	no
	UNI ID	Arbitrary text string to identify each UNI instance
	UNI EC ID	Arbitrary text string to identify each EC instance
	VLAN ID mapping	no
	Bundling	All-to-one
	Bandwidth profile	CIR, CBS
	Layer 2 control protocol processing	Specified in Tables 8-2, 8-3, and 8-4
ETY	PHY speed	10 Mbit/s, 100 Mbit/s, 1 Gbit/s or 10 Gbit/s
	PHY mode	Full duplex
	PHY medium	IEEE 802.3-2002 Physical Interface

8.1.1 MAC service

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.

8.1.2 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.

8.1.3 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.

8.1.4 UNI EC 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.

8.1.5 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.

8.1.6 Bundling

When a UNI has the bundling attribute, it is configurable so that more than one VLAN ID can map to an EC at the UNI. For EPL, bundling is all-to-one.

8.1.7 Bandwidth profile

The bandwidth profile at the ETH_UNI is specified in 7.1.7.

8.1.8 Layer 2 control protocol processing

L2 control frames may be passed, processed, generated, or blocked as specified in Tables 8-2, 8-3, and 8-4. ITU-T Rec. G.8011/Y.1307 describes these actions.

Table 8-2/G.8011.1/Y.1307.1 – Ingress (sink) 802 L2 control protocols UNI processing

MAC address	Valid actions	L2 control protocol
01-80-C2-00-00-00	pass	STP, MSTP, RSTP
01-80-C2-00-00-01	See Table 8-3	MAC Control (PAUSE)
01-80-C2-00-00-02	See Table 8-3	Slow protocols
01-80-C2-00-00-03	pass	802.1X Port authentication
01-80-C2-00-00-04	pass	reserved address
01-80-C2-00-00-05	pass	reserved address
01-80-C2-00-00-06	pass	reserved address
01-80-C2-00-00-07	pass	reserved address
01-80-C2-00-00-08	pass	reserved address
01-80-C2-00-00-09	pass	reserved address
01-80-C2-00-00-0A	pass	reserved address
01-80-C2-00-00-0B	pass	reserved address
01-80-C2-00-00-0C	pass	reserved address

Table 8-2/G.8011.1/Y.1307.1 – Ingress (sink) 802 L2 control protocols UNI processing

MAC address	Valid actions	L2 control protocol
01-80-C2-00-00-0D	pass	reserved address
01-80-C2-00-00-0E	pass	reserved address
01-80-C2-00-00-0F	pass	reserved address
01-80-C2-00-00-10	pass	Bridge management
01-80-C2-00-00-20	pass	GARP – GMRP address
01-80-C2-00-00-21	pass	GARP – GVRP address
01-80-C2-00-00-22	pass	GARP – reserved address
01-80-C2-00-00-23	pass	GARP – reserved address
01-80-C2-00-00-24	pass	GARP – reserved address
01-80-C2-00-00-25	pass	GARP – reserved address
01-80-C2-00-00-26	pass	GARP – reserved address
01-80-C2-00-00-27	pass	GARP – reserved address
01-80-C2-00-00-28	pass	GARP – reserved address
01-80-C2-00-00-29	pass	GARP – reserved address
01-80-C2-00-00-2A	pass	GARP – reserved address
01-80-C2-00-00-2B	pass	GARP – reserved address
01-80-C2-00-00-2C	pass	GARP – reserved address
01-80-C2-00-00-2D	pass	GARP – reserved address
01-80-C2-00-00-2E	pass	GARP – reserved address
01-80-C2-00-00-2F	pass	GARP – reserved address

Table 8-3/G.8011.1/Y.1307.1 – Ingress (sink) 802.3 L2 control protocols UNI processing

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-01 or unicast	88-08	0x0001	block	MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02	pass	Slow protocols – LACP, LAMP

Table 8-4/G.8011.1/Y.1307.1 – Egress (source) 802.3 L2 control protocols UNI processing

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-01 or unicast	88-08	0x0001	none or generate	MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02	none	Slow protocols – LACP, LAMP

8.2 ETY UNI attributes

The ETY_UNI is a PHY characterized by speed, mode, and medium. These attributes are described in ITU-T Rec. G.8011/Y.1307. The attributes that apply to EPL are specified as follows:

8.2.1 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 Rec. G.8012/Y.1308: 10 Mbit/s, 100 Mbit/s, 1 Gbit/s or 10 Gbit/s.

8.2.2 Mode

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

8.2.3 Medium

This attribute indicates the medium of Ethernet PHY layer that is used to transport the Ethernet service. The values are defined by ITU-T Rec. G.8012/Y.1308.

9 EPL type 1 NNI attributes

9.1 ETH_NNI attributes

Table 9-1/G.8011.1/Y.1307.1 – NNI service attributes

	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 mapping	Not applicable
	Bundling	Not applicable
	Bandwidth profile	CIR, CBS
	Layer 2 control protocol processing	Specified in Tables 9-2 and 9-3
Server	Server layer	SDH, PDH, OTH, ETY, ATM, MPLS

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 8.1.4.

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 7.1.7.

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, processed, blocked, or none (per ITU-T Rec. G.8011/Y.1307). All 802.1 L2 protocols as listed in Table 8-2/G.8011/Y.1307 are passed. The 802.3 L2 protocols processing are shown in Tables 9-2 and 9-3. Note that the action taken at the NNI should be consistent with action taken at the UNI.

Table 9-2/G.8011.1/Y.1307.1 – Ingress (sink) 802.3 L2 control protocols NNI processing

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-01 or unicast	88-08	0x0001	pass	MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02	pass	Slow protocols – LACP, LAMP

Table 9-3/G.8011.1/Y.1307.1 – Egress (source) 802.3 L2 control protocols NNI processing

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-01 or unicast	88-08	0x0001	none	MAC Control (PAUSE)
01-80-C2-00-00-02	88-09	0x01, 0x02	none	Slow protocols – LACP, LAMP

9.2 Server layer adaptation

The server layers for EPL Type 1 are specified in Table 9-4.

Table 9-4/G.8011.1/Y.1307.1 – EPL type 1 server layers

Server layer technology
SDH
OTH
PDH
MPLS
ATM
ETY

Annex A

EPL type 1 network models

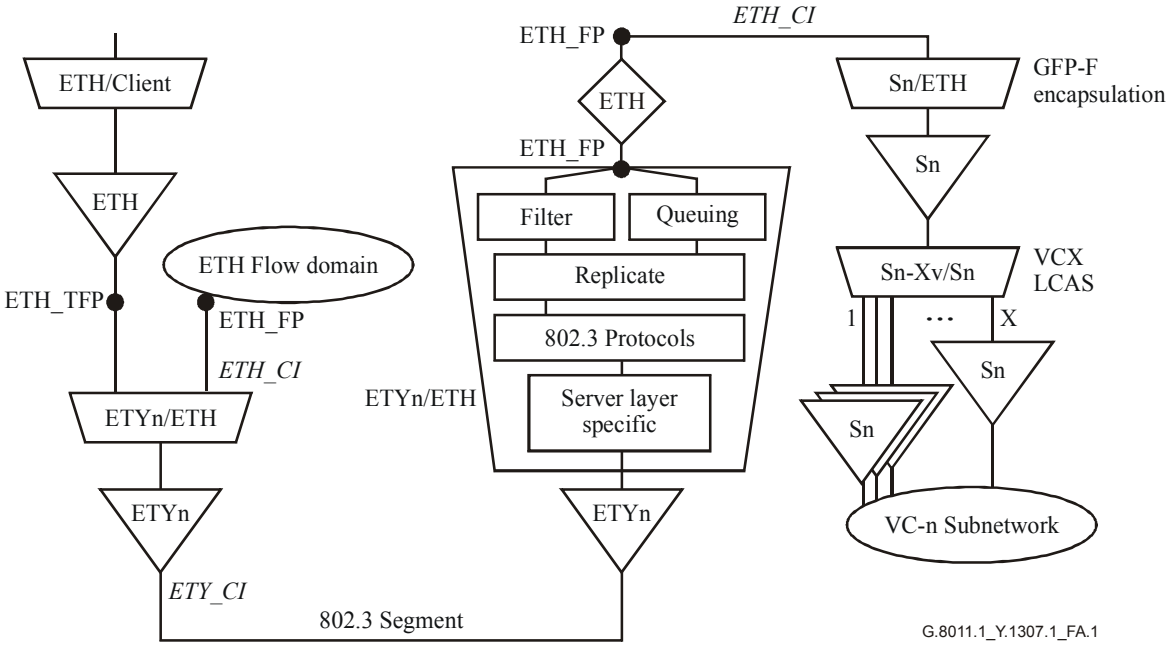

Figure A.1/G.8011.1/Y.1307.1 – EPL access link with type 1 mapping into SDH

A G.8010/Y.1306 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

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). The service attributes defined in ITU-T Rec. G.8011/Y.1307, therefore, do not apply to this service. The service is at the full rate of the specific Ethernet physical signal. Sub-rate services are not supported.

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

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.

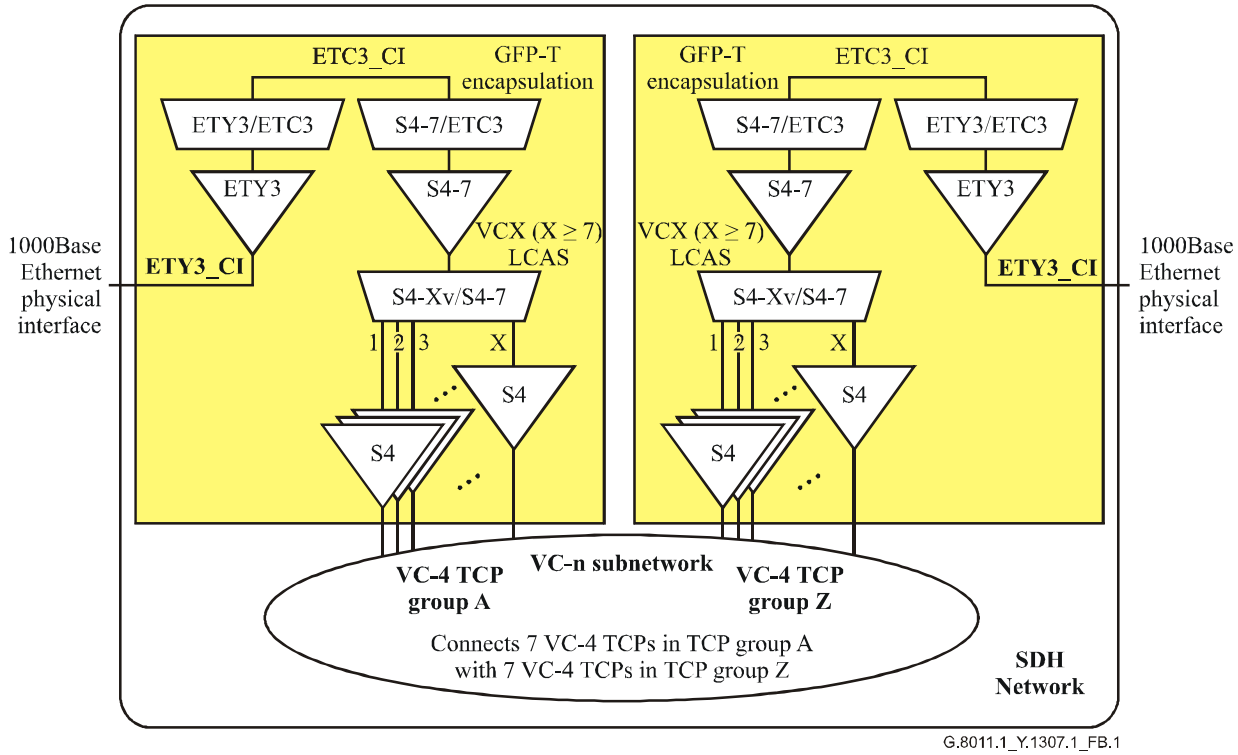

Figure B.1/G.8011.1/Y.1307.1 – EPL type 2 architecture for a 1 Gbit/s Ethernet signal

Annex C

Special case of bit transport for 10 Gbit/s Ethernet

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 – The transport and path overhead used by the 10GBASE-W is compatible with that specified in ITU-T Rec. G.707/Y.1322, 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 Rec. G.709/Y.1331 (Figure C.1). ODU2 path monitoring is deployed to assess the quality of service. The functional architecture is shown in Figure C.1.

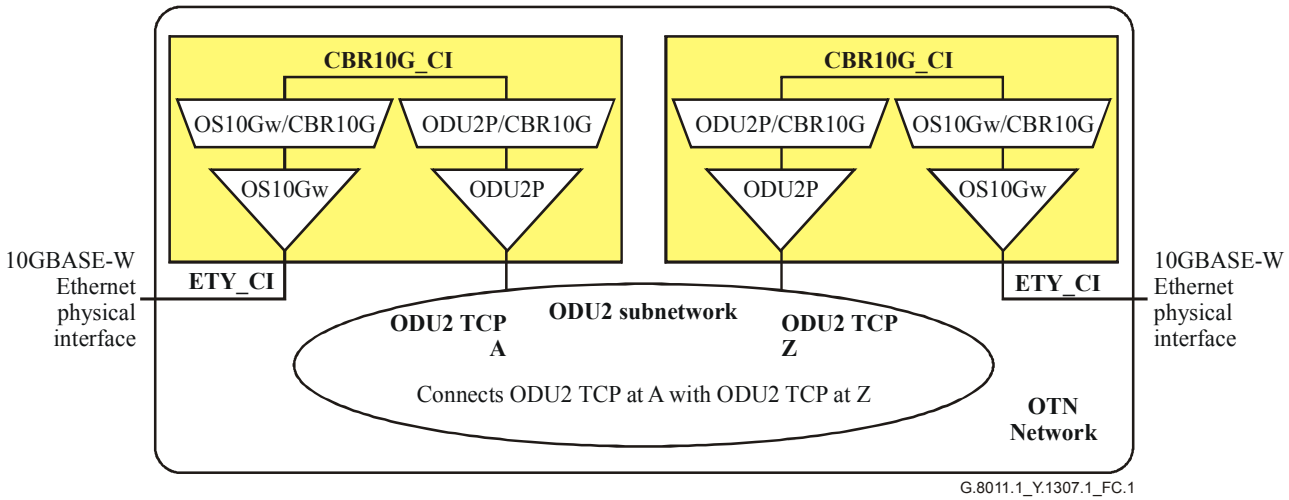

Figure C.1/G.8011.1/Y.1307.1 – Ethernet private line architecture for the case of an OTH network (10G WAN case)

The VC-4-64c of the 10GBASE WAN signal can also be transported over a SDH network in the case where the clock requirements are met (see Appendix XII/G.707/Y.1322). 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 – 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.

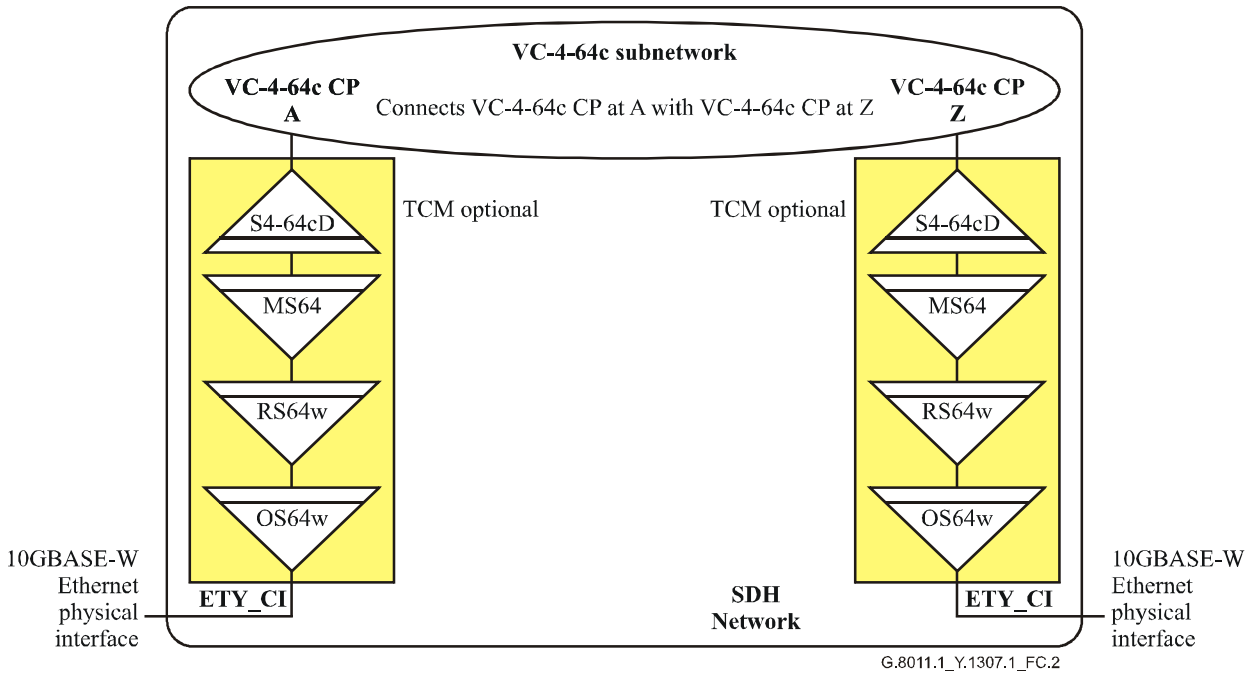

Figure C.2/G.8011.1/Y.1307.1 – Ethernet private line architecture for the case of a SDH network (10GBASE-W signal's clock accuracy complies with the SDH clock accuracy requirements)

Annex D

Processing of L2 control frames at the ETY/ETH adaptation

Table D.1/G.8011.1/Y.1307.1 – Processing of L2 control frames at the ETY/ETH_A_Sk adaptation 802.3 protocols process for UNI or NNI application

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-02	88-09	0x03	Process, block (See Note)	Slow protocols – 802.3ah OAM
ITU-T Rec. G.8011/Y.1307 describes the actions "Process" and "block". NOTE – If there is no UNI/NNI process implementing the 802.3ah 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).				

Table D.2/G.8011.1/Y.1307.1 – Processing of L2 control frames at the ETY/ETH_A_So adaptation 802.3 protocols process for UNI or NNI application

MAC address	Ethertype	Subtype	Valid actions	L2 control protocol
01-80-C2-00-00-02	88-09	0x03	Generate, none (See Note)	Slow protocols – 802.3ah OAM
NOTE – ITU-T Rec. G.8011/Y.1307 describes the actions "Generate" and "none".				

Appendix I

Customer view and network view of Ethernet services

I.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.

I.2 MEF – G.8011.1/Y.1307.1 comparison

Using the MEF as an example, the MEF E-Line Ethernet service type that is defined in the MEF Phase I documents can be implemented using the EPL infrastructure Ethernet services defined in this Recommendation.

This can be further refined with the review of the many possible service definitions that the MEF suggests is possible. Only the first such service definition is explored in this appendix.

I.3 Ethernet private line implementation

The G.8011.1/Y.1307.1 EPL service can be viewed as a subset of the MEF Ethernet private line service of the E-line service type and shows the mapping of G.8011.1/Y.1307.1 attributes to MEF attributes. That is, the EPL described in this Recommendation can be used to implement the MEF service.

The attributes of the MEF Ethernet private line service are shown in the following tables along with the matched ETH_CI attribute from the G.8011.1/Y.1307.1 EPL definition.

Table I.1/G.8011.1/Y.1307.1 – E-Line service type EVC service attribute requirements for MEF Ethernet private line implemented with G.8011.1/Y.1307.1 EPL

MEF EVC service attribute	MEF service attribute parameters and values	G.8011/Y.1307 EC attribute	G.8011.1/Y.1307.1 value
EVC type	**MUST** be point-to-point	Network connectivity	point-to-point
		Link type	dedicated
UNI list	**MUST** list the two UNIs associated with the EVC.	UNI list	Arbitrary text string to identify the UNIs
CE-VLAN ID preservation	**MUST** be Yes	Preservation – VLAN	Yes
CE-VLAN CoS preservation	**MUST** be Yes	Preservation – CoS	Yes

Table I.1/G.8011.1/Y.1307.1 – E-Line service type EVC service attribute requirements for MEF Ethernet private line implemented with G.8011.1/Y.1307.1 EPL

MEF EVC service attribute	MEF service attribute parameters and values	G.8011/Y.1307 EC attribute	G.8011.1/Y.1307.1 value
Unicast service frame delivery	**MUST** deliver unconditionally	Transfer characteristics – address	Deliver unconditionally
Multicast service frame delivery	**MUST** deliver unconditionally		
Broadcast service frame delivery	**MUST** deliver unconditionally		
(Note a)	–	Transfer characteristics – drop precedence	Not applicable
Layer 2 control protocol processing (only applies for L2CP passed to the EVC)	**SHOULD discard PAUSE** **SHOULD tunnel LACP, LAMP, 802.1X** **MUST tunnel STP, RSTP, MSTP, All LANs Bridge Management Group, GARP**	UNI L2 control protocol processing	PAUSE – block LACP/LAMP – pass 33 reserved addresses – pass
EVC performance	Only one CoS is **REQUIRED**. A CoS ID of <EVC> **MUST** be specified. Frame delay, Frame delay Variation and frame loss ratio **MUST** be specified.	(Note 1)	
(Note b)	–	Customer separation	spatial
(Note b)	–	Service instance separation	spatial
(Note c)	–	Connectivity monitoring	proactive, on-demand
(Note c)	–	Survivability	None, Server-specific
MEF Notes: NOTE a – Not specified by MEF, but handled implicitly by EVC performance. NOTE b – Handled implicitly by EVC performance parameters that prevent the sharing of resources. NOTE c – No equivalent G.8011/Y.1307 Notes: NOTE 1 – Not defined in ITU-T Rec. G.8011/Y.1307. Depends on server layer.			

Table I.2/G.8011.1/Y.1307.1 – E-Line service type UNI service attribute requirements for MEF Ethernet private line implemented with G.8011.1/Y.1307.1 EPL

MEF UNI service attribute	MEF service attribute parameters and values	G.8011/Y.1307 UNI attribute	G.8011.1/Y.1307.1 value
UNI identifier	Arbitrary text string to identify the UNI	UNI ID	Arbitrary text string to identify the UNI
Physical medium	IEEE 802.3-2002 Physical Interface	PHY medium	Defined in ITU-T Rec. G.8012/Y.1308
Speed	10 Mbit/s, 100 Mbit/s, 1 Gbit/s or 10 Gbit/s	PHY speed	10 Mbit/s, 100 Mbit/s, 1 Gbit/s or 10 Gbit/s
Mode	**MUST** be Full Duplex	PHY mode	Full Duplex
MAC layer	IEEE 802.3-2002	MAC service	IEEE 802.3-2002
Service multiplexing	**MUST** be No	Multiplexed access	No
UNI EVC ID	Arbitrary text string to identify each EVC instance	UNI EC ID	Arbitrary text string to identify each EC
CE-VLAN ID / EVC map	All CE-VLAN IDs at the UNI **MUST** map to the E-Line Service type EVC.	VLAN mapping	No
Maximum number of EVCs	**MUST** be 1	(Note 1)	–
Bundling	**MUST** be No	Bundling	all-to-one
All-to-one bundling	**MUST** be Yes	Bundling	all-to-one
Ingress bandwidth profile per ingress UNI	CIR: **MUST** be ≤ UNI Speed CBS: **MUST** be > largest Service Frame size	EC bandwidth profile	CIR and CBS
Layer 2 control protocol processing	**SHOULD discard PAUSE** **SHOULD pass LACP, LAMP, 802.1X** **MUST pass STP, RSTP, MSTP, All LANs Bridge Management Group, GARP**	L2 control protocol processing (Note 2)	PAUSE – block LACP/LAMP – pass 33 reserved addresses – pass

NOTE 1 – EPL is defined as point-to-point service.

NOTE 2 – These are the ingress actions. Valid actions per protocol on ingress and egress are defined in Tables 8-2, 8-3, and 8-4.

Appendix II

Traffic conditioning

II.1 Introduction

A complete Ethernet traffic conditioning Recommendation is under study in SG 13. In the interim, a description is provided in this appendix.

II.2 Traffic conditioning

The objective of traffic conditioning is to determine the conformance of the incoming Ethernet frames. The level of conformance is expressed as one of two colors: Green or Red.

Compliance for a bandwidth profile is described by two parameters that are associated with two token bucket algorithms. The parameters are:

1) Committed Information Rate (CIR) expressed as bytes per second. CIR must be ≥ 0.
2) Committed Burst Size (CBS) expressed as bytes. CBS must be ≥ Maximum Ethernet frame allowed to enter the network.

For a sequence of ingress Ethernet frames, {tj,lj}j ≥ 0, with arrival times tj and lengths lj, the color assigned to each frame during traffic conditioning is defined by using the algorithm shown in Figure II.1. For this algorithm, Bc = CBS and Tc = CBS/CIR.

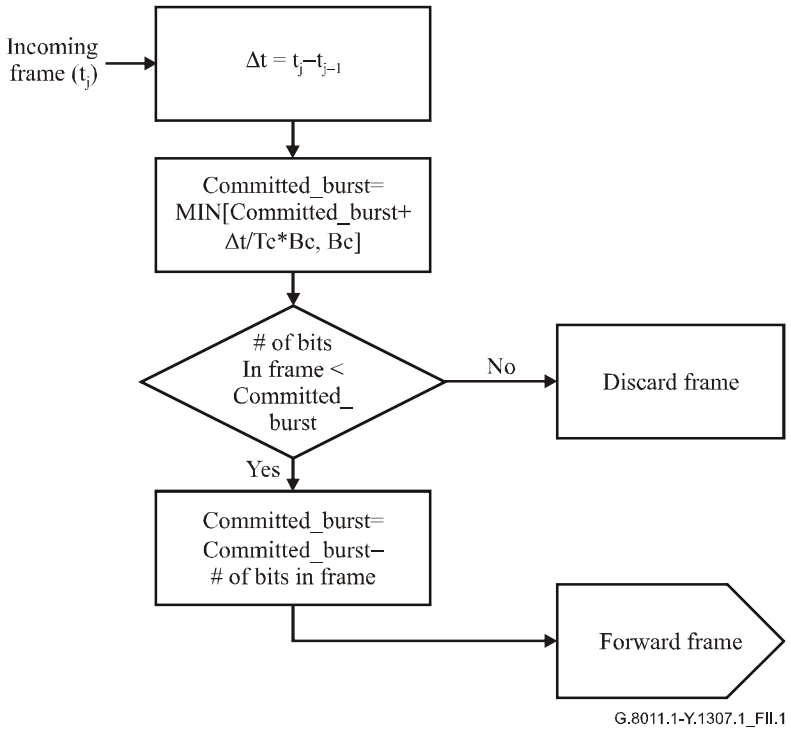

Figure II.1/G.8011.1/Y.1307.1 – Traffic conditioning algorithm

Note that the algorithm does not define an implementation of any network equipment. Any implementation that results in the same conditioning results meets the requirements of this Recommendation.

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