International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.984.4

Amendment 1

(06/2009)

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

Digital sections and digital line system – Optical line systems for local and access networks

---

Gigabit-capable passive optical networks (G-PON): ONT management and control interface specification

Amendment 1

Recommendation ITU-T G.984.4 (2008) – Amendment 1

ITU-T

ITU-T G-SERIES RECOMMENDATIONS

TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
General	G.900–G.909
Parameters for optical fibre cable systems	G.910–G.919
Digital sections at hierarchical bit rates based on a bit rate of 2048 kbit/s	G.920–G.929
Digital line transmission systems on cable at non-hierarchical bit rates	G.930–G.939
Digital line systems provided by FDM transmission bearers	G.940–G.949
Digital line systems	G.950–G.959
Digital section and digital transmission systems for customer access to ISDN	G.960–G.969
Optical fibre submarine cable systems	G.970–G.979
Optical line systems for local and access networks	**G.980–G.989**
Access networks	G.990–G.999
MULTIMEDIA QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
ACCESS NETWORKS	G.9000–G.9999

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

Recommendation ITU-T G.984.4

Gigabit-capable passive optical networks (G-PON): ONT management and control interface specification

Amendment 1

Summary

Amendment 1 to Recommendation ITU-T G.984.4 contains various updates to ITU-T G.984.4 (2008). A number of editorial corrections and clarifications are included, along with the following substantive changes and extensions to G-PON OMCI.

- OMCI for reach extenders
- PM extensions for Ethernet bridge ports and circuit emulation services (pseudowires)
- Update of OMCI to align with Recommendation ITU-T G.997.1 (2009)
- Revision of the VLAN tagging filter data managed entity
- A managed entity to control out-of-band file transfer through OMCI
- Extended descriptions and OMCI extensions on traffic management and quality of service
- A number of additional minor extensions to OMCI

Source

Amendment 1 to Recommendation ITU-T G.984.4 (2008) was approved on 6 June 2009 by ITU-T Study Group 15 (2009-2012) under Recommendation ITU-T A.8 procedures.

FOREWORD

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

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

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

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

NOTE

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

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

INTELLECTUAL PROPERTY RIGHTS

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

As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

CONTENTS

		Page
1)	Clause 2, References	1
2)	Clause 3, Definitions	1
3)	Clause 4, Abbreviations	1
4)	Clause 8.1, Managed entities	2
5)	Clause 8.2, Managed entity relation diagrams	3
6)	Clause 8.2.4, xDSL service	6
7)	New clause 8.2.10	7
8)	Clause 9.1.1, ONT-G	9
9)	Clause 9.1.2, ONT2-G	10
10)	Clause 9.1.5, Cardholder	10
11)	Clause 9.1.10, Protection data	11
12)	Clause 9.2.1, ANI-G	12
13)	Clause 9.2.3, GEM port network CTP	12
14)	Clause 9.2.4, GEM interworking termination point	14
15)	Clause 9.2.6, GEM port performance monitoring history data	16
16)	Clause 9.3, Layer 2 data services	17
17)	Clause 9.3.10, 802.1p mapper service profile	18
18)	Clause 9.3.11, VLAN tagging filter data	19
19)	Clause 9.3.12, VLAN tagging operation configuration data	22
20)	Clause 9.3.13 , Extended VLAN tagging operation configuration data	22
21)	Clause 9.3.27, Multicast operations profile	25
22)	New clauses 9.3.30 and 9.3.31	26
23)	Clause 9.7, xDSL services	28
24)	Clause 9.7.3, xDSL line configuration profile part 1	28
25)	Clause 9.7.5, xDSL line configuration profile part 3	30
26)	Clause 9.7.6, VDSL2 line configuration extensions	32
27)	Clause 9.7.7, xDSL channel configuration profile	34
28)	Clause 9.7.12, xDSL line inventory and status data part 1	35
29)	Clause 9.7.16, VDSL2 line inventory and status data part 1	36
30)	Clause 9.7.17, VDSL2 line inventory and status data part 2	37
31)	Clause 9.7.19, xDSL channel downstream status data	37
32)	Clause 9.7.20, xDSL channel upstream status data	38
33)	Clause 9.7.21, xDSL xTU-C performance monitoring history data	38
34)	Clause 9.7	38

Page

35) Clause 9.8, TDM services 48
36) Clause 9.8.1, Physical path termination point CES UNI 49
37) Clause 9.8.4, CES physical interface performance monitoring history data 51
38) Clause 9.8 53
39) Clause 9.11.1, Priority queue-G 56
40) Clause 9.11.3, GEM traffic descriptor 58
41) Clause 9.12 60
42) New clause 9.14 62
43) Clause 11.1.6, Message identifier 75
44) Clause I.1.1, MIB data sync increase 76
45) Clause I.1.4, Alarm audit and resynchronization 76
46) Clause I.1.5, Table attributes 76
47) Clause I.1.9, Performance monitoring 76
48) Clause I.2.7, Software image download 77
49) Clause II.2.33, End software download 79
50) Clause II.2.27, Test 79
51) Clause II.2.45, Test result 79
52) Appendix III 81
53) Bibliography 83

Recommendation ITU-T G.984.4

Gigabit-capable passive optical networks (G-PON): ONT management and control interface specification

Amendment 1

1) Clause 2, References

a) Modify the following reference as shown:

[ITU-T G.997.1] Recommendation ITU-T G.997.1 (2009), *Physical layer management for digital subscriber line (DSL) transceivers*.

b) Add the following references:

[ITU-T G.704] Recommendation ITU-T G.704 (1998), *Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels*.

[ITU-T G.826] Recommendation ITU-T G.826 (2002), *End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections*.

[ITU-T G.984.6] Recommendation ITU-T G.984.6 (2008), *Gigabit-capable passive optical networks (GPON): Reach extension*.

2) Clause 3, Definitions

Add the following clause:

3.5 shaping and policing: A shaper causes a flow of input packets to conform to a given PIR/PBS by controlling the release rate/burst size of output packets. This typically results in queuing delay; packets may be dropped if there is a queue overflow because the input rate or burst size is too great.

A policer causes a flow of input packets to conform to a given PIR/PBS by immediately dropping packets that exceed PIR/PBS. This typically results in packet loss; packets may be further marked as drop eligible if they exceed CIR/CBS.

3) Clause 4, Abbreviations

Add the following acronyms in alphabetic order:

ACL Access Control List

CBS Committed Block Size

DMT Discrete Multitone

FDL Facility Data Link

LBO Line Buildout

PBS Peak Block Size

PCP Priority Code Point

R'/S' Reach extender interface to optical trunk line

RAD Rate Adaptation Downshift

RAU Rate Adaptation Upshift

RE Reach Extender

S'/R' Reach extender interface to optical distribution network

SRA Seamless Rate Adaptation

4) Clause 8.1, Managed entities

Add the following entries in alphabetic order to Table 8-1:

Table 8-1 – Managed entities of the OMCI

Managed entity	Required/ Optional	Description	Clause
RE ANI-G	CR	Used for mid-span PON reach extender ANI	9.14.1
Physical path termination point RE UNI	CR	Used for mid-span PON reach extender UNI	9.14.2
RE upstream amplifier	CR	Used for mid-span PON reach extender upstream optical amplifier	9.14.3
RE downstream amplifier	CR	Used for mid-span PON reach extender downstream optical amplifier	9.14.4
RE config portal	CR	Used for non-OMCI configuration method on mid-span PON reach extenders	9.14.5
RE common amplifier parameters	CR	Used for monitoring and maintenance of PON reach extender optical amplifiers	9.14.6
File transfer controller	O	Used to control out-of-band file transfers	9.12.13
CES physical interface performance monitoring history data 2	O	Used for PM of DS1, E1 and similar CESs	9.8.12
CES physical interface performance monitoring history data 3	O	Used for PM of DS1, E1 and similar CESs	9.8.13
Ethernet frame performance monitoring history data upstream	O	Used for PM of upstream Ethernet flows on a bridge port	9.3.30
Ethernet frame performance monitoring history data downstream	O	Used for PM of downstream Ethernet flows on a bridge port	9.3.31
VDSL2 line configuration extensions 2	O	Used to configure additional VDSL2 parameters	9.7.26
xDSL impulse noise monitor performance monitoring history data	O	Used for impulse noise monitoring PM	9.7.27
xDSL line inventory and status data part 5	CR	Additional xDSL test parameters for G.992.3, G.992.5 Annex C	9.7.28
xDSL line inventory and status data part 6	CR	Additional xDSL test parameters for G.992.3, G.992.5 Annex C	9.7.29
xDSL line inventory and status data part 7	CR	Additional xDSL test parameters for G.992.3, G.992.5 Annex C	9.7.30

5) Clause 8.2, Managed entity relation diagrams

a) Throughout clause 8.2, replace the indicated figures with the following:

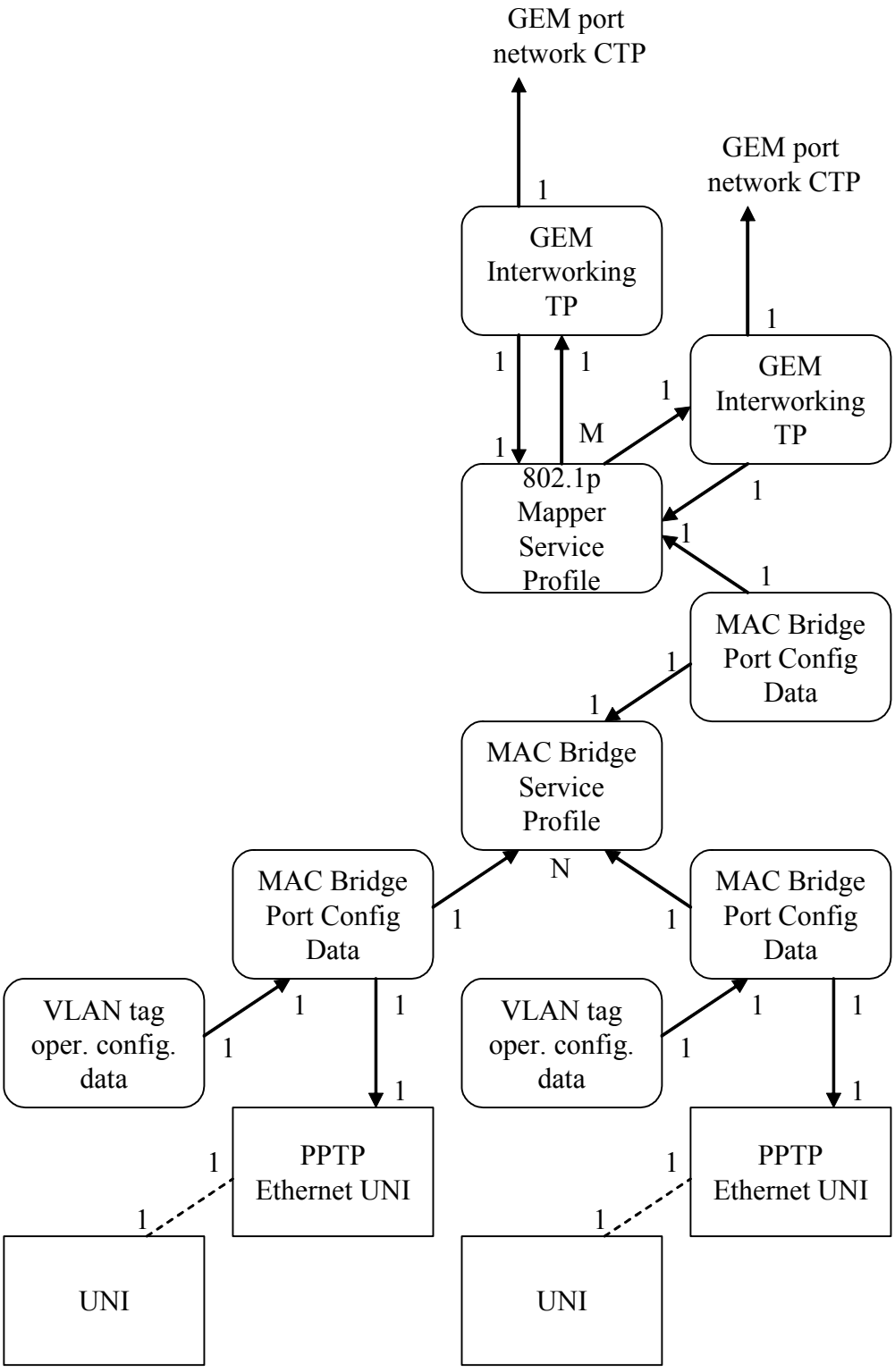


Figure 8.2.2-6 – Illustration of N:M bridge-mapping

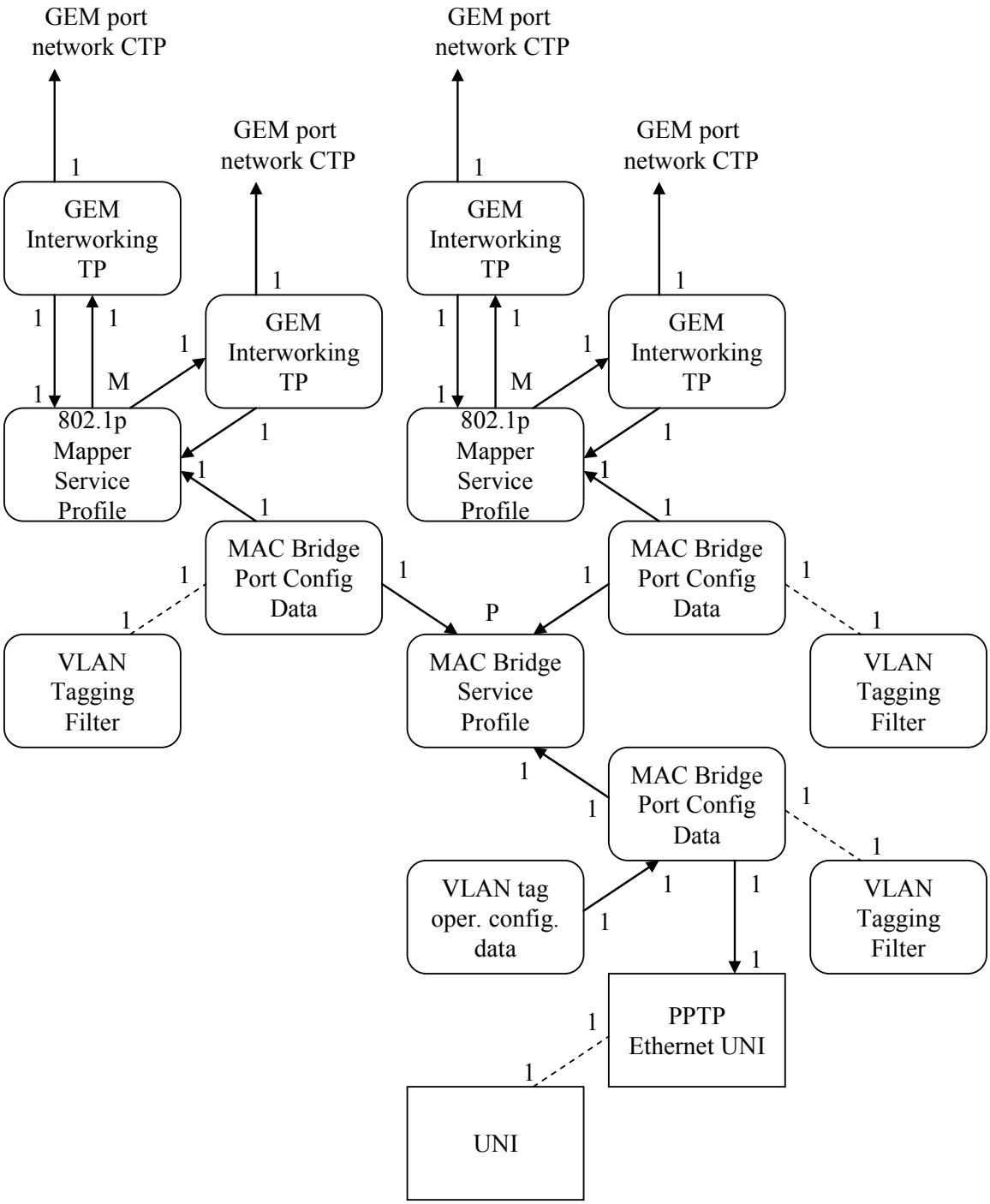


Figure 8.2.2-7 – Illustration of 1:MP map-filtering

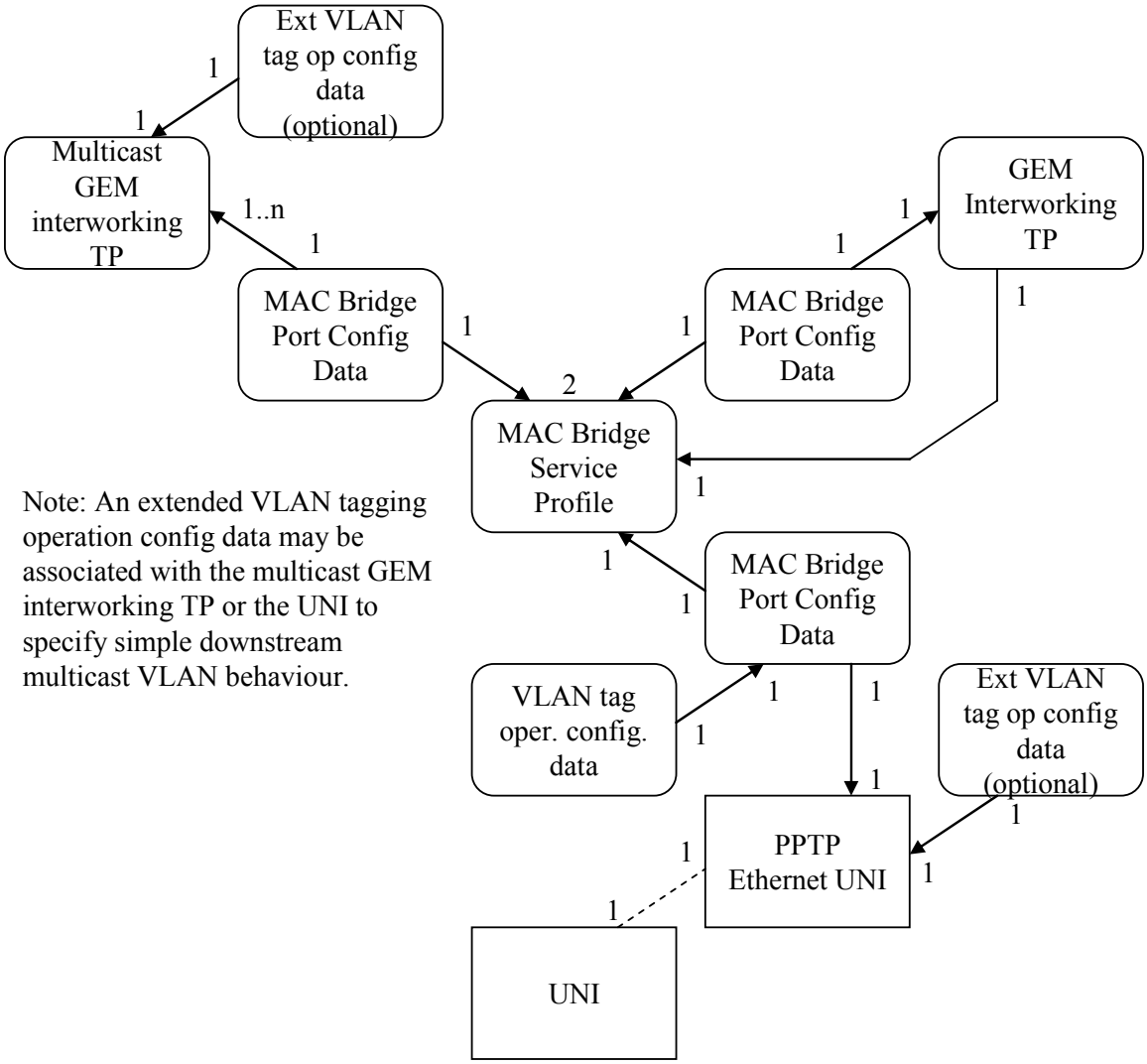


Figure 8.2.2-10 – Illustration of multicast service

b) Add the following figure at the end of clause 8.2.2:

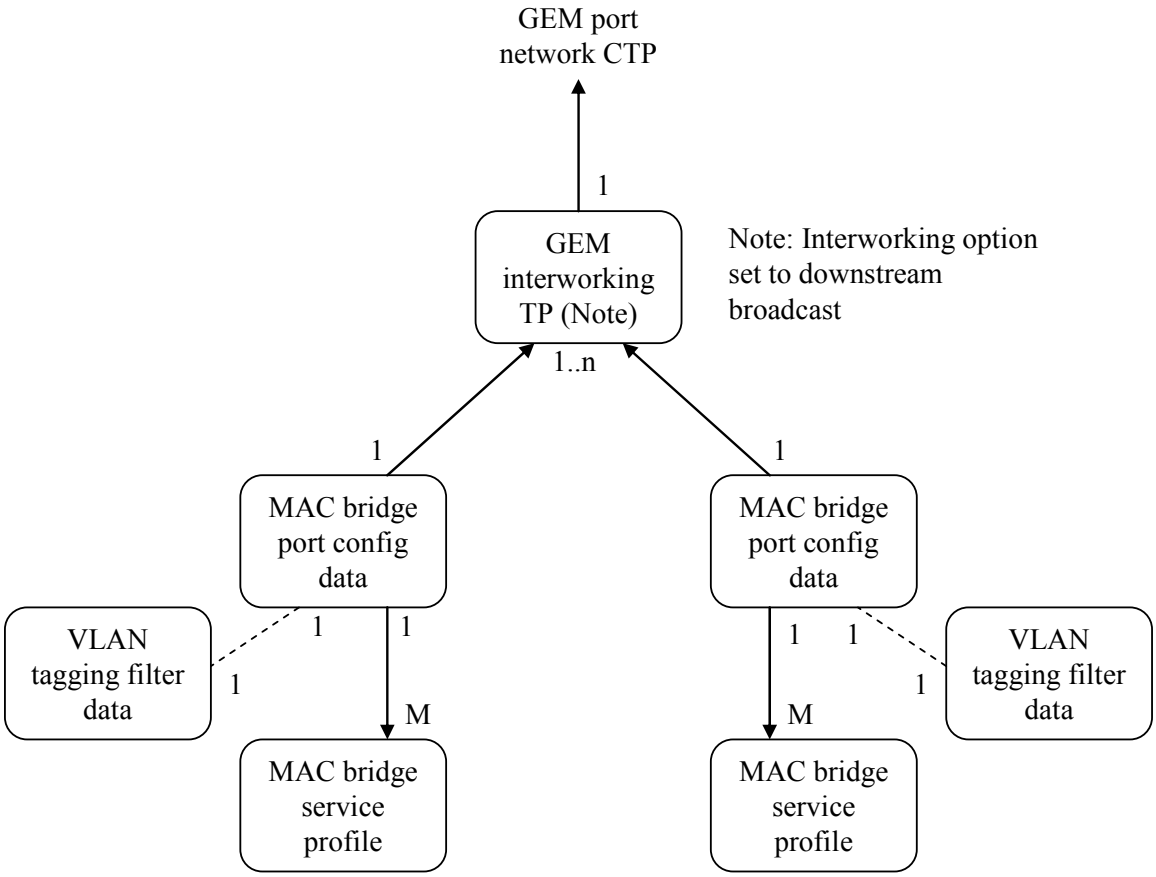
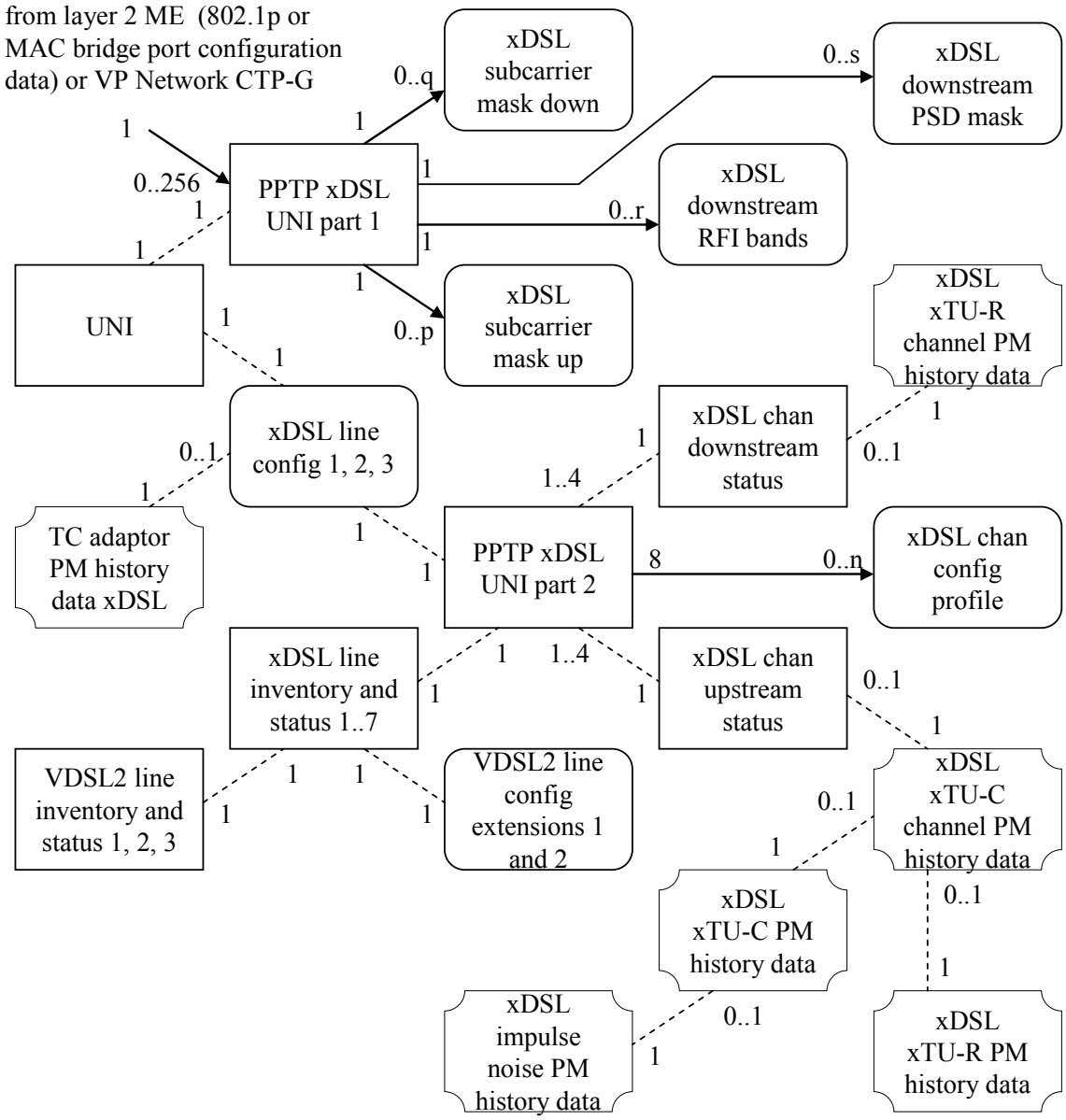


Figure 8.2.2-11 – Illustration of downstream broadcast configuration

6) Clause 8.2.4, xDSL service

Replace Figure 8.2.4-1 with the following:



7) New clause 8.2.10

Add the following new clause at the end of clause 8.2:

8.2.10 Mid-span PON reach extenders

The PON reach extender is modelled as an ONT (the management entity) containing cardholders and circuit packs whose functions are to extend the reach of one or more PONs. The PON reach extender's own management ONT is understood to exist as a member of one of the extended PONs.

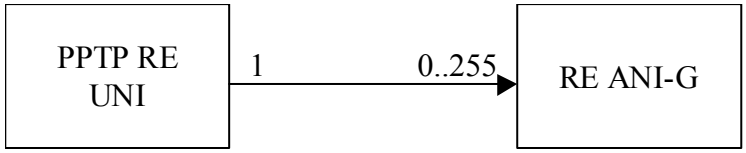


Figure 8.2.10-1 – Mid-span PON reach extender core (repeater)

NOTE 1 – In many cases, the RE ANI-G and PPTP RE UNI will be implemented on the same circuit pack. If so, the port mapping package can be used to create the hybrid line card.

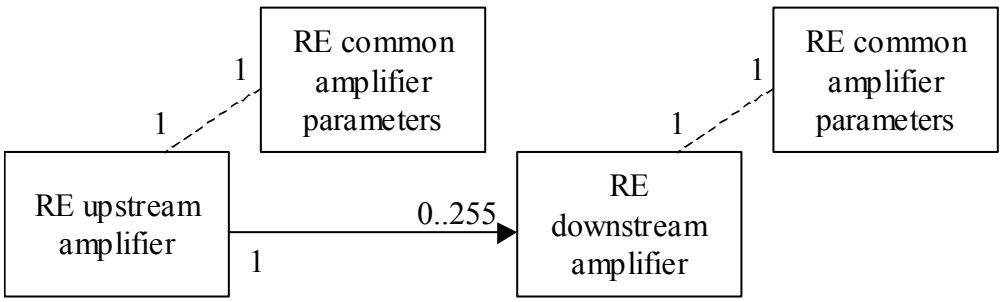


Figure 8.2.10-2 – Mid-span PON reach extender core (optical amplifier)

NOTE 2 – In many cases, the RE upstream amplifier and RE downstream amplifier will be implemented on the same circuit pack. If so, the port mapping package can be used to create the hybrid line card.

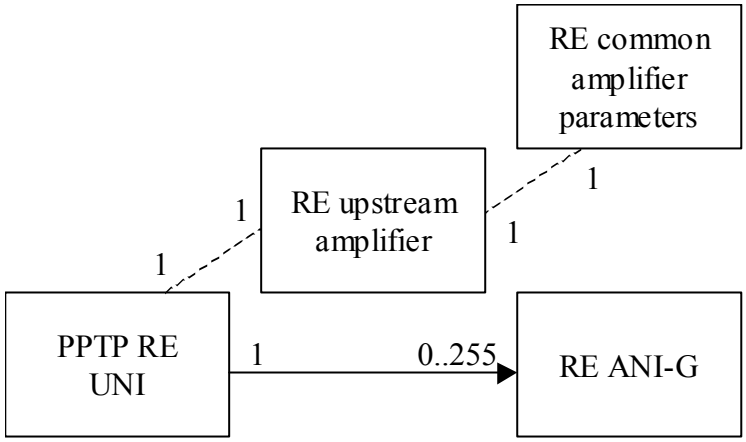


Figure 8.2.10-3 – Mid-span PON reach extender core (hybrid)

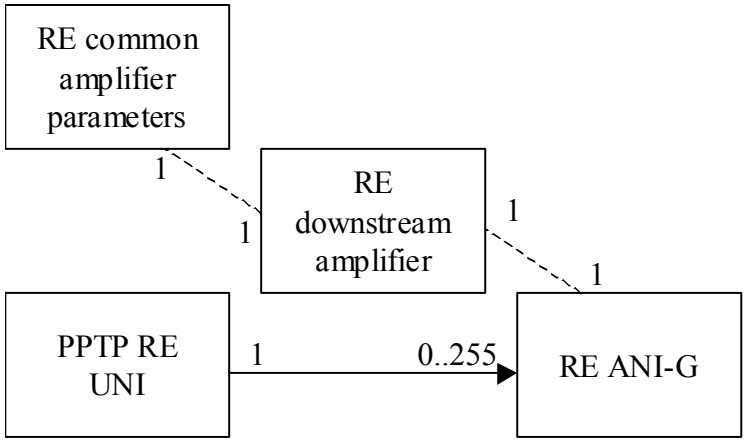


Figure 8.2.10-4 – Mid-span PON reach extender core (hybrid)

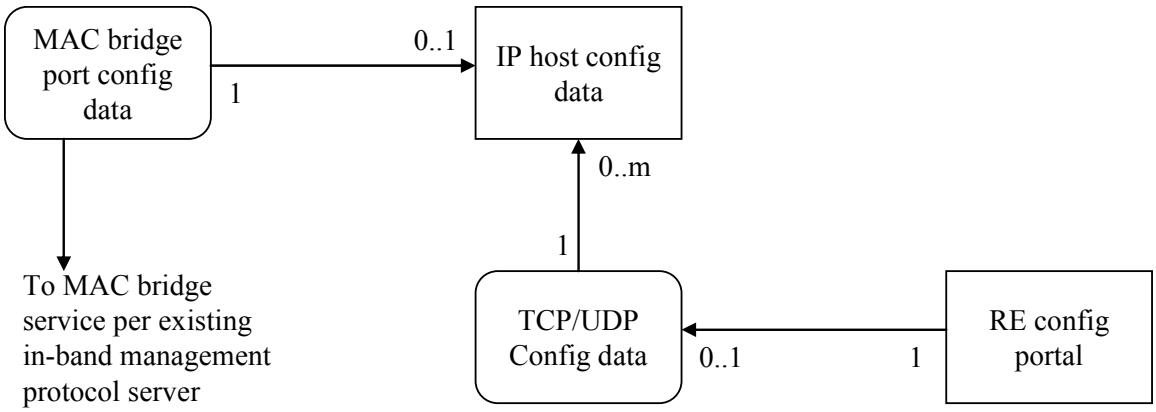


Figure 8.2.10-5 – In-band management for mid-span PON reach extender

8) Clause 9.1.1, ONT-G

a) Replace:

Traffic management option: This attribute identifies the upstream traffic management function implemented in the ONT. There are two options:

0 Priority controlled and flexibly scheduled upstream traffic. The traffic scheduler and priority queue mechanism are used for upstream traffic.

1 Rate controlled upstream traffic. The maximum upstream traffic of each individual connection is guaranteed.

With:

Traffic management option: This attribute identifies the upstream traffic management function implemented in the ONT. There are three options:

0 Priority controlled and flexibly scheduled upstream traffic. The traffic scheduler and priority queue mechanism are used for upstream traffic.

1 Rate controlled upstream traffic. The maximum upstream traffic of each individual connection is guaranteed by shaping.

2 Priority and rate controlled. The traffic scheduler and priority queue mechanism are used for upstream traffic. The maximum upstream traffic of each individual connection is guaranteed by shaping.

b) Add the following new attribute:

ONT survival time: This attribute indicates the minimum guaranteed time in milliseconds between the loss of external power and the silence of the ONT. This does not include survival time attributable to a backup battery. The value zero implies that the actual time is not known. (R) (optional) (1 byte)

9) Clause 9.1.2, ONT2-G

Replace:

OMCC version: This attribute identifies the version of the OMCC protocol being used by the ONT. This allows the OLT to manage a network with ONTs that support different OMCC versions. Release levels of this Recommendation may be supported with the following code points:

0x80 G.984.4 (06/04).

NOTE – For historic reasons, this codepoint may also appear in ONTs that support later versions of G.984.4.

0x81 G.984.4 Amd.1 (06/05)

0x82 G.984.4 Amd.2 (03/06)

0x83 G.984.4 Amd.3 (12/06)

0x84 G.984.4 (02/2008)

(R) (mandatory) (1 byte)

With:

OMCC version: This attribute identifies the version of the OMCC protocol being used by the ONT. This allows the OLT to manage a network with ONTs that support different OMCC versions. Release levels of this Recommendation may be supported with the following code points:

0x80 G.984.4 (06/04).

NOTE – For historic reasons, this codepoint may also appear in ONTs that support later versions of G.984.4.

0x81 G.984.4 Amd.1 (06/05)

0x82 G.984.4 Amd.2 (03/06)

0x83 G.984.4 Amd.3 (12/06)

0x84 G.984.4 (02/08)

0x85 G.984.4 (2008) Amd.1 (06/09)

(R) (mandatory) (1 byte)

10) Clause 9.1.5, Cardholder

Where Table 9.1.5-1 presently reads:

Table 9.1.5-1 – Circuit pack types

Coding	Content	Description
224..242	Reserved	

Modify it to read:

Table 9.1.5-1 – Circuit pack types

Coding	Content	Description
224..238	Reserved	
239	Mid-span PON reach extender UNI	The UNI of a mid-span PON reach extender, 2488 Mbit/s downstream and 1244 Mbit/s upstream
240	Mid-span PON reach extender ANI	The ANI of a mid-span PON reach extender, 2488 Mbit/s downstream and 1244 Mbit/s upstream
241	Mid-span PON reach extender upstream optical amplifier	The 1310 nm wavelength optical amplifier
242	Mid-span PON reach extender downstream optical amplifier	The 1490 nm wavelength optical amplifier

11) Clause 9.1.10, Protection data

Modify the description of this managed entity to read as follows:

This managed entity models the capability and parameters of PON protection. An ONT that supports PON protection automatically creates an instance of this managed entity.

NOTE 1 – Equipment protection is modelled with the equipment protection profile and cardholder managed entities.

NOTE 2 – For ONTs that implement reach extender functions, this ME can be used to describe OMCI protection, reach extender R'/S' protection, or both. For reach extender R'/S' protection, the protection type must be 1:1 without extra traffic, because the switching is done on a link-by-link basis, and the protection link is in cold stand-by mode. The instance that pertains to OMCI protection has ME ID = 0.

Relationships

One instance of this managed entity is associated with two instances of the ANI-G, RE ANI-G or RE upstream amplifier. One of the ANI managed entities represents the working side; the other represents the protection side.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. This ME is numbered in ascending order from 0. (R) (mandatory) (2 bytes)

Working ANI-G pointer: This attribute points to the ANI-G, RE ANI-G or RE upstream amplifier managed entity that represents the working side of PON protection. (R) (mandatory) (2 bytes)

Protection ANI-G pointer: This attribute points to the ANI-G, RE ANI-G or RE upstream amplifier managed entity that represents the protection side of PON protection. (R) (mandatory) (2 bytes)

(Remainder of description remains unchanged)

12) Clause 9.2.1, ANI-G

Replace:

Piggyback DBA reporting: This attribute indicates the ONT's piggyback DBA reporting format capabilities. [ITU-T G.984.3] defines three possible piggyback reporting modes. For reporting mode 0, the single field is the entire report. For reporting mode 1, the DBA report is two fields long. For reporting mode 2, the DBA report is four fields long. Mode 0 is mandatory for ONTs that utilize the piggyback DBA reporting method; modes 1 and 2 are optional. The following coding indicates the ONT's piggyback DBA reporting mode capabilities:

0 Mode 0 only

1 Modes 0 and 1

2 Modes 0 and 2

3 Modes 0, 1 and 2

4 Piggyback DBA reporting not supported

(R) (mandatory) (1 byte)

Whole ONT DBA reporting: This attribute indicates that the ONT supports whole ONT DBA reporting (1) as specified in [ITU-T G.984.3], or that it does not (0). (R) (mandatory) (1 byte)

With:

Piggyback DBA reporting: This attribute indicates the ONT's piggyback DBA reporting format capabilities. [ITU-T G.984.3] defines two possible piggyback reporting modes. For reporting mode 0, the single field is the entire report. For reporting mode 1, the DBA report is two fields long. Mode 0 is mandatory for ONTs that utilize the piggyback DBA reporting method; mode 1 is optional. The following coding indicates the ONT's piggyback DBA reporting mode capabilities:

0 Mode 0 only

1 Modes 0 and 1

2 Deprecated

3 Deprecated

4 Piggyback DBA reporting not supported

(R) (mandatory) (1 byte)

Whole ONT DBA reporting: This attribute is deprecated. It should be set to 0 by the ONT and ignored by the OLT. (R) (mandatory) (1 byte)

13) Clause 9.2.3, GEM port network CTP

a) Replace:

Port id value: This attribute is the port ID of the GEM port associated with this CTP. (R, W, Set-by-create) (mandatory) (2 bytes)

With:

Port id value: This attribute is the port ID of the GEM port associated with this CTP.

NOTE 1 – While nothing forbids the existence of several GEM port network CTPs with the same port id value, downstream traffic is modelled as being delivered to all such GEM port network CTPs. Be aware of potential difficulties associated with defining downstream flows and aggregating PM statistics.

(R, W, Set-by-create) (mandatory) (2 bytes)

b) Replace:

Traffic management pointer for upstream: If the traffic management option attribute in the ONT-G ME is 0 (priority controlled), this pointer specifies the priority queue-G ME serving this GEM port network CTP. If the traffic management option attribute is 1 (rate controlled), this attribute redundantly points to the T-CONT serving this GEM port network CTP. (R, W, Set-by-create) (mandatory) (2 bytes)

Traffic descriptor profile pointer: This attribute points to the instance of the GEM traffic descriptor managed entity that contains the traffic parameters used for this GEM port network CTP ME. This attribute is used when the traffic management option attribute in the ONT-G ME is 1 (rate controlled). (R, W, Set-by-create) (optional) (2 bytes)

See also Appendix III.

With:

Traffic management pointer for upstream: If the traffic management option attribute in the ONT-G ME is 0 (priority controlled) or 2 (priority and rate controlled), this pointer specifies the priority queue-G ME serving this GEM port network CTP. If the traffic management option attribute is 1 (rate controlled), this attribute redundantly points to the T-CONT serving this GEM port network CTP. (R, W, Set-by-create) (mandatory) (2 bytes)

Traffic descriptor profile pointer for upstream: This attribute points to the instance of the GEM traffic descriptor managed entity that contains the upstream traffic parameters used for this GEM port network CTP ME. This attribute is used when the traffic management option attribute in the ONT-G ME is 1 (rate controlled), specifying the PIR/PBS to which the upstream traffic is shaped. This attribute is also used when the traffic management option attribute in the ONT-G ME is 2 (priority and rate controlled), specifying the CIR/CBS/PIR/PBS to which the upstream traffic is policed. (R, W, Set-by-create) (optional) (2 bytes)

See also Appendix III.

c) Replace:

Priority queue pointer for downstream: This attribute points to the instance of the priority queue-G used for this GEM port network CTP in the downstream direction. (R, W, Set-by-create) (mandatory) (2 bytes)

With:

Priority queue pointer for downstream: This attribute points to the instance of the priority queue-G used for this GEM port network CTP in the downstream direction. It is the responsibility of the OLT to provision the downstream pointer in a way that is consistent with bridge and mapper connectivity. If the pointer is undefined, downstream queueing is determined by other mechanisms in the ONT. (R, W, Set-by-create) (mandatory) (2 bytes)

NOTE 3 – If the GEM port network CTP is associated with more than one UNI (downstream multicast), the downstream priority queue pointer defines a pattern (e.g., queue number 3 for a given UNI) to be replicated (i.e., to queue number 3) at the other affected UNIs.

d) Add the following additional attribute:

Traffic descriptor profile pointer for downstream: This attribute points to the instance of the GEM traffic descriptor managed entity that contains the downstream traffic parameters used for this GEM port network CTP ME. This attribute is used when the traffic management option attribute in the ONT-G ME is 2 (priority and rate controlled), specifying the CIR/CBS/PIR/PBS to which the downstream traffic is policed. (R, W, Set-by-create) (optional) (2 bytes)

See also Appendix III.

14) Clause 9.2.4, GEM interworking termination point

a) Replace:

Interworking option: This attribute identifies the type of non-GEM function that is being interworked. The options are:

0 Unstructured TDM
1 MAC bridge LAN
2 Reserved for future use
3 IP data service
4 Video return path
5 802.1p mapper

(R, W, Set-by-create) (mandatory) (1 byte)

Service profile pointer: This attribute points to an instance of a service profile, such as:

CES service profile-G	if interworking option = 0
MAC bridge service profile	if interworking option = 1
IP router service profile	if interworking option = 3
Video return path service profile	if interworking option = 4
802.1p mapper service profile	if interworking option = 5

(R, W, Set-by-create) (mandatory) (2 bytes)

With:

Interworking option: This attribute identifies the type of non-GEM function that is being interworked. The options are:

0 Unstructured TDM
1 MAC bridge LAN
2 Reserved for future use
3 IP data service
4 Video return path
5 802.1p mapper
6 Downstream broadcast

(R, W, Set-by-create) (mandatory) (1 byte)

Service profile pointer: This attribute points to an instance of a service profile, such as:

CES service profile-G	if interworking option = 0
MAC bridge service profile	if interworking option = 1
IP router service profile	if interworking option = 3
Video return path service profile	if interworking option = 4
802.1p mapper service profile	if interworking option = 5
Null pointer	if interworking option = 6

(R, W, Set-by-create) (mandatory) (2 bytes)

b) Replace:

GAL profile pointer: This attribute points to an instance of the GAL profile. The relationship between the interworking option and the related GAL profile is:

Interworking option	GAL profile type
0	GAL TDM profile
1	GAL Ethernet profile
2	Reserved for future use
3	GAL Ethernet profile for data service
4	GAL Ethernet profile for video return path
5	GAL Ethernet profile for 802.1p mapper

(R, W, Set-by-create) (mandatory) (2 bytes)

GAL loopback configuration: This attribute sets the loopback configuration when using GEM mode:

0 No loopback.
1 Loopback of downstream traffic after GAL.

The default value of this attribute is 0. (R, W) (mandatory) (1 byte)

With:

GAL profile pointer: This attribute points to an instance of the GAL profile. The relationship between the interworking option and the related GAL profile is:

Interworking option	GAL profile type
0	GAL TDM profile
1	GAL Ethernet profile
2	Reserved for future use
3	GAL Ethernet profile for data service
4	GAL Ethernet profile for video return path
5	GAL Ethernet profile for 802.1p mapper
6	Null pointer

(R, W, Set-by-create) (mandatory) (2 bytes)

GAL loopback configuration: This attribute sets the loopback configuration when using GEM mode:

0 No loopback
1 Loopback of downstream traffic after GAL

The default value of this attribute is 0. When the interworking option is 6 (downstream broadcast), this attribute is not used. (R, W) (mandatory) (1 byte)

15) Clause 9.2.6, GEM port performance monitoring history data

Replace:

Lost packets: This attribute counts background GEM frame loss. It does not distinguish between packets lost because of header bit errors or buffer overflows; it records only loss of information. (R) (mandatory) (4 bytes)

Misinserted packets: This attribute counts GEM frames misrouted to this GEM port. (R) (mandatory) (4 bytes)

Received packets: This attribute counts GEM frames that were received correctly at the monitored GEM port. (R) (mandatory) (5 bytes)

Received blocks: This attribute counts GEM blocks that were received correctly at the monitored GEM port. (R) (mandatory) (5 bytes)

Transmitted blocks: This attribute counts GEM blocks originated by the transmitting end point (i.e., backward reporting is assumed). (R) (mandatory) (5 bytes)

Impaired blocks: This severely errored data block counter is incremented whenever one of the following events takes place: the number of misinserted packets reaches its threshold, the number of bipolar violations reaches its threshold, or the number of lost packets reaches its threshold. Threshold values are based on vendor-operator negotiation. (R) (mandatory) (4 bytes)

With:

Lost packets: This attribute counts downstream GEM frame loss. It does not distinguish between GEM frames lost because of header bit errors or buffer overflows; it records only loss of information. (R) (mandatory) (4 bytes)

Misinserted packets: <no change>

Received packets: This attribute counts downstream GEM frames that were received correctly at the monitored GEM port. (R) (mandatory) (5 bytes)

Received blocks: This attribute counts downstream GEM blocks or partial blocks that were received correctly at the monitored GEM port. (R) (mandatory) (5 bytes)

Transmitted blocks: This attribute counts upstream GEM blocks or partial blocks originated by the transmitting end point. (R) (mandatory) (5 bytes)

Impaired blocks: This severely errored data block counter is incremented whenever the number of misinserted packets reaches its threshold or the number of lost packets reaches its threshold. Threshold values are based on vendor-operator negotiation. (R) (mandatory) (4 bytes)

16) Clause 9.3, Layer 2 data services

Replace Figure 9.3-1 with the following:

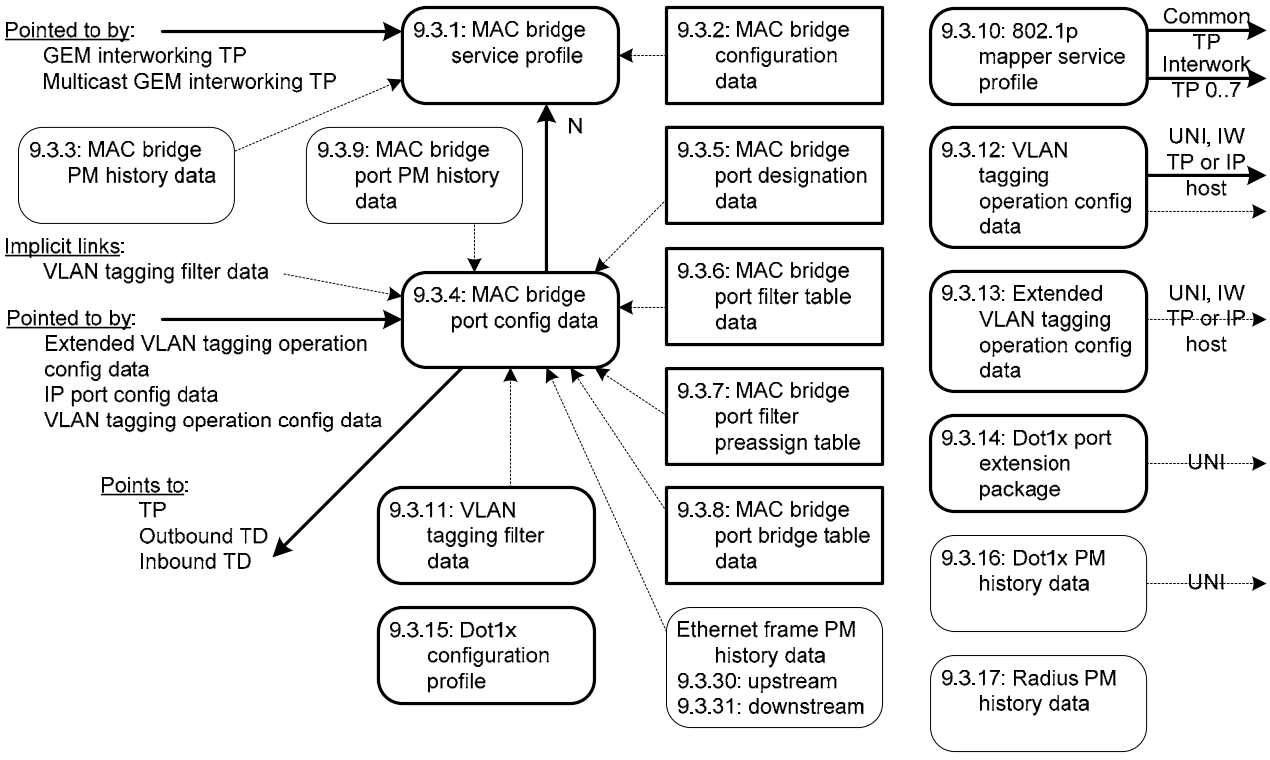


Figure 9.3-1 – Managed entities that support layer 2

17) Clause 9.3.10, 802.1p mapper service profile

a) Replace:

This managed entity associates the priorities of 802.1P priority tagged frames with specific connections. Instances of this managed entity are created and deleted by the OLT.

With:

This managed entity associates the priorities of 802.1P priority tagged frames with specific connections. The operation of this managed entity affects only upstream traffic. Instances of this managed entity are created and deleted by the OLT.

b) *Replace:*

Unmarked frame option: This attribute specifies how the ONT should handle untagged Ethernet frames received across the associated interface. Valid values include:

0 Convert from DSCP to 802.1p

1 Tag frame to a certain value

(R, W, Set-by-create) (mandatory) (1 byte)

DSCP to P-bit mapping: This attribute is valid when the unmarked frame option attribute is set to 0. The DSCP to P-bit attribute can be considered a bit string sequence of 64 3-bit groupings. The 64 sequence entries represent the possible values of the 6-bit DSCP field. Each 3-bit grouping specifies the P-bit value to which the associated DSCP value should be mapped. Once marked, the P-bit marked frame is then directed to the GEM interworking termination point indicated by the interwork TP pointer mappings. (R, W) (mandatory) (24 bytes)

NOTE 2 – If certain bits in the DSCP field are to be ignored in the mapping process, the attribute should be provisioned such that all possible values of those bits produce the same P-bit mapping. This can be applied to the case where the operator wishes to adopt the priority mechanism based on IP precedence instead of full DSCP, which needs only the three MSBs of the DSCP field.

Default P-bit marking: This attribute is valid when the unmarked frame option attribute is set to 1. The default P-bit marking attribute contains the default P-bit priority setting to be applied. The P-bit marked frame is then directed to the GEM interworking termination point indicated by the interwork TP pointer mappings. (R, W, Set-by-create) (mandatory) (1 byte)

With:

Unmarked frame option: This attribute specifies how the ONT should handle untagged Ethernet frames received across the associated interface. Although it does not alter the frame in any way, the ONT routes the frame as if it were tagged with P bits (PCP field) according to the following code points.

0 Derive implied PCP field from DSCP bits of received frame

1 Set implied PCP field to fixed value specified by default P-bit marking attribute

(R, W, Set-by-create) (mandatory) (1 byte)

Untagged downstream frames are passed through the mapper transparently.

DSCP to P-bit mapping: This attribute is valid when the unmarked frame option attribute is set to 0. The DSCP to P-bit attribute can be considered a bit string sequence of 64 3-bit groupings. The 64 sequence entries represent the possible values of the 6-bit DSCP field. Each 3-bit grouping specifies the P-bit value to which the associated DSCP value should be mapped. The unmarked frame is then directed to the GEM interworking termination point indicated by the interwork TP pointer mappings. (R, W) (mandatory) (24 bytes)

NOTE 2 – If certain bits in the DSCP field are to be ignored in the mapping process, the attribute should be provisioned such that all possible values of those bits produce the same P-bit mapping. This can be applied to the case where instead of full DSCP, the operator wishes to adopt the priority mechanism based on IP precedence, which needs only the three MSBs of the DSCP field.

Default P-bit marking: This attribute is valid when the unmarked frame option attribute is set to 1. In its least significant bits, the default P-bit marking attribute contains the default PCP field to be assumed. The unmodified frame is then directed to the GEM interworking termination point indicated by the interwork TP pointer mappings. (R, W, Set-by-create) (mandatory) (1 byte)

18) Clause 9.3.11, VLAN tagging filter data

a) Replace the description of the **"Forward operation"** *attribute with the following text:*

Forward operation: When a frame passes through the MAC bridge port, it is processed according to the operation specified by the forward operation table. Figure 9.3.11-2 illustrates the treatment of frames according to the provisioned action possibilities. Tagged and untagged frames are treated separately, but both in accordance with the figure. While all forwarding operations are plausible, only actions 0x10 and 0x12 are necessary to construct a VLAN mapper and an 802.1p mapper, respectively. (R, W, Set-by-create) (mandatory) (1 byte)

Forward operation	Type of received frame	
	Tagged	Untagged
0x00	Bridging (a) (no investigation)	Bridging (a)
0x01	Discarding (c)	Bridging (a)
0x02	Bridging (a) (no investigation)	Discarding (c)
0x03	Action (h) (VID investigation)	Bridging (a)
0x04	Action (h) (VID investigation)	Discarding (c)
0x05	Action (g) (VID investigation)	Bridging (a)
0x06	Action (g) (VID investigation)	Discarding (c)
0x07	Action (h) (user priority investigation)	Bridging (a)
0x08	Action (h) (user priority investigation)	Discarding (c)
0x09	Action (g) (user priority investigation)	Bridging (a)
0x0A	Action (g) (user priority investigation)	Discarding (c)
0x0B	Action (h) (TCI investigation)	Bridging (a)
0x0C	Action (h) (TCI investigation)	Discarding (c)

Forward operation	Type of received frame	
	Tagged	Untagged
0x0D	Action (g) (TCI investigation)	Bridging (a)
0x0E	Action (g) (TCI investigation)	Discarding (c)
0x0F	Action (h) (VID investigation)	Bridging (a)
0x10	Action (h) (VID investigation)	Discarding (c)
0x11	Action (h) (user priority investigation)	Bridging (a)
0x12	Action (h) (user priority investigation)	Discarding (c)
0x13	Action (h) (TCI investigation)	Bridging (a)
0x14	Action (h) (TCI investigation)	Discarding (c)
0x15	Bridging (a) (no investigation)	Discarding (c)
0x16	Action (j) (VID investigation)	Bridging (a)
0x17	Action (j) (VID investigation)	Discarding (c)
0x18	Action (j) (user priority investigation)	Bridging (a)
0x19	Action (j) (user priority investigation)	Discarding (c)
0x1A	Action (j) (TCI investigation)	Bridging (a)
0x1B	Action (j) (TCI investigation)	Discarding (c)
0x1C	Action (k) (VID investigation)	Bridging (a)
0x1D	Action (k) (VID investigation)	Discarding (c)
0x1E	Action (k) (user priority investigation)	Bridging (a)
0x1F	Action (k) (user priority investigation)	Discarding (c)
0x20	Action (k) (TCI investigation)	Bridging (a)
0x21	Action (k) (TCI investigation)	Discarding (c)

The table contains duplicate entries due to simplification of the original set of actions.

This table and the actions are discussed in detail below.

b) Replace the **"Supplementary explanation"** *with the following text:*

Supplementary explanation

This clause explains the actions specified in the forward operation attribute.

The format of an Ethernet frame for VLAN services is described in [IEEE 802.1Q]:

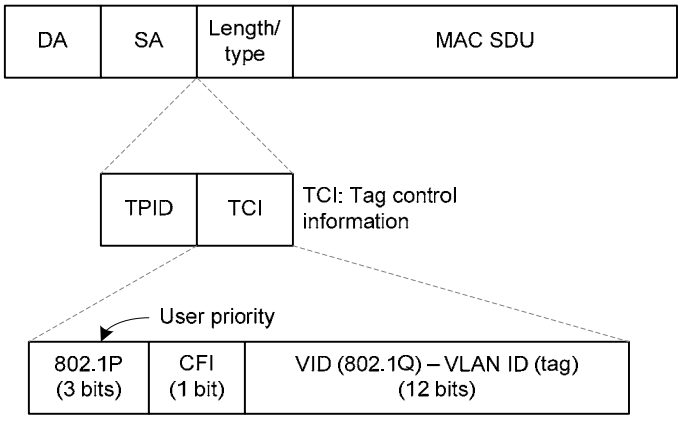


Figure 9.3.11-1 – Format of an Ethernet frame for VLAN services

a) **Basic MAC bridge operation**: All frames are accepted into the MAC bridging entity. Egress frames are forwarded from this port if either: a) the frame's MAC destination address (DA) is listed in the MAC bridge port bridge table data for this port; or b) the frame's DA does not appear in the MAC bridge port bridge table data for any port (flooding). The content of the VLAN filter list attribute is not meaningful.

NOTE – Action (a) on a given port may imply egress flooding of a frame from other ports of the bridge. The possible VLAN tagging filter data MEs attached to the other ports override this action; however, so the frame is only transmitted from some other port if it also satisfies the forward operation attribute value established on that port.

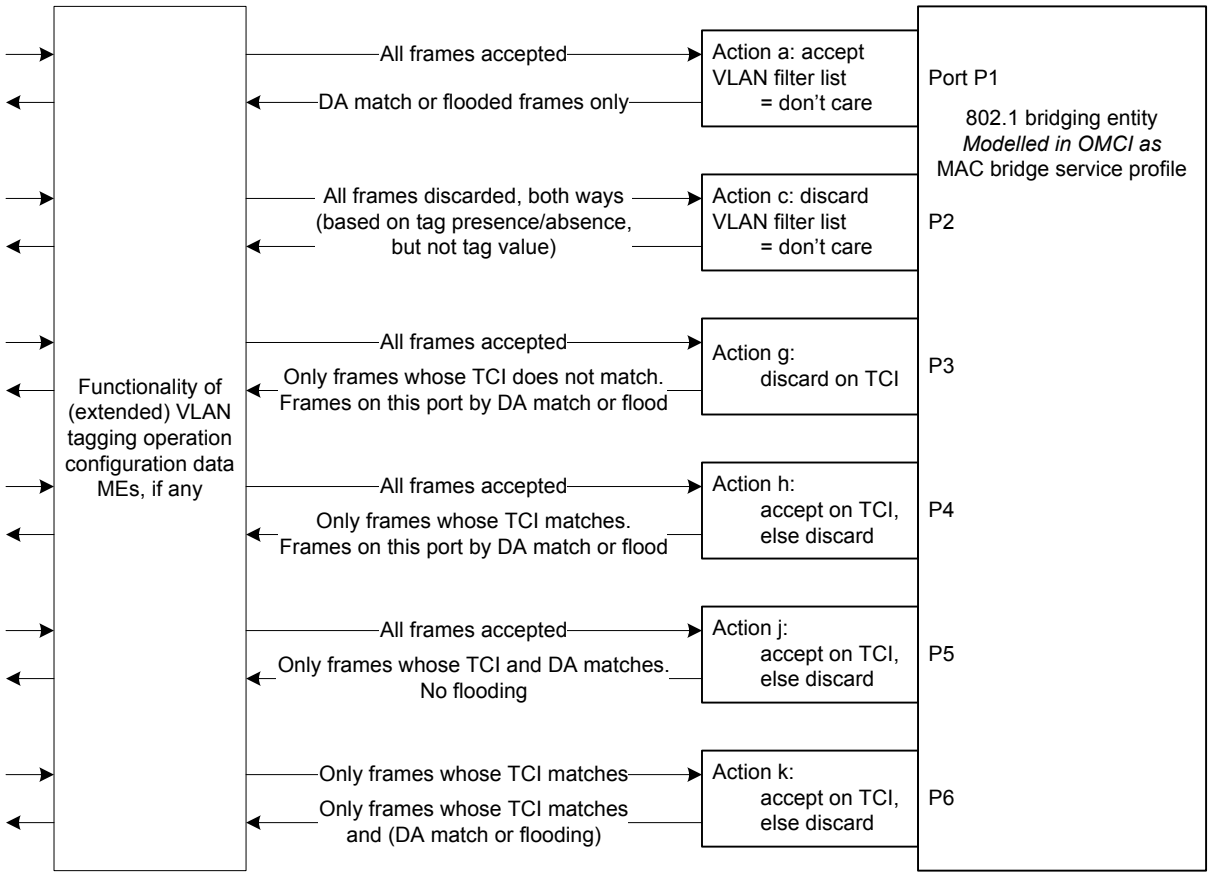


Figure 9.3.11-2 – Forwarding behaviour

Other possible actions are as follows:

c) **Unconditional discarding**: Frames in both directions are unconditionally discarded without investigation of TCI or MAC address. This action can be used to discard all tagged traffic or all untagged traffic at the port of attachment, depending on the code point in the table. The content of the VLAN filter list attribute is not meaningful.

g) **Negative filtering by TCI**: All frames are admitted into the bridging entity. If the specified fields in the TCI of a candidate egress frame match any entry in the VLAN filter list, the frame is not forwarded by this port. Otherwise, the frame is forwarded based on destination MAC address, according to action (a).

h) **Positive filtering by TCI and dropping for no match**: All frames are admitted into the bridging entity. If the specified fields in the TCI of a candidate egress frame match any entry in the VLAN filter list, the frame is forwarded based on destination MAC address, according to action (a). If there is no match of the specified TCI fields, the frame is discarded.

j) **Positive filtering by TCI and DA**: All frames are admitted into the bridging entity. If the specified fields in the TCI of a candidate egress frame match any entry in the VLAN filter list, the frame is forwarded based on destination MAC address. The frame is never flooded to this or other ports. If the specified TCI fields and DA do not both match, the frame is discarded.

k) **Bidirectional positive filtering by TCI and dropping for no match**: Both ingress and egress frames are filtered on investigation of TCI fields. If the specified fields in the TCI of a candidate ingress/egress frames match any entry in the VLAN filter list, the frame is forwarded based on destination MAC address, according to action (a). If there is no match of the specified TCI fields, the frame is discarded.

(Action codes b, d, e, f are not used.)

19) Clause 9.3.12, VLAN tagging operation configuration data

Replace:

Relationships

Zero or one instance of this managed entity may exist for an instance of any managed entity that can terminate or modify an Ethernet stream. By definition, tagging operation occurs farther away from the MAC bridge than filtering.

With:

Relationships

Zero or one instance of this managed entity may exist for an instance of any managed entity that can terminate or modify an Ethernet stream.

When this managed entity is associated with a UNI-side termination point, it performs its upstream classification and tagging operations before offering the upstream frame to other filtering, bridging or switching functions. In the downstream direction, the defined inverse operation is the last operation performed on the frame before offering it to the UNI-side termination.

When this managed entity is associated with an ANI-side termination point, it performs its upstream classification and tagging operations as the last step before queuing for transmission to the OLT, after having received the upstream frame from other filtering, bridging or switching functions. In the downstream direction, the defined inverse operation is the first operation performed on the frame before offering it to possible filter, bridge or switch functions.

20) Clause 9.3.13, Extended VLAN tagging operation configuration data

a) Replace:

Relationships

Zero or one instance of this managed entity may exist for an instance of any managed entity that can terminate or modify an Ethernet stream. By definition, tagging operation occurs farther away from the MAC bridge than filtering.

With:

Relationships

Zero or one instance of this managed entity may exist for an instance of any managed entity that can terminate or modify an Ethernet stream.

When this managed entity is associated with a UNI-side termination point, it performs its upstream classification and tagging operations before offering the upstream frame to other filtering, bridging or switching functions. In the downstream direction, the defined inverse operation is the last operation performed on the frame before offering it to the UNI-side termination.

When this managed entity is associated with an ANI-side termination point, it performs its upstream classification and tagging operations as the last step before transmission to the OLT, after having received the upstream frame from other filtering, bridging or switching functions. In the downstream direction, the defined inverse operation is the first operation performed on the frame before offering it to possible filter, bridge or switch functions.

b) Replace:

Association type: This attribute identifies the type of the ME associated with this extended VLAN tagging ME. Values are assigned as follows:

0 MAC bridge port configuration data
1 802.1p mapper service profile
2 Physical path termination point Ethernet UNI
3 IP host config data
4 Physical path termination point xDSL UNI
5 GEM interworking termination point
6 Multicast GEM interworking termination point
7 Physical path termination point MoCA UNI
8 Physical path termination point 802.11 UNI
9 Ethernet flow termination point

(R, W, Set-by-create) (mandatory) (1 byte)

With:

Association type: This attribute identifies the type of the ME associated with this extended VLAN tagging ME. Values are assigned as follows:

0 MAC bridge port configuration data
1 802.1p mapper service profile
2 Physical path termination point Ethernet UNI
3 IP host config data
4 Physical path termination point xDSL UNI
5 GEM interworking termination point
6 Multicast GEM interworking termination point
7 Physical path termination point MoCA UNI
8 Physical path termination point 802.11 UNI
9 Ethernet flow termination point

(R, W, Set-by-create) (mandatory) (1 byte)

NOTE 1 – If a MAC bridge is configured, codepoints 1, 5 and 6 are associated with the ANI side of the MAC bridge, and the other codepoints are associated with the UNI side. Codepoint 0 is associated with the ANI or UNI side depending on where the MAC bridge port is.

When the extended VLAN tagging ME is associated with the ANI side, it behaves as an upstream egress rule, and as a downstream ingress rule when the downstream mode attribute is equal to 0. When the extended VLAN tagging ME is associated with the UNI side, the extended VLAN tagging ME behaves as an upstream ingress rule, and as a downstream egress rule when the downstream mode attribute is equal to 0.

c) Replace:

Treatment tags to remove: (2 bits)

0..2 Remove 0, 1 or 2 tags, respectively. If one tag is specified, then the outer tag is stripped from double-tagged frames.
3 Reserved

Padding: 10 bits

Treatment outer priority: (4 bits)

0..7 Add an outer tag, and insert this value as the priority in the outer VLAN tag.
8 Add an outer tag, and copy the outer priority from the inner priority of the received frame.
9 Add an outer tag, and copy the outer priority from the outer priority of the received frame.
15 Do not add an outer tag.

Other values: Reserved

With:

Treatment tags to remove: (2 bits)

0..2 Remove 0, 1 or 2 tags, respectively. If one tag is specified, then the outer tag is stripped from double-tagged frames.

3 Discard the frame. No symmetric downstream operation exists; i.e., this rule is ignored in the downstream direction.

Padding: (10 bits).

Treatment outer priority: (4 bits)

0..7 Add an outer tag, and insert this value as the priority in the outer VLAN tag.

8 Add an outer tag, and copy the outer priority from the inner priority of the received frame.

9 Add an outer tag, and copy the outer priority from the outer priority of the received frame.

10 Add an outer tag, and derive P bits from the DSCP field of the incoming frame according to the DSCP to P-bit mapping attribute.

15 Do not add an outer tag.

Other values: Reserved.

d) Replace:

Treatment inner priority: (4 bits)

0..7	Add an inner tag, and insert this value as the priority to insert in the inner VLAN tag.
8	Add an inner tag, and copy the inner priority from the inner priority of the received frame.
9	Add an inner tag, and copy the inner priority from the outer priority of the received frame.
15	Do not add an inner tag.

Other values: Reserved

With:

Treatment inner priority: (4 bits)

0..7	Add an inner tag, and insert this value as the priority to insert in the inner VLAN tag.
8	Add an inner tag, and copy the inner priority from the inner priority of the received frame.
9	Add an inner tag, and copy the inner priority from the outer priority of the received frame.
10	Add an inner tag, and derive P bits from the DSCP field of the incoming frame according to the DSCP to P-bit mapping attribute.
15	Do not add an inner tag.

Other values: Reserved.

e) Add the following attribute:

DSCP to P-bit mapping: This attribute specifies mapping from DSCP to P-bits. The attribute can be considered a bit string sequence of 64 3-bit groups. The 64 sequence entries represent the possible values of the 6-bit DSCP field. Each 3-bit group specifies the P-bit value to which the associated DSCP value should be mapped. (R, W) (optional) (24 bytes)

NOTE 5 – If certain bits in the DSCP field are to be ignored in the mapping process, the attribute should be provisioned such that all possible values of those bits produce the same P-bit mapping. This can be applied to the case where instead of full DSCP, the operator wishes to adopt the priority mechanism based on IP precedence, which needs only the three MSBs of the DSCP field.

21) Clause 9.3.27, Multicast operations profile

a) Replace:

Dynamic access control list table: This attribute is a list that specifies one or more multicast group address ranges. The ONT is expected to silently discard IGMP join requests for groups that are not listed in this table.

With:

Dynamic access control list table: This attribute is a list that specifies one or more multicast group address ranges.

b) Add the following new attribute:

Unauthorized join request behaviour: This boolean attribute specifies the ONT's behaviour when it receives an IGMP join request for a group that is not authorized in the dynamic address control list table, or an IGMPv3 membership report for groups, none of which are authorized in the dynamic ACL. The default value false specifies that the ONT silently discards the IGMP request; the value true specifies that the ONT forwards the request upstream. The ONT does not attempt to honour the request for the unauthorized group(s) in either case. (R, W) (optional) (1 byte)

22) New clauses 9.3.30 and 9.3.31

Add the following two new clauses at the end of clause 9.3:

9.3.30 Ethernet frame performance monitoring history data upstream

This managed entity collects performance monitoring data associated with upstream Ethernet frame delivery. It it based on the Etherstats group of [b-IETF RFC 2819]. Instances of this managed entity are created and deleted by the OLT. For a complete discussion of generic PM architecture, refer to clause I.1.9.

Relationships

An instance of this managed entity is associated with an instance of a MAC bridge port configuration data.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Through an identical ID, this managed entity is implicitly linked to an instance of a MAC bridge port configuration data. (R, Set-by-create) (mandatory) (2 bytes)

Interval end time: This attribute identifies the most recently finished 15-minute interval. (R) (mandatory) (1 byte)

Threshold data 1/2 id: This attribute points to an instance of the threshold data 1 managed entity that contains PM threshold values. Since no threshold value attribute number exceeds 7, a threshold data 2 ME is optional. (R, W, Set-by-create) (mandatory) (2 bytes)

Drop events: The total number of events in which packets were dropped due to lack of resources. This is not necessarily the number of packets dropped; it is the number of times this event was detected. (R) (mandatory) (4 bytes)

Octets: The total number of octets received, including those in bad packets, excluding framing bits, but including FCS. (R) (mandatory) (4 bytes)

Packets: The total number of packets received, including bad packets, broadcast packets and multicast packets. (R) (mandatory) (4 bytes)

Broadcast packets: The total number of received good packets directed to the broadcast address. This does not include multicast packets. (R) (mandatory) (4 bytes)

Multicast packets: The total number of received good packets directed to a multicast address. This does not include broadcast packets. (R) (mandatory) (4 bytes)

CRC errored packets: The total number of packets received that had a length (excluding framing bits, but including FCS octets) of between 64 and 1518 octets, inclusive, but had either a bad frame check sequence (FCS) with an integral number of octets (FCS error) or a bad FCS with a non-integral number of octets (alignment error). (R) (mandatory) (4 bytes)

Undersize packets: The total number of packets received that were less than 64 octets long but were otherwise well formed (excluding framing bits, but including FCS octets). (R) (mandatory) (4 bytes)

Oversize packets: The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) and were otherwise well formed. (R) (mandatory) (4 bytes)

Packets 64 octets: The total number of received packets (including bad packets) that were 64 octets long, excluding framing bits but including FCS. (R) (mandatory) (4 bytes)

Packets 65 to 127 octets: The total number of received packets (including bad packets) that were 65..127 octets long, excluding framing bits but including FCS. (R) (mandatory) (4 bytes)

Packets 128 to 255 octets: The total number of packets (including bad packets) received that were 128..255 octets long, excluding framing bits but including FCS. (R) (mandatory) (4 bytes)

Packets 256 to 511 octets: The total number of packets (including bad packets) received that were 256..511 octets long, excluding framing bits but including FCS. (R) (mandatory) (4 bytes)

Packets 512 to 1023 octets: The total number of packets (including bad packets) received that were 512..1023 octets long, excluding framing bits but including FCS. (R) (mandatory) (4 bytes)

Packets 1024 to 1518 octets: The total number of packets (including bad packets) received that were 1024..1518 octets long, excluding framing bits but including FCS. (R) (mandatory) (4 bytes)

Actions

Create, delete, get, set

Get current data (optional)

Notifications

Threshold crossing alert

Number	Threshold crossing alert	Threshold data counter # (Note)
0	Drop events	1
1	CRC errored packets	2
2	Undersize packets	3
3	Oversize packets	4
NOTE – This number associates the TCA with the specified threshold value attribute of the threshold data 1 managed entity.		

9.3.31 Ethernet frame performance monitoring history data downstream

This managed entity is identical to the Ethernet frame performance monitoring history data upstream managed entity, with the exception that it monitors downstream traffic.

23) Clause 9.7, xDSL services

Replace Figure 9.7-1 with the following:

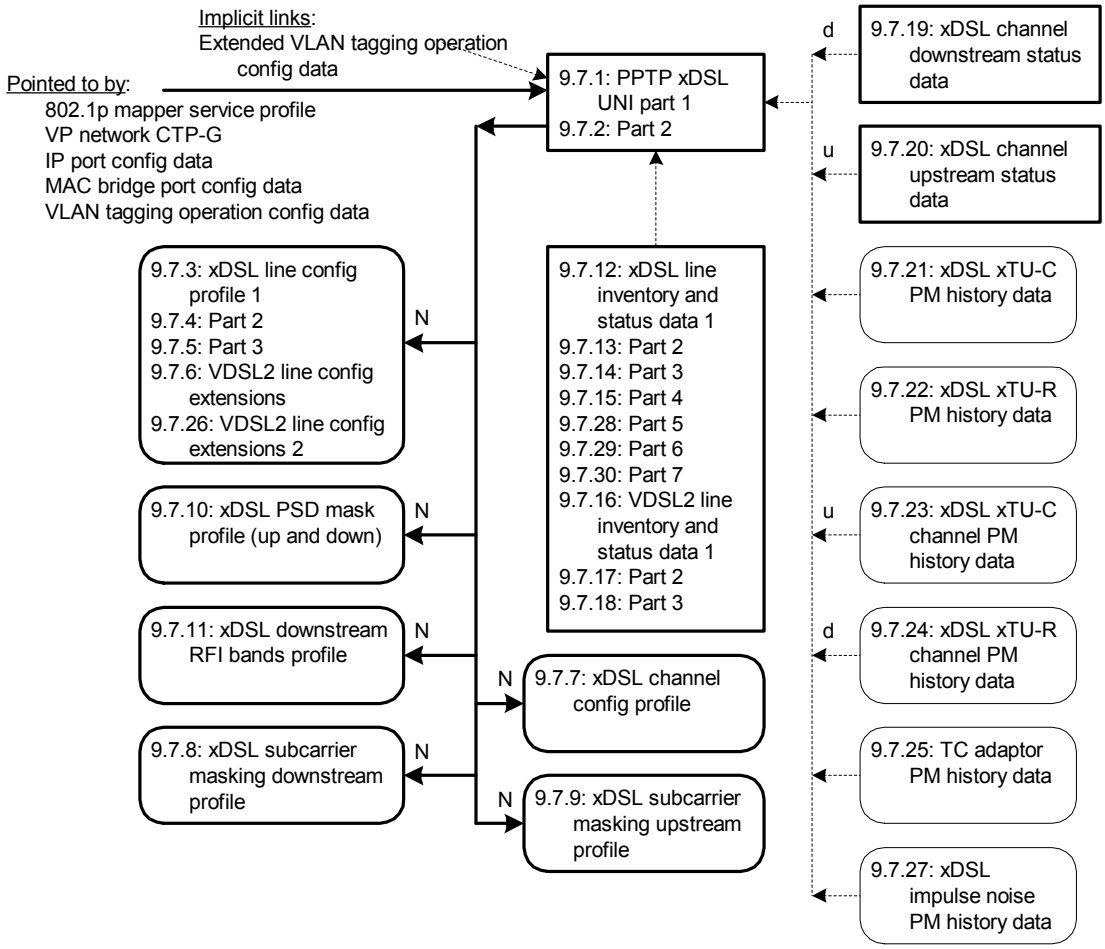


Figure 9.7-1 – Managed entities associated with physical xDSL UNIs

24) Clause 9.7.3, xDSL line configuration profile part 1

Revise the following attribute descriptions as shown:

Downstream maximum noise margin: The MAXSNRMds attribute specifies the maximum noise margin the xTU-R receiver tries to sustain. If the noise margin is above this level, the xTU-R requests the xTU-C to reduce its transmit power, if this functionality is supported by the pertinent xDSL Recommendation. Its value ranges from 0 (0.0 dB) to 310 (31.0 dB). The special value 0xFFFF indicates that the maximum noise margin limit is unbounded. (R, W, Set-by-create) (mandatory) (2 bytes)

Upstream maximum noise margin:

The MAXSNRMus attribute specifies the maximum noise margin the xTU-C receiver tries to sustain. If the noise margin is above this level, the xTU-C requests the xTU-R to reduce its transmit power, if this functionality is supported by the pertinent xDSL Recommendation. Its value ranges from 0 (0.0 dB) to 310 (31.0 dB). The special value 0xFFFF indicates that the maximum noise margin limit is unbounded. (R, W, Set-by-create) (mandatory) (2 bytes)

Downstream rate adaptation mode:

The RA-MODEds attribute specifies the mode of operation of a rate-adaptive xTU-C in the transmit direction. The parameter can take four values.

(no change in the descriptions of modes 1 and 2)

3 Mode 3: DYNAMIC – Data rate is automatically selected at initialization and is continuously adapted during showtime. The dynamic rate adaptation mode is optional. All related configuration parameters are also optional.

At startup:

The xTU-C starts up as in mode 2.

At showtime:

During showtime, rate adaptation is allowed according to the rate adaptation ratios for distributing the excess data rate amongst the bearer channels, as described in mode 2. The downstream data rate can vary between the downstream minimum data rate and the downstream maximum data rate. Downstream rate adaptation is performed when the conditions specified for downstream upshift noise margin and downstream upshift interval – or for downstream downshift noise margin and downstream downshift interval – are satisfied. This means:

- An upshift action is allowed when the downstream noise margin is above the downstream upshift noise margin during the downstream minimum time interval for upshift rate adaptation (i.e., upon RAU anomaly).
- A downshift action is allowed when the downstream noise margin is below the downstream downshift noise margin during the downstream minimum time interval for downshift rate adaptation (i.e., upon RAD anomaly).

As long as the downstream data rate is below the downstream maximum data rate for one of the bearer channels, data rate increase takes priority over transmit power reduction.

In G.993.2 startup, if it is detected that SRA is supported in the downstream direction by neither xTU, the xTUs fall back to mode 2.

4 Mode 4: DYNAMIC with SOS – Data rate is automatically selected at initialization and is continuously adapted during showtime by SOS and SRA. Rate adaptation mode 4 is optional, but if it is selected, enabling of SOS and SRA is mandatory. This mode is defined only in [ITU-T G.993.2].

At startup:

The xTU-C starts up as in mode 2.

At showtime:

SRA behaviour is the same as described for mode 3, unless the actual net data rate is below the minimum net data rate as a result of an SOS procedure.

Additionally, SOS may be performed when the conditions specified by the SOS trigger parameters are satisfied. The detailed specification of the SOS OLR procedure appears in [ITU-T G.993.2].

If at startup, it is detected that SOS is supported in the downstream direction by neither xTU, but SRA is supported by both xTUs, the xTUs fall back to mode 3.

If at startup, it is detected that neither SOS nor SRA are supported in the downstream direction by both xTUs, the xTUs fall back to mode 2.

(R, W, Set-by-create) (mandatory) (1 byte)

Upstream rate adaptation mode: The RA-MODEus attribute specifies the mode of operation of a rate-adaptive xTU-R in the transmit direction. The parameter is used only if rate-adaptive functionality is supported. It can take four values:

1 MANUAL
2 AT_INIT
3 DYNAMIC
4 DYNAMIC with SOS

The definition of each of the values is identical to its definition in the downstream rate adaptation mode (replacing *xTU-C* with *xTU-R* and *downstream* with *upstream*). (R, W, Set-by-create) (mandatory) (1 byte)

25) Clause 9.7.5, xDSL line configuration profile part 3

a) Revise the following attribute descriptions as shown:

Force INP downstream: When set to 1, the FORCEINPds attribute forces the framer settings of all downstream bearer channels to be selected such that the impulse noise protection computed according to the formula specified in the relevant Recommendation is greater than or equal to the minimal impulse noise protection requirement. The default value 0 disables this function. (R, W) (mandatory for [ITU-T G.993.2], optional for other Recommendations that support it) (1 byte)

Force INP upstream: When set to 1, the FORCEINPus attribute forces the framer settings of all upstream bearer channels to be selected such that the impulse noise protection computed according to the formula specified in the relevant Recommendation is greater than or equal to the minimal impulse noise protection requirement. The default value 0 disables this function. (R, W) (mandatory for [ITU-T G.993.2], optional for other Recommendations that support it) (1 byte)

b) Add the following attributes to this managed entity:

Update request flag for near-end test parameters: The UPDATE-TEST-NE attribute forces an update of all near-end test parameters that can be updated during showtime in [ITU-T G.993.2]. Update is triggered by setting this attribute to 1, whereupon the near-end test parameters are expected to be updated within 10 seconds, and the ONT should reset the attribute value to 0. The update request flag is independent of any autonomous update process in the system. The update request attribute must be prepared to accept another set after a period not to exceed 3 minutes, a period that starts when the flag is set via OMCI or by an autonomous process in the system. (R, W) (optional) (1 byte)

Update request flag for far-end test parameters: The UPDATE-TEST-FE attribute forces an update of all far-end test parameters that can be updated during showtime in [ITU-T G.993.2]. Update is triggered by setting this attribute to 1, whereupon the far-end test parameters are expected to be updated within 10 seconds, and the ONT should reset the attribute value to 0. The update request flag is independent of any autonomous update process in the system. The update request attribute must be prepared to accept another set after a period not to exceed 3 minutes, a period that starts when the flag is set via OMCI or by an autonomous process in the system. (R, W) (optional) (1 byte)

The following eight attributes configure the impulse noise monitoring function, whose results are available via the xDSL impulse noise monitor performance monitoring history data managed entity.

INM inter-arrival time offset upstream: INMIATOus is the inter-arrival time offset that the xTU-C receiver uses to determine in which bin of the inter-arrival time histogram the IAT is reported. Valid values for INMIATO range from 3 to 511 DMT symbols in steps of 1 DMT symbol. (R, W) (optional) (2 bytes)

INM inter-arrival time step upstream: INMIATSus is the inter-arrival time step that the xTU-C receiver uses to determine in which bin of the inter-arrival time histogram the IAT is reported. Valid values for INMIATS range from 0 to 7 in steps of 1. (R, W) (optional) (1 byte)

INM cluster continuation value upstream: INMCCus is the cluster continuation value that the xTU-C receiver uses in the cluster indication process described in the pertinent Recommendation. Valid values for INMCC range from 0 to 64 DMT symbols in steps of 1 DMT symbol. (R, W) (optional) (1 byte)

INM equivalent INP mode upstream: INM_INPEQ_MODEus is the INM equivalent INP mode that the xTU-C receiver uses in the computation of the equivalent INP, as defined in the pertinent Recommendation. Valid values for INM_INPEQ_MODE are 0..4. (R, W) (optional) (1 byte)

INM inter-arrival time offset downstream: INMIATOds is the inter-arrival time offset that the xTU-R receiver uses to determine in which bin of the inter-arrival time histogram the IAT is reported. Valid values for INMIATO range from 3 to 511 DMT symbols in steps of 1 DMT symbol. (R, W) (optional) (2 bytes)

INM inter-arrival time step downstream: INMIATSds is the inter-arrival time step that the xTU-R receiver uses to determine in which bin of the inter-arrival time histogram the IAT is reported. Valid values for INMIATS range from 0 to 7 in steps of 1. (R, W) (optional) (1 byte)

INM cluster continuation value downstream: INMCCds is the cluster continuation value that the xTU-R receiver uses in the cluster indication process described in the pertinent Recommendation. Valid values for INMCC range from 0 to 64 DMT symbols in steps of 1 DMT symbol. (R, W) (optional) (1 byte)

INM equivalent INP mode downstream: INM_INPEQ_MODEds is the INM equivalent INP mode that the xTU-R receiver uses in the computation of the equivalent INP, as defined in the pertinent Recommendation. Valid values for INM_INPEQ_MODE are 0..4. (R, W) (optional) (1 byte)

c) Add the following notifications:

Notifications

Attribute value change

Number	Attribute value change	Description
1..6	N/A	
7	Update request NE	Need only be reported on the 1 to 0 transition to signal the OLT that test parameters have been updated.
8	Update request FE	Need only be reported on the 1 to 0 transition to signal the OLT that test parameters have been updated.
9..16	Reserved	

26) Clause 9.7.6, VDSL2 line configuration extensions

a) Revise the introductory text to read:

This managed entity extends the xDSL line configuration MEs with attributes that are unique to [ITU-T G.993.2] VDSL2. Due to continuing standards development, some attributes – and therefore this managed entity – have also become applicable to other Recommendations, specifically [ITU-T G.992.3] and [ITU-T G.992.5]. The attributes of this ME are further defined in [ITU-T G.997.1]. An instance of this managed entity is created and deleted by the OLT.

b) Revise the following attribute descriptions as shown:

VDSL2 PSD mask class selection (CLASSMASK): To reduce the number of configuration possibilities, the limit PSD masks are grouped in the following PSD mask classes:

- Class 998 Annex A of [ITU-T G.993.2]: D-32, D-48, D-64, D-128
- Class 997-M1c Annex B of [ITU-T G.993.2]: 997-M1c-A-7
- Class 997-M1x Annex B of [ITU-T G.993.2]: 997-M1x-M-8, 997-M1x-M
- Class 997-M2x Annex B of [ITU-T G.993.2]: 997-M2x-M-8, 997-M2x-A, 997-M2x-M, 997E17-M2x-NUS0, 997E30-M2x-NUS0
- Class 998-M1x Annex B of [ITU-T G.993.2]: 998-M1x-A, 998-M1x-B, 998-M1x-NUS0
- Class 998-M2x Annex B of [ITU-T G.993.2]: 998-M2x-A, 998-M2x-M, 998-M2x-B, 998-M2x-NUS0, 998E17-M2x-NUS0, 998E17-M2x-NUS0-M, 998E30-M2x-NUS0, 998E30-M2x-NUS0-M

- Class 998ADE-M2x Annex B of [ITU-T G.993.2]: 998-M2x-A, 998-M2x-M, 998-M2x-B, 998-M2x-NUS0, 998ADE17-M2x-A, 998ADE17-M2x-B, 998ADE17-M2x-NUS0-M, 998ADE30-M2x-NUS0-A, 998ADE30-M2x-NUS0-M
- Class 998-B Annex C: POTS-138b, POTS-276b (clause C.2.1.1 of [ITU-T G.993.2]), TCM-ISDN (clause C.2.1.2 of [ITU-T G.993.2])
- Class 998-CO Annex C of [ITU-T G.993.2]: POTS-138co, POTS-276co (clause C.2.1.1 of [ITU-T G.993.2])
- Class HPE-M1 Annex B of [ITU-T G.993.2]: HPE17-M1-NUS0, HPE30-M1-NUS0

Each class is designed such that the PSD levels of each limit PSD mask of a specific class are equal in their respective passbands above 552 kHz.

The CLASSMASK attribute is defined per G.993.2 annex enabled in the xTSE table (see Table 9.7.12-1). It selects a single PSD mask class per G.993.2 annex to be activated at the VTU-O. The coding is as follows:

Attribute value	**G.993.2 Annex A**	**G.993.2 Annex B**	**G.993.2 Annex C**

(etc.)

UPBOSHAPED: Upstream power back-off (UPBO) is specified in [ITU-T G.993.2] to provide spectral compatibility between loops of different lengths deployed in the same cable binder. The upstream transmit PSD mask, UPBOMASKus is defined in clause 7.2.1.3.2 of [ITU-T G.993.2].

The G.993.2 UPBO configuration attributes *a* and *b* are set by the OLT via this attribute. The reference length $kl0\_REF$ is set by the companion attribute UPBO kl_{REF}-pb, defined below. Further detail appears in [ITU-T G.997.1].

(no change to the remainder of this description)

Transmitter referred virtual noise downstream table: The TXREFVNds table defines the downstream transmitter referred virtual noise. TXREFVNds is specified through a set of breakpoints. Each breakpoint comprises a subcarrier index *t*, with a subcarrier spacing of 4.3125 kHz, and a noise PSD level at that subcarrier. The set of breakpoints can then be represented as [(t_1, PSD_1), (t_2, PSD_2), … , (t_N, PSD_N)]. The subcarrier index *t* is an unsigned two-byte integer. The noise level is one byte whose value ranges from 0 (–40 dBm/Hz) to 200 (–140 dBm/Hz), in steps of 0.5 dB. Values between 201 and 254 indicate a noise PSD level of 0 W/Hz. The maximum number of breakpoints is 32; no more than 15 breakpoints may be configured below the upper edge of the passband of every mode enabled for [ITU-T G.992.3] and [ITU-T G.992.5].

(no change to the remainder of this description)

Transmitter referred virtual noise upstream table: The TXREFVNus attribute defines the upstream transmitter referred virtual noise. TXREFVNus is specified through a set of breakpoints. Each breakpoint comprises a subcarrier index *t*, with a subcarrier spacing of 4.3125 kHz, and a noise PSD level at that subcarrier. The set of breakpoints can then be represented as [(t_1, PSD_1), (t_2, PSD_2), … , (t_N,

PSD_N)]. The subcarrier index *t* is an unsigned two-byte integer. The noise level is one byte whose value ranges from 0 (–40 dBm/Hz) to 200 (–140 dBm/Hz), in steps of 0.5 dB. Values between 201 and 254 indicate a noise PSD level of 0 W/Hz. The maximum number of breakpoints is 16; no more than 3 breakpoints may be configured below the upper edge of the passband of every mode enabled for [ITU-T G.992.3] and [ITU-T G.992.5].

(no change to the remainder of this description)

c) Add the following new attribute:

UPBOKLREF-pb: This attribute represents the reference loop length, the electrical length used to compute upstream power back-off for each upstream band except US0, for the optional equalized FEXT UPBO method. The value for each upstream band ranges from 1.8 to 63.5 dB in steps of 0.1 dB, i.e., with values 18..635. The special value 0 is also allowed, with semantics as defined in clause 7.2.1.3.2 of [ITU-T G.993.2]. (R, W) (optional) (2 bytes x 5 upstream bands)

27) Clause 9.7.7, xDSL channel configuration profile

a) Revise the following attribute description as shown:

Minimum impulse noise protection: The INP_{min} attribute specifies the minimum impulse noise protection for the bearer channel if it is transported over DMT symbols with a subcarrier spacing of 4.3125 kHz. Impulse noise protection is expressed in DMT symbols with a subcarrier spacing of 4.3125 kHz. It can be 1/2 symbol or any integer number of symbols from 0 to 16, inclusive.

If the xTU does not support the configured INP_{min} value, it uses the nearest supported impulse noise protection value greater than INP_{min}.

Value	INP_{min}
1	0 symbols
2	1/2 symbol
3	1 symbol
4	2 symbols
N	(N-2) symbols, $3 \leq N \leq 18$

(R, W, Set-by-create) (optional for [ITU-T G.992.1], mandatory for other xDSL standards that use this attribute) (1 byte)

b) Add the following new attributes:

Minimum SOS bit rate downstream: The MIN-SOS-BR-ds attribute specifies the minimum net data rate required for a valid SOS request in the downstream direction. The value is coded as an unsigned integer representing the data rate as a multiple of 8 kbit/s. (R, W) (optional) (4 bytes)

Minimum SOS bit rate upstream: The MIN-SOS-BR-us attribute specifies the minimum net data rate required for a valid SOS request in the upstream direction. The value is coded as an unsigned integer representing the data rate as a multiple of 8 kbit/s. (R, W) (optional) (4 bytes)

28) Clause 9.7.12, xDSL line inventory and status data part 1

a) Revise the following attribute descriptions as shown:

xTU-R version number: This is the version number as inserted by the xTU-R in the embedded operations channel of [ITU-T G.992.1] or [b-ITU-T G.992.2], or the overhead messages of [ITU-T G.992.3], [ITU-T G.992.4], [ITU-T G.992.5] and [ITU-T G.993.2]. The attribute value may be vendor-specific, but is recommended to comprise up to 16 ASCII characters, null-terminated if it is shorter than 16. The string should contain the xTU-R firmware version and the xTU-R model, encoded in that order and separated by a space character: "<xTU-R firmware version> <xTU-R model>". It is recognized that legacy xTU-Rs may not support this format. (R) (mandatory) (16 bytes)

xTU-R serial number part 1: The serial number inserted by the xTU-R in the embedded operations channel of [ITU-T G.992.1] or [b-ITU-T G.992.2], or the overhead messages of [ITU-T G.992.3], [ITU-T G.992.4], [ITU-T G.992.5] and [ITU-T G.993.2], comprises up to 32 ASCII characters, null-terminated if it is shorter than 32. It is recommended to contain the equipment serial number, the equipment model and the equipment firmware version, encoded in that order and separated by space characters: "<equipment serial number> <equipment model> <equipment firmware version>". It is recognized that legacy xTU-Rs may not support this format. This attribute contains the first 16 characters. (R) (mandatory) (16 bytes)

xTU-R serial number part 2: This attribute contains the second 16 characters of the xTU-R serial number. (R) (mandatory) (16 bytes)

b) Modify Table 9.7.12-1 as shown:

Table 9.7.12-1 – xTU transmission system table

Octet 3	
17	Reserved.
18	Reserved.
19	G.992.3 operation over POTS non-overlapped spectrum (Annex A of [ITU-T G.992.3]).
20	G.992.3 operation over POTS overlapped spectrum (Annex A of [ITU-T G.992.3]).
21	G.992.3 operation over ISDN non-overlapped spectrum (Annex B of [ITU-T G.992.3]).
22	G.992.3 operation over ISDN overlapped spectrum (Annex B of [ITU-T G.992.3]).
23	G.992.3 operation in conjunction with TCM-ISDN non-overlapped spectrum (Annex C of [ITU-T G.992.3]).
24	G.992.3 operation in conjunction with TCM-ISDN overlapped spectrum (Annex C of [ITU-T G.992.3].

…

Octet 6	
41	G.992.5 operation over POTS non-overlapped spectrum (Annex A of [ITU-T G.992.5]).
42	G.992.5 operation over POTS overlapped spectrum (Annex A of [ITU-T G.992.5]).
43	G.992.5 operation over ISDN non-overlapped spectrum (Annex B of [ITU-T G.992.5]).
44	G.992.5 operation over ISDN overlapped spectrum (Annex B of [ITU-T G.992.5]).
45	G.992.5 operation in conjunction with TCM-ISDN non-overlapped spectrum (Annex C of [ITU-T G.992.5]).
46	G.992.5 operation in conjunction with TCM-ISDN overlapped spectrum (Annex C of [ITU-T G.992.5]).
47	G.992.5 all digital mode operation with non-overlapped spectrum (Annex I of [ITU-T G.992.5]).
48	G.992.5 all digital mode operation with overlapped spectrum (Annex I of [ITU-T G.992.5]).

29) Clause 9.7.16, VDSL2 line inventory and status data part 1

a) Revise the introductory text to read:

This managed entity extends the other xDSL line inventory and status data MEs with attributes specific to VDSL2. Due to continuing standards development, some attributes – and therefore this managed entity – have also become applicable to other Recommendations, specifically [ITU-T G.992.3] and [ITU-T G.992.5]. This ME contains general and downstream attributes.

Relationships

This is one of the status data MEs pointed to by a physical path termination point xDSL managed entity. It is meaningful if the PPTP supports [ITU-T G.992.3] and [ITU-T G.992.5] or [ITU-T G.993.2]. The ONT automatically creates or deletes an instance of this managed entity upon creation and deletion of a physical path termination point xDSL that supports these attributes.

b) Add the following new attributes:

Actual rate adaptation mode downstream: The ACT-RA-MODEds attribute indicates the actual active RA mode in the downstream direction.

1 MANUAL
2 AT_INIT
3 DYNAMIC
4 DYNAMIC with SOS ([ITU-T G.993.2] only)

(R) (optional) (1 byte)

Actual impulse noise protection ROC downstream: The ACTINP-ROC-ds attribute reports the actual impulse noise protection (INP) of the robust operations channel ROC in the downstream direction. The format and usage is identical to that of the ACTINP attribute defined in the xDSL channel downstream status data ME. (R) (optional) (1 byte)

SNR margin ROC downstream: The SNRM-ROC-ds attribute reports the actual signal-to-noise margin of the ROC in the downstream direction. Its value ranges from 0 (–64.0 dB) to 1270 (+63.0 dB). The special value 0xFFFF indicates that the attribute is out of range. (R) (optional) (2 bytes)

30) Clause 9.7.17, VDSL2 line inventory and status data part 2

a) Revise the following attribute description as shown:

UPBOKLE: This attribute contains the electrical length estimated by the VTU-O expressed in dB at 1 MHz, kl_0 (see O-UPDATE in clause 12.3.3.2.1.2 of [ITU-T G.993.2]). This is the final electrical length that would have been sent from the VTU-O to the VTU-R if the electrical length were not forced by the OLT. The value lies in the range 0 (0.0 dB) to 1280 (128.0 dB) (R) (mandatory) (2 bytes)

b) Add the following new attributes:

UPBOKLE-R: This attribute contains the electrical length estimated by the VTU-R expressed in dB at 1 MHz. This is the value contained in the message R-MSG1 (see clause 12.3.3.2.2.1 of [ITU-T G.993.2]). Its value lies in the range 0 (0.0 dB) to 1280 (128.0 dB) (R) (optional) (2 bytes)

Actual rate adaptation mode upstream: The ACT-RA-MODEus attribute indicates the actual active RA mode in the upstream direction.

1 MANUAL
2 AT_INIT
3 DYNAMIC
4 DYNAMIC with SOS ([ITU-T G.993.2] only)

(R) (optional) (1 byte)

Actual impulse noise protection ROC upstream: The ACTINP-ROC-us attribute reports the actual impulse noise protection (INP) of the robust operations channel ROC in the upstream direction. The format and usage is identical to that of the ACTINP attribute defined in the xDSL channel upstream status data ME. (R) (optional) (1 byte)

SNR margin ROC upstream: The SNRM-ROC-us attribute reports the actual signal-to-noise margin of the ROC in the upstream direction. Its value ranges from 0 (–64.0 dB) to 1270 (+63.0 dB). The special value 0xFFFF indicates that the attribute is out of range. (R) (optional) (2 bytes)

31) Clause 9.7.19, xDSL channel downstream status data

a) Replace:

Actual impulse noise protection: The ACTINP attribute reports the actual impulse noise protection (INP) on the bearer channel in the L0 state. In the L1 or L2 state, the attribute contains the INP in the previous L0 state.

For ADSL, this value is computed according to the formula specified in the relevant Recommendation based on the actual framing attributes. G.993.2 VDSL2 specifies no means to retrieve the impulse noise protection estimated by the xTU-R receiver. Therefore, the far-end ACTINP is computed according to the INP_no_erasure formula.

The value of this attribute is a number of DMT symbols, with a granularity of 0.1 symbols. Its range is from 0 (0.0 symbols) to 254 (25.4 symbols). The special value 255 indicates an ACTINP higher than 25.4.

(R) (mandatory) (1 byte)

With:

Actual impulse noise protection: The ACTINP attribute reports the actual impulse noise protection (INP) on the bearer channel in the L0 state. In the L1 or L2 state, the attribute contains the INP in the previous L0 state. The value of this attribute is a number of DMT symbols, with a granularity of 0.1 symbols. Its range is from 0 (0.0 symbols) to 254 (25.4 symbols). The special value 255 indicates an ACTINP higher than 25.4.

(R) (optional for [ITU-T G.992.1], mandatory for other xDSL Recommendations that support this attribute) (1 byte)

b) Revise the following attribute description as shown:

Actual interleaving block length: The INTLVBLOCK attribute reports the actual block length of the interleaver used in the latency path in which the bearer channel is transported. The value ranges from 4..255 in steps of 1. (R) (mandatory for G.993.2 VDSL2, undefined for others) (1 byte)

32) Clause 9.7.20, xDSL channel upstream status data

Revise the following attribute description as shown:

Actual impulse noise protection: The ACTINP attribute reports the actual impulse noise protection (INP) on the bearer channel in the L0 state. In the L1 or L2 state, the attribute contains the INP in the previous L0 state. The value is coded in fractions of DMT symbols with a granularity of 0.1 symbols. The range is from 0 (0.0 symbols) to 254 (25.4 symbols). The special value 255 indicates an ACTINP higher than 25.4. (R) (mandatory for G.993.2 VDSL2, optional for other xDSL Recommendations that support it) (1 byte)

33) Clause 9.7.21, xDSL xTU-C performance monitoring history data

Add the following new attributes:

SOS success count, near end: The SOS-SUCCESS-NE attribute is a count of the total number of successful SOS procedures initiated by the near-end xTU on the line during the accumulation period. Successful SOS is defined in clause 12.1.4 of [ITU-T G.993.2]. (R) (optional) (2 bytes)

SOS success count, far end: The SOS-SUCCESS-FE attribute is a count of the total number of successful SOS procedures initiated by the far-end xTU on the line during the accumulation period. Successful SOS is defined in clause 12.1.4 of [ITU-T G.993.2]. (R) (optional) (2 bytes)

34) Clause 9.7

Add the following new clauses after clause 9.7.25:

9.7.26 VDSL2 line configuration extensions 2

This managed entity extends the xDSL line configuration MEs with attributes that are unique to G.993.2 VDSL2. However, two of the attributes (FEXT and NEXT TXREFVNds) are used in [ITU-T G.992.3] and [ITU-T G.992.5]. The attributes of this ME are further defined in [ITU-T G.997.1]. An instance of this managed entity is created and deleted by the OLT.

Relationships

An instance of this managed entity may be associated with zero or more instances of the physical path termination point xDSL UNI part 1.

The overall xDSL line configuration profile is modelled in several parts, all of which are associated together through a common managed entity ID. (The client physical path termination point xDSL UNI part 1 has a single pointer, which refers to the entire set of line configuration parts.)

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. All xDSL and VDSL2 line configuration profiles that pertain to a given physical path termination point xDSL must share a common managed entity id. (R, Set-by-create) (mandatory) (2 bytes)

SOS time downstream: The SOS-TIME-ds attribute is used in the specification of receiver initiated SOS (see clause 13.4.3 of [ITU-T G.993.2]). If the attribute value is not zero, the standard SOS triggering criteria are enabled, and the value specifies the duration of the window used in the standard SOS triggering criteria in the downstream direction. The special value zero indicates that the standard SOS triggering criteria are disabled, i.e., vendor discretionary values may be used instead of the values configured in the MIB for the following parameters: SOS-NTONES-ds, SOS-CRC-ds, SOS-TIME-ds. The valid range of non-zero values is from 1..255, specifying 64 to 16320 ms in steps of 64 ms. (R, W, Set-by-create) (optional) (1 byte)

SOS time upstream: The SOS-TIME-us attribute is used in the specification of receiver initiated SOS (see clause 13.4.3 of [ITU-T G.993.2]). If the attribute value is not zero, the standard SOS triggering criteria are enabled, and the value specifies the duration of the window used in the standard SOS triggering criteria in the upstream direction. The special value zero indicates that the standard SOS triggering criteria are disabled, i.e., vendor discretionary values may be used instead of the values configured in the MIB for the following parameters: SOS-NTONES-us, SOS-CRC-us, SOS-TIME-us. The valid range of non-zero values is from 1..255, specifying 64 to 16320 ms in steps of 64 ms. (R, W, Set-by-create) (optional) (1 byte)

SOS degraded tones threshold downstream: The SOS-NTONES-ds attribute is the minimum percentage of tones in the downstream medley set that must be degraded in order to arm the first sub-condition of the standard SOS triggering criteria in the downstream direction. The valid range of values is from 1 to 100% in steps of 1. Use of the special value 0 is described in clause 13.4.3.2 of [ITU-T G.993.2]. (R, W, Set-by-create) (optional) (1 byte)

SOS degraded tones threshold upstream: The SOS-NTONES-us attribute is the minimum percentage of tones in the upstream medley set that must be degraded in order to arm the first sub-condition of the standard SOS triggering criteria in the upstream direction. The valid range of values is from 1 to 100% in steps of 1. Use of the special value 0 is described in clause 13.4.3.2 of [ITU-T G.993.2]. (R, W, Set-by-create) (optional) (1 byte)

SOS CRC threshold downstream: The SOS-CRC-ds attribute is the minimum number of normalized CRC anomalies received in SOS-TIME-ds seconds in order to arm the second sub-condition of the standard SOS triggering criteria (see clause 13.4.3.2 of [ITU-T G.993.2]) in the downstream direction. The valid range of SOS-CRC values is 0.02 to (2^{16}–1) * 0.02, in steps of 0.02. (R, W, Set-by-create) (optional) (2 bytes)

SOS CRC threshold upstream: The SOS-CRC-us attribute is the minimum number of normalized CRC anomalies received in SOS-TIME-us seconds in order to arm the second sub-condition of the standard SOS triggering criteria (see clause 13.4.3.2 of [ITU-T G.993.2]) in the upstream direction. The valid range of SOS-CRC values is 0.02 to (2^{16}–1) * 0.02, in steps of 0.02. (R, W, Set-by-create) (optional) (2 bytes)

MAX SOS downstream: The MAX-SOS-ds attribute is used in deactivation. If the number of successful SOS procedures in the downstream direction performed within a 120-second interval exceeds MAX-SOS-ds, the modem goes to state L3. See clause 12.1.4 of [ITU-T G.993.2] for details. The valid range of values is 1 to 15, with special value 0 as described in clause 12.1 of [ITU-T G.993.2]. (R, W, Set-by-create) (optional) (1 byte)

MAX SOS upstream: The MAX-SOS-us attribute is used in deactivation. If the number of successful SOS procedures in the upstream direction performed within a 120-second interval exceeds MAX-SOS-us, the modem goes to state L3. See clause 12.1.4 of [ITU-T G.993.2] for details. The valid range of values is 1 to 15, with special value 0 as described in clause 12.1 of [ITU-T G.993.2]. (R, W, Set-by-create) (optional) (1 byte)

SNR max offset downstream: The SNRMOFFSET-ROC-ds attribute is the SNR margin offset for the robust operations channel ROC in the downstream direction. The attribute is used in the specification of the channel initialization policy (see clause 12.3.7.1 of [ITU-T G.993.2]). The valid range of SNR margin offset values is from 0..31 dB in 0.1 dB steps. (R, W, Set-by-create) (optional) (2 bytes)

SNR max offset upstream: The SNRMOFFSET-ROC-us attribute is the SNR margin offset for the robust operations channel ROC in the upstream direction. The attribute is used in the specification of the channel initialization policy (see clause 12.3.7.1 of [ITU-T G.993.2]). The valid range of SNR margin offset values is from 0..31 dB in 0.1 dB steps. (R, W, Set-by-create) (optional) (2 bytes)

ROC minimum impulse noise protection downstream: The INPMIN-ROC-ds attribute specifies the minimum impulse noise protection to apply on the robust operations channel ROC in the downstream direction. The minimum impulse noise protection is an integer ranging from 0 to 16. (R, W, Set-by-create) (optional) (1 byte)

ROC minimum impulse noise protection upstream: The INPMIN-ROC-us attribute specifies the minimum impulse noise protection to apply on the robust operations channel ROC in the upstream direction. The minimum impulse noise protection is an integer ranging from 0 to 16. (R, W, Set-by-create) (optional) (1 byte)

FEXT downstream transmitter referred virtual noise table: The FEXT TXREFVNds attribute is the downstream transmitter referred virtual noise specified for $FEXT_R$ duration in G.992.3 (ADSL2) Annex C and G.992.5 (ADSL2plus) Annex C. The syntax of this attribute is the same as that of the TXREFVNds table attribute of the VDSL2 line configuration extensions managed entity. (R, W) (mandatory for G.992.3 Annex C and G.992.5 Annex C) (3N bytes, where N is the number of breakpoints)

NEXT downstream transmitter referred virtual noise table: The NEXT TXREFVNds attribute is the downstream transmitter referred virtual noise specified for $NEXT_R$ duration in G.992.3 (ADSL2) Annex C and G.992.5 (ADSL2plus) Annex C. The syntax of this attribute is the same as that of the TXREFVNds table attribute of the VDSL2 line configuration extensions managed entity. (R, W) (mandatory for G.992.3 Annex C and G.992.5 Annex C) (3N bytes, where N is the number of breakpoints)

Actions

Create, delete, get, get next, set

Notifications

None.

9.7.27 xDSL impulse noise monitor performance monitoring history data

This managed entity collects performance monitoring data from the impulse noise monitor function at both near and far ends. Instances of this managed entity are created and deleted by the OLT. Note that [ITU-T G.997.1] only requires current and previous 15-minute interval storage; a longer view of this PM is not expected at 15-minute granularity.

For a complete discussion of generic PM architecture, refer to clause I.1.9.

Relationships

An instance of this managed entity may be associated with a physical path termination point xDSL UNI. This managed entity is meaningful only for G.993.2 VDSL2, [ITU-T G.992.3] and [ITU-T G.992.5].

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. The managed entity ID is identical to that of this ME's parent physical path termination point xDSL UNI part 1. (R, Set-by-create) (mandatory) (2 bytes)

Interval end time: This attribute identifies the most recently finished 15-minute interval. (R) (mandatory) (1 byte)

Threshold data 1/2 id: No thresholds are defined for this managed entity. For uniformity with other PM, the attribute is retained and shown as mandatory, but it should be set to a null pointer. (R, W, Set-by-create) (mandatory) (2 bytes)

INM INPEQ histogram table: INMINPEQ1..17-L is a count of the near-end INMAINPEQi anomalies occurring on the line during the accumulation period. This parameter is subject to inhibiting – see clause 7.2.7.13 of [ITU-T G.997.1]. (R) (optional) (2 bytes × 17 entries = 34 bytes)

INM total measurement: INMME-L is a count of the near-end INMAME anomalies occurring on the line during the accumulation period. This parameter is subject to inhibiting – see clause 7.2.7.13 of [ITU-T G.997.1]. (R) (optional) (2 bytes)

INM IAT histogram: INMIAT0..7-L is a count of the near-end INMAIATi anomalies occurring on the line during the accumulation period. This parameter is subject to inhibiting – see clause 7.2.7.13 of [ITU-T G.997.1]. (R) (optional) (2 bytes × 8 entries = 16 bytes)

INM INPEQ histogram LFE table: INMINPEQ1..17-LFE is a count of the far-end INMAINPEQi anomalies occurring on the line during the accumulation period. This parameter is subject to inhibiting – see clause 7.2.7.13 of [ITU-T G.997.1]. (R) (optional) (2 bytes × 17 entries = 34 bytes)

INM total measurement LFE: INMME-LFE is a count of the far-end INMAME anomalies occurring on the line during the accumulation period. This parameter is subject to inhibiting – see clause 7.2.7.13 of [ITU-T G.997.1]. (R) (optional) (2 bytes)

INM IAT histogram LFE: INMIAT0..7-LFE is a count of the far-end INMAIATi anomalies occurring on the line during the accumulation period. This parameter is subject to inhibiting – see clause 7.2.7.13 of [ITU-T G.997.1]. (R) (optional) (2 bytes × 8 entries = 16 bytes)

Actions

Create, delete, get, get next, set

Get current data (optional)

Notifications

None.

9.7.28 xDSL line inventory and status data part 5

This managed entity extends the attributes defined in the xDSL line inventory and status data parts 1..4. This ME reports FEXT and NEXT attributes, and pertains to G.992.3 (ADSL2) Annex C and G.992.5 (ADSL2plus) Annex C.

Relationships

This is one of the status data MEs pointed to by a physical path termination point xDSL managed entity. The ONT automatically creates or deletes an instance of this managed entity upon creation or deletion of a physical path termination point xDSL that supports these attributes.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Through an identical id, this managed entity is implicitly linked to an instance of the physical path termination point xDSL managed entity. (R) (mandatory) (2 bytes)

FEXT downstream signal-to-noise ratio margin: The FEXT SNRMds attribute is the downstream signal-to-noise ratio margin measured during $FEXT_R$ duration at the ATU-R. The attribute value ranges from 0 (–64.0 dB) to 1270 (+63.0 dB). The special value 0xFFFF indicates that the attribute is out of range. (R) (mandatory) (2 bytes)

NEXT downstream signal-to-noise ratio margin: The NEXT SNRMds attribute is the downstream signal-to-noise ratio margin measured during $NEXT_R$ duration at the ATU-R. The attribute value ranges from 0 (–64.0 dB) to 1270 (+63.0 dB). The special value 0xFFFF indicates that the attribute is out of range. (R) (mandatory) (2 bytes)

FEXT upstream signal-to-noise ratio margin: The FEXT SNRMus attribute is the upstream signal-to-noise ratio margin (see clause 7.5.1.16 of [ITU-T G.997.1]) measured during $FEXT_C$ duration at the ATU-C. The attribute value ranges from 0 (–64.0 dB) to 1270 (+63.0 dB). The special value 0xFFFF indicates that the attribute is out of range. (R) (mandatory) (2 bytes)

NEXT upstream signal-to-noise ratio margin: The NEXT SNRMus attribute is the upstream signal-to-noise ratio margin (see clause 7.5.1.16 of [ITU-T G.997.1]) measured during $NEXT_C$ duration at the ATU-C. The attribute value ranges from 0 (–64.0 dB) to 1270 (+63.0 dB). The special value 0xFFFF indicates that the attribute is out of range. (R) (mandatory) (2 bytes)

FEXT downstream maximum attainable data rate: The FEXT ATTNDRds attribute is the maximum downstream net data rate calculated from FEXT downstream SNR(f) (see clause 7.5.1.19.1 of [ITU-T G.997.1]). The rate is coded in bit/s. (R) (mandatory) (4 bytes)

NEXT downstream maximum attainable data rate: The NEXT ATTNDRds attribute is the maximum downstream net data rate calculated from NEXT downstream SNR(f) (see clause 7.5.1.19.2 of [ITU-T G.997.1]). The rate is coded in bit/s. (R) (mandatory) (4 bytes)

FEXT upstream maximum attainable data rate: The FEXT ATTNDRus attribute is the maximum upstream net data rate calculated from FEXT upstream SNR(f) (see clause 7.5.1.20.1 of [ITU-T G.997.1]). The rate is coded in bit/s. (R) (mandatory) (4 bytes)

NEXT upstream maximum attainable data rate: The NEXT ATTNDRus attribute is the maximum upstream net data rate calculated from NEXT upstream SNR(f) (see clause 7.5.1.20.2 of [ITU-T G.997.1]). The rate is coded in bit/s. (R) (mandatory) (4 bytes)

FEXT downstream actual power spectral density: The FEXT ACTPSDds attribute is the average downstream transmit PSD over the used subcarriers (see clause 7.5.1.21 of [ITU-T G.997.1]) calculated from the REFPSDds and RMSGIds for $FEXT_R$ duration. The attribute value ranges from 0 (–90.0 dBm/Hz) to 900 (0.0 dBm/Hz). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

NEXT downstream actual power spectral density: The NEXT ACTPSDds attribute is the average downstream transmit PSD over the used subcarriers (see clause 7.5.1.21 of [ITU-T G.997.1]) calculated from the REFPSDds and RMSGIds for $NEXT_R$ duration. The attribute value ranges from 0 (–90.0 dBm/Hz) to 900 (0.0 dBm/Hz). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

FEXT upstream actual power spectral density: The FEXT ACTPSDus attribute is the average upstream transmit PSD over the used subcarriers (see clause 7.5.1.22 of [ITU-T G.997.1]) calculated from the REFPSDus and RMSGIus for $FEXT_C$ duration. The attribute value ranges from 0 (–90.0 dBm/Hz) to 900 (0.0 dBm/Hz). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

NEXT upstream actual power spectral density: The NEXT ACTPSDus attribute is the average upstream transmit PSD over the used subcarriers (see clause 7.5.1.22 of [ITU-T G.997.1]) calculated from the REFPSDus and RMSGIus for $NEXT_C$ duration. The attribute value ranges from 0 (–90.0 dBm/Hz) to 900 (0.0 dBm/Hz). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

FEXT downstream actual aggregate transmit power: The FEXT ACTATPds attribute is the total amount of transmit power (see clause 7.5.1.24 of [ITU-T G.997.1]) calculated from PSDds measured during $FEXT_R$ duration at the ATU-R. The attribute value ranges from 0 (–31.0 dBm) to 620 (+31.0 dBm). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

NEXT downstream actual aggregate transmit power: The NEXT ACTATPds attribute is the total amount of transmit power (see clause 7.5.1.24 of [ITU-T G.997.1]) calculated from PSDds measured during $NEXT_R$ duration at the ATU-R. The attribute value ranges from 0 (–31.0 dBm) to 620 (+31.0 dBm). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

FEXT upstream actual aggregate transmit power: The FEXT ACTATPus attribute is the total transmit power (see clause 7.5.1.25 of [ITU-T G.997.1]) calculated from PSDus measured during $FEXT_C$ duration at the ATU-C. The attribute value ranges from 0 (–31.0 dBm) to 620 (+31.0 dBm). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

NEXT upstream actual aggregate transmit power: The NEXT ACTATPus attribute is the total transmit power (see clause 7.5.1.25 of [ITU-T G.997.1]) calculated from PSDus measured during $NEXT_C$ duration at the ATU-C. The attribute value ranges from 0 (–31.0 dBm) to 620 (+31.0 dBm). The special value 0xFFFF indicates that the parameter is out of range. (R) (mandatory) (2 bytes)

Actions

Get, get next

Notifications

None.

9.7.29 xDSL line inventory and status data part 6

This managed entity extends the attributes defined in the xDSL line inventory and status data parts 1..4. This ME reports FEXT and NEXT attributes, and pertains to G.992.3 (ADSL2) Annex C and G.992.5 (ADSL2plus) Annex C.

Relationships

This is one of the status data MEs pointed to by a physical path termination point xDSL managed entity. The ONT automatically creates or deletes an instance of this managed entity upon creation or deletion of a physical path termination point xDSL that supports these attributes.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Through an identical id, this managed entity is implicitly linked to an instance of the physical path termination point xDSL managed entity. (R) (mandatory) (2 bytes)

FEXT downstream quiet line noise PSD measurement time: The FEXT QLNMTds attribute is the number of symbols used to measure FEXT downstream QLN(f) (see clause 7.5.1.27.3.1 of [ITU-T G.997.1]). (R) (mandatory) (2 bytes)

NEXT downstream quiet line noise PSD measurement time: The NEXT QLNMTds attribute is the number of symbols used to measure NEXT downstream QLN(f) (see clause 7.5.1.27.3.2 of [ITU-T G.997.1]). (R) (mandatory) (2 bytes)

FEXT downstream QLN(f) table: The FEXT QLNpsds attribute is the downstream QLN(f) (see clause 7.5.1.27.3 of [ITU-T G.997.1]) measured during $FEXT_R$ duration at the ATU-R. The attribute syntax is the same as that of the downstream QLNpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

NEXT downstream QLN(f) table: The NEXT QLNpsds attribute is the downstream QLN(f) (see clause 7.5.1.27.3 of [ITU-T G.997.1]) measured during $NEXT_R$ duration at the ATU-R. The attribute syntax is the same as that of the downstream QLNpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

FEXT upstream quiet line noise PSD measurement time: The FEXT QLNMTus attribute is the number of symbols used to measure FEXT upstream QLN(f) (see clause 7.5.1.27.6.1 of [ITU-T G.997.1]). (R) (mandatory) (2 bytes)

NEXT upstream quiet line noise PSD measurement time: The NEXT QLNMTus attribute is the number of symbols used to measure NEXT upstream QLN(f) (see clause 7.5.1.27.6.2 of [ITU-T G.997.1]). (R) (mandatory) (2 bytes)

FEXT upstream QLN(f) table: The FEXT QLNpsus attribute is the upstream QLN(f) (see clause 7.5.1.27.6 of [ITU-T G.997.1]) measured during $FEXT_C$ duration at the ATU-C. The attribute syntax is the same as that of the downstream QLNpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

NEXT upstream QLN(f) table: The NEXT QLNpsus attribute is the upstream QLN(f) (see clause 7.5.1.27.6 of [ITU-T G.997.1]) measured during $NEXT_C$ duration at the ATU-C. The attribute syntax is the same as that of the downstream QLNpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

FEXT downstream SNR measurement time: The FEXT SNRMTds attribute is the number of symbols used to measure FEXT downstream SNR(f) values (see clause 7.5.1.28.1.1 of [ITU-T G.997.1]). Its value corresponds to the value specified in the Recommendation (e.g., the number of symbols in a 1-second interval for [ITU-T G.992.3]). (R) (mandatory) (2 bytes)

NEXT downstream SNR measurement time: The NEXT SNRMTds attribute is the number of symbols used to measure NEXT downstream SNR(f) values (see clause 7.5.1.28.1.2 of [ITU-T G.997.1]). Its value corresponds to the value specified in the Recommendation (e.g., the number of symbols in a 1-second interval for [ITU-T G.992.3]). (R) (mandatory) (2 bytes)

FEXT downstream SNR(f) table: The FEXT SNRpsds attribute is the downstream SNR(f) (see clause 7.5.1.28.3 of [ITU-T G.997.1]) measured during $FEXT_R$ duration at the ATU-R. The attribute is represented in the same way as the SNRpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

NEXT downstream SNR(f) table: The NEXT SNRpsds attribute is the downstream SNR(f) (see clause 7.5.1.28.3 of [ITU-T G.997.1]) measured during $NEXT_R$ duration at the ATU-R. The attribute is represented in the same way as the SNRpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

FEXT upstream SNR measurement time: The FEXT SNRMTus attribute is the number of symbols used to measure FEXT upstream SNR(f) values (see clause 7.5.1.28.4.1 of [ITU-T G.997.1]). Its value corresponds to the value specified in the Recommendation (e.g., the number of symbols in a 1-second interval for [ITU-T G.992.3]). (R) (mandatory) (2 bytes)

NEXT upstream SNR measurement time: The NEXT SNRMTus attribute is the number of symbols used to measure NEXT upstream SNR(f) values (see clause 7.5.1.28.4.2 of [ITU-T G.997.1]). Its value corresponds to the value specified in the Recommendation (e.g., the number of symbols in a 1-second interval for [ITU-T G.992.3]). (R) (mandatory) (2 bytes)

FEXT upstream SNR(f) table: The FEXT SNRpsus attribute is the upstream SNR(f) (see clause 7.5.1.28.6 of [ITU-T G.997.1]) measured during $FEXT_C$ duration at the ATU-C. The attribute is represented in the same way as the SNRpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

NEXT upstream SNR(f) table: The NEXT SNRpsus attribute is the upstream SNR(f) (see clause 7.5.1.28.6 of [ITU-T G.997.1]) measured during $NEXT_C$ duration at the ATU-C. The attribute is represented in the same way as the SNRpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

Actions

Get, get next

Notifications

None.

9.7.30 xDSL line inventory and status data part 7

This managed entity extends the attributes defined in the xDSL line inventory and status data parts 1..4. This ME reports FEXT and NEXT attributes, and pertains to G.992.3 (ADSL2) Annex C and G.992.5 (ADSL2plus) Annex C.

Relationships

This is one of the status data MEs pointed to by a physical path termination point xDSL managed entity. The ONT automatically creates or deletes an instance of this managed entity upon creation or deletion of a physical path termination point xDSL that supports these attributes.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Through an identical id, this managed entity is implicitly linked to an instance of the physical path termination point xDSL managed entity. (R) (mandatory) (2 bytes)

FEXT downstream bits allocation table: The FEXT BITSpsds attribute is the downstream bits allocation table per subcarrier (see clause 7.5.1.29.1 of [ITU-T G.997.1]) used during $FEXT_R$ duration. The syntax of this attribute is the same as that of the BITSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

NEXT downstream bits allocation table: The NEXT BITSpsds attribute is the downstream bits allocation table per subcarrier (see clause 7.5.1.29.1 of [ITU-T G.997.1]) used during $NEXT_R$ duration. The syntax of this attribute is the same as that of the BITSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarrier groups)

FEXT upstream bits allocation table: The FEXT BITSpsus attribute is the upstream bits allocation table per subcarrier (see clause 7.5.1.29.2 of [ITU-T G.997.1]) used during $FEXT_C$ duration. The syntax of this attribute is the same as that of the BITSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarriers)

NEXT upstream bits allocation table: The NEXT BITSpsus attribute is the upstream bits allocation table per subcarrier (see clause 7.5.1.29.2 of [ITU-T G.997.1]) used during $NEXT_C$ duration. The syntax of this attribute is the same as that of the BITSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (N bytes, where N is the number of subcarriers)

FEXT downstream gains allocation table: The FEXT GAINSpsds attribute is the downstream gains allocation table per subcarrier (see clause 7.5.1.29.3 of [ITU-T G.997.1]) used during $FEXT_R$ duration. The syntax of this attribute is the same as that of the GAINSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (2N bytes, where N is the number of subcarriers)

NEXT downstream gains allocation table: The NEXT GAINSpsds attribute is the downstream gains allocation table per subcarrier (see clause 7.5.1.29.3 of [ITU-T G.997.1]) used during $NEXT_R$ duration. The syntax of this attribute is the same as that of the GAINSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (2N bytes, where N is the number of subcarriers)

FEXT upstream gains allocation table: The FEXT GAINSpsus attribute is the upstream gains allocation table per subcarrier (see clause 7.5.1.29.4 of [ITU-T G.997.1]) used during $FEXT_C$ duration. The syntax of this attribute is the same as that of the GAINSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (2N bytes, where N is the number of subcarriers)

NEXT upstream gains allocation table: The NEXT GAINSpsus attribute is the upstream gains allocation table per subcarrier (see clause 7.5.1.29.4 of [ITU-T G.997.1]) used during $NEXT_C$ duration. The syntax of this attribute is the same as that of the GAINSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (2N bytes, where N is the number of subcarriers)

FEXT downstream transmit spectrum shaping table: The FEXT TSSpsds attribute is the downstream transmit spectrum shaping parameter set per subcarrier (see clause 7.5.1.29.5 of [ITU-T G.997.1]) used during $FEXT_R$ duration. The syntax of this attribute is the same as that of the TSSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (3N bytes, where N is the number of breakpoints)

NEXT downstream transmit spectrum shaping table: The NEXT TSSpsds attribute is the downstream transmit spectrum shaping parameter set per subcarrier (see clause 7.5.1.29.5 of [ITU-T G.997.1]) used during $NEXT_R$ duration. The syntax of this attribute is the same as that of the TSSpsds table attribute of the xDSL line inventory and status data part 3 managed entity. (R) (mandatory) (3N bytes, where N is the number of breakpoints)

FEXT upstream transmit spectrum shaping table: The FEXT TSSpsus attribute is the upstream transmit spectrum shaping parameter set per subcarrier (see clause 7.5.1.29.6 of [ITU-T G.997.1]) used during $FEXT_C$ duration. The syntax of this attribute is the same as that of the TSSpsus table attribute of the xDSL line inventory and status data part 4 managed entity. (R) (mandatory) (3N bytes, where N is the number of breakpoints)

NEXT upstream transmit spectrum shaping table: The NEXT TSSpsus attribute is the upstream transmit spectrum shaping parameter set per subcarrier (see clause 7.5.1.29.6 of [ITU-T G.997.1]) used during $NEXT_C$ duration. The syntax of this attribute is the same as that of the TSSpsus table attribute of the xDSL line inventory and status data part 4 managed entity. (R) (mandatory) (3N bytes, where N is the number of breakpoints)

Actions

Get, get next

Notifications

None.

35) Clause 9.8, TDM services

Replace Figure 9.8-1 with the following:

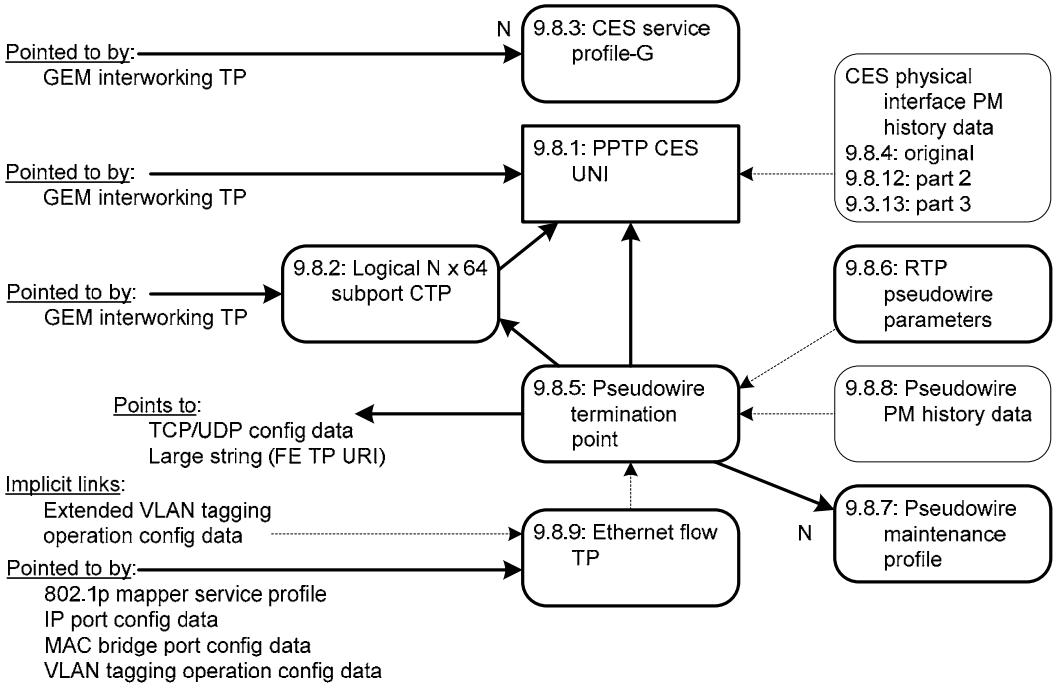


Figure 9.8-1 – Managed entities associated with CES UNIs

36) Clause 9.8.1, Physical path termination point CES UNI

a) Replace:

DS1 framing: This attribute specifies the DS1 framing structure. Valid values are:

0 Extended superframe.
1 Superframe.
2 Unframed.
3 G.704.
4 JT-G.704.

Upon ME instantiation, the ONT sets this attribute to 0. (R, W) (mandatory for DS1 interfaces) (1 byte)

With:

Framing: This attribute specifies the framing structure.

These code points are for use with DS1 services. Code point 2 may also be used for unframed E1 service.

0 Extended superframe
1 Superframe
2 Unframed
3 G.704

NOTE – [ITU-T G.704] describes both SF and ESF framing for DS1 signals. This code point is retained for backward compatibility, but its meaning is undefined.

4 JT-G.704

The following code points are for use with E1 services.

5 Basic framing: clause 2.3.2 of [ITU-T G.704]
6 Basic framing with CRC-4: clause 2.3.3 of [ITU-T G.704]

7 Basic framing with TS16 multiframe
8 Basic framing with CRC-4 and TS16 multiframe

Upon ME instantiation, the ONT sets this attribute to a value that reflects the vendor's default. (R, W) (optional) (1 byte)

b) Replace:

DS1 mode: This attribute specifies the mode of a DS1. Valid values are as shown:

Value	Mode	Connect	Line length	Power	Loopback
0	#1	DS1 CPE	Short haul	No power feed	Smart jack
1	#2	DS1 CPE	Long haul	No power feed	Smart jack
2	#3	DS1 NIU CPE	Long haul	No power feed	Intelligent office repeater
3	#4	DS1 NIU CPE	Long haul	With power feed	Intelligent office repeater

Upon ME instantiation, the ONT sets this attribute to 0. (R, W) (optional) (1 byte)

Line type: This attribute specifies the line type used in a DS3 or E3 application. Valid values are:

0 Other.
1 ds3 m23.
2 ds3 syntran.
3 ds3 Cbit parity.
4 ds3 clear channel.
5 e3 framed.
6 e3 plcp.

(R, W) (mandatory for DS3 and E3 interfaces, not applicable to other interfaces) (1 byte)

With:

DS1 mode: This attribute specifies the mode of a DS1. Valid values are as shown:

Value	Mode	Connect	Line length	Power	Loopback
0	#1	DS1 CPE	Short haul	No power feed	Smart jack
1	#2	DS1 CPE	Long haul	No power feed	Smart jack
2	#3	DS1 NIU CPE	Long haul	No power feed	Intelligent office repeater. Transparent to FDL
3	#4	DS1 NIU CPE	Long haul	With power feed	Intelligent office repeater. Transparent to FDL

In the event of conflicting values between this attribute and the (also optional) line length attribute, the line length attribute is taken to be valid. This permits the separation of LBO and power settings from smart jack and FDL behaviour. Upon ME instantiation, the ONT sets this attribute to 0. (R, W) (optional) (1 byte)

Line type: This attribute specifies the line type used in a DS3 or E3 application, or when the sensed type of the PPTP is configurable. Valid values are:

0 Other
1 ds3 m23
2 ds3 syntran
3 ds3 Cbit parity
4 ds3 clear channel
5 e3 framed
6 e3 plcp
7 DS1
8 E1
9 J1

(R, W) (mandatory for DS3, E3 and multi-configuration interfaces, not applicable to other interfaces) (1 byte)

c) Add the following alarms:

Number	Alarm	Description
20	AIS-CI	Refer to [b-ATIS 0300231]
21	DS1 idle	Refer to [b-ANSI T1.403]
22	RAI-CI	Refer to [b-ATIS 0300231]
23..207	Reserved	

37) Clause 9.8.4, CES physical interface performance monitoring history data

a) Replace:

This managed entity collects statistics for a CES physical interface. Interfaces include DS1, DS3, E1, E3, J1, J2 and possibly others. The performance management requirements of particular interfaces are described in the corresponding ITU-T or other standard document, e.g., [ITU-T G.784].

With:

This managed entity collects statistics for a CES physical interface. Interfaces include DS1, DS3, E1, E3, J1, J2 and possibly others. The performance management requirements of particular interfaces are described in the corresponding ITU-T or other standard document, e.g., [ITU-T G.784] or [b-ATIS 0300231].

b) Replace:

Threshold data 1/2 id: This attribute points to an instance of the threshold data 1 managed entity that contains PM threshold values. Since no threshold value attribute number exceeds 7, a threshold data 2 ME is optional. (R, W, Set-by-create) (mandatory) (2 bytes)

Errored seconds: (R) (mandatory) (2 bytes)

Severely errored seconds: (R) (mandatory) (2 bytes)

Burst errored seconds: A burst errored second is any second that is not a UAS, that contains between 2 and 319 error events but no LOS, AIS or OOF condition. (R) (optional) (2 bytes)

Unavailable seconds: (R) (mandatory) (2 bytes)

Controlled slip seconds: (R) (mandatory) (2 bytes)

With:

Threshold data 1/2 id: This attribute points to an instance of the threshold data 1 managed entity that contains PM threshold values. Since no mandatory threshold value attribute number exceeds 7, a threshold data 2 ME is optional. (R, W, Set-by-create) (mandatory) (2 bytes)

Errored seconds: When a detailed distinction needs to be made, this attribute corresponds to near-end line errored seconds, ES-L, also known as LES. (R) (mandatory) (2 bytes)

Severely errored seconds: When a detailed distinction needs to be made, this attribute corresponds to near-end line severely errored seconds, SES-L. (R) (mandatory) (2 bytes)

Burst errored seconds: A burst errored second (BES) is any second that is not a UAS, that contains between 2 and 319 error events but no LOS, AIS or OOF condition. This attribute is also known as ESB-P. (R) (optional) (2 bytes)

Unavailable seconds: When a detailed distinction needs to be made, this attribute corresponds to near-end path unavailable seconds, UAS-P. (R) (mandatory) (2 bytes)

Controlled slip seconds: When a detailed distinction needs to be made, this attribute corresponds to near-end path controlled slip seconds CSS-P. (R) (mandatory) (2 bytes)

Each of the following attributes is (R) (optional) (2 bytes).

Attribute name	Common acronym
Loss of signal seconds	LOSS-L
AIS seconds	AISS-P
Errored seconds, path	ES-P
Errored seconds, type A	ESA-P
Severely errored seconds, path	SES-P

Attribute name	Common acronym
Severely errored frame and AIS seconds	SAS-P aka SEFS
Code violations, line	CV-L aka LCV
Code violations, path	CV-P aka PCV
Errored blocks (see ITU-T G.826)	EB

c) Add the following entries to the threshold crossing alert table:

Number	Threshold crossing alert	Threshold value attribute # (Note)
5	LOSS-L	6
6	AISS-P	7
7	ES-P	8
8	ESA-P	9
9	SES-P	10
10	SAS-P	11
11	CV-L	12
12	CV-P	13
13	EB	14

38) Clause 9.8

Add the following MEs to clause 9.8:

9.8.12 CES physical interface performance monitoring history data 2

This managed entity collects far-end statistics for a CES physical interface. It is specifically directed at DS1 interfaces [b-ATIS 0300231] and [b-ANSI T1.403], but may be useful in other cases as well.

Instances of this managed entity are created and deleted by the OLT.

For a complete discussion of generic PM architecture, refer to clause I.1.9.

Relationships

An instance of this managed entity is associated with one instance of the physical path termination point CES UNI.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Through an identical ID, this managed entity is implicitly linked to an instance of the physical path termination point CES UNI. (R, Set-by-create) (mandatory) (2 bytes)

Interval end time: This attribute identifies the most recently finished 15-minute interval. (R) (mandatory) (1 byte)

Threshold data 1/2 id: This attribute points to an instance of the threshold data 1 and 2 managed entities that contain PM threshold values. (R, W, Set-by-create) (mandatory) (2 bytes)

Each of the following attributes is (R) (optional) (2 bytes).

Attribute name	Common acronym
Errored seconds, line far-end	ES-LFE
Code violations, path far-end	CV-PFE
Errored seconds, path far-end	ES-PFE
Errored seconds type A, path far-end	ESA-PFE
Errored seconds type B, path far-end	ESB-PFE
Severely errored seconds, path far-end	SES-PFE
Severely errored framing seconds, path far-end	SEFS-PFE
Unavailable seconds, path far-end	UAS-PFE
Controlled slip seconds, path far-end	CSS-PFE
Failure count, path far-end	FC-PFE

Actions

Create, delete, get, set

Get current data (optional)

Notifications

Threshold crossing alert

Number	Threshold crossing alert	Threshold value attribute # (Note)
0	ES-LFE	1
1	CV-PFE	2
2	ES-PFE	3
3	ESA-PFE	4
4	ESB-PFE	5
5	SES-PFE	6
6	SEFS-PFE	7
7	UAS-PFE	8
8	CSS-PFE	9
NOTE – This number associates the TCA with the specified threshold value attribute of the threshold data 1 and 2 managed entities.		

9.8.13 CES physical interface performance monitoring history data 3

This managed entity collects auxiliary statistics for a CES physical interface. It is specifically directed at DS1 interfaces [b-ATIS 0300231], and [b-ANSI T1.403], but may be useful in other cases as well.

Instances of this managed entity are created and deleted by the OLT.

For a complete discussion of generic PM architecture, refer to clause I.1.9.

Relationships

An instance of this managed entity is associated with one instance of the physical path termination point CES UNI.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Through an identical ID, this managed entity is implicitly linked to an instance of the physical path termination point CES UNI. (R, Set-by-create) (mandatory) (2 bytes)

Interval end time: This attribute identifies the most recently finished 15-minute interval. (R) (mandatory) (1 byte)

Threshold data 1/2 id: This attribute points to an instance of the threshold data 1 managed entity that contains PM threshold values. (R, W, Set-by-create) (mandatory) (2 bytes)

Each of the following attributes is (R) (optional) (2 bytes).

Attribute name	Common acronym
AIS-CI seconds	AISSCI-P
Errored seconds, network performance	ES-NP
Severely errored seconds, network performance	SES-NP
Unavailable seconds, network performance	UAS-NP
Errored seconds, network performance, far-end	ES-NPFE
Severely errored seconds, NP far-end	SES-NPFE
Unavailable seconds, NP far-end	UAS-NPFE
Failure count	FC
Protection switch count	PSC
Protection switch duration	PSD

Actions

Create, delete, get, set

Get current data (optional)

Notifications

Threshold crossing alert

Number	Threshold crossing alert	Threshold value attribute # (Note)
0	AISSCI-P	1
1	ES-NP	2
2	SES-NP	3
3	UAS-NP	4
4	ES-NPFE	5
5	SES-NPFE	6
6	UAS-NPFE	7
NOTE – This number associates the TCA with the specified threshold value attribute of the threshold data 1 managed entity.		

39) Clause 9.11.1, Priority queue-G

a) Replace:

The weight attribute permits configuring an optional traffic scheduler. Several attributes support back pressure operation, whereby a back pressure signal is sent backward and causes the attached terminal to temporarily suspend sending data.

With:

In the upstream direction, the weight attribute permits configuring an optional traffic scheduler. Several attributes support back pressure operation, whereby a back pressure signal is sent backward and causes the attached terminal to temporarily suspend sending data.

b) Add the following text to the introductory section, just above the Relationships sub-heading:

The yellow packet drop thresholds are used to specify the packet drop probability for a packet that has been marked yellow (drop eligible) by a GEM traffic descriptor or by external equipment such as a residential gateway. If the current queue occupancy is less than the min threshold, the yellow packet drop probability is zero. If the current queue occupancy is greater than or equal to the max threshold, the yellow packet drop probability is one. Otherwise, the yellow drop probability increases linearly between 0 and max_p as the current queue occupancy increases from the min to the max threshold.

Drop precedence colour marking indicates the method by which a packet is marked as drop eligible (yellow). For DEI and PCP marking, a drop eligible indicator is equivalent to yellow colour; otherwise, the colour is green. For DSCP AF marking, the lowest drop precedence is equivalent to green, otherwise the colour is yellow.

c) Replace:

Relationships

One or more instances of this managed entity are associated with the ONT-G managed entity to model the upstream priority queues if the traffic management option attribute in the ONT-G ME is 0.

One or more instances of this managed entity are associated with a circuit pack managed entity serving UNI functions as downstream priority queues.

For an ONT that has one or more fixed user interfaces, one or more instances are associated with the ONT-G managed entity for the downstream priority queues.

With:

Relationships

One or more instances of this managed entity are associated with the ONT-G managed entity to model the upstream priority queues if the traffic management option attribute in the ONT-G ME is 0 or 2.

One or more instances of this managed entity are associated with a physical path termination point UNI managed entity as downstream priority queues.

d) Replace:

Weight: This attribute represents weight for WRR. This weight is used by the traffic scheduler or T-CONT (whose policy is WRR) indicated by the traffic scheduler-G pointer attribute or related port attribute. Upon ME instantiation, the ONT sets this attribute to 1. (R, W) (mandatory) (1 byte)

With:

Weight: This attribute represents weight for WRR. In the upstream direction, this weight is used by the traffic scheduler or T-CONT (whose policy is WRR) indicated by the traffic scheduler-G pointer attribute or related port attribute. Upon ME instantiation, the ONT sets this attribute to 1. (R, W) (mandatory) (1 byte)

e) Replace:

Back pressure occur queue threshold: This attribute identifies the threshold size of this queue to start sending back pressure signal. (R, W) (mandatory) (2 bytes)

Back pressure clear queue threshold: This attribute identifies the threshold size of this queue to stop sending back pressure signal. (R, W) (mandatory) (2 bytes)

Revise it to read as follows, adding four new attributes:

Back pressure occur queue threshold: This attribute specifies the threshold queue occupancy, in GEM block lengths, to start sending back pressure signal. (R, W) (mandatory) (2 bytes)

Back pressure clear queue threshold: This attribute specifies the threshold queue occupancy, in GEM block lengths, to stop sending back pressure signal. (R, W) (mandatory) (2 bytes)

Packet drop queue thresholds: This attribute is a composite of four 2-byte values, a minimum and a maximum threshold, measured in GEM block lengths, for green and yellow packets. The first value is the minimum threshold, the queue occupancy below which all green packets are admitted to the queue. The second value is the maximum threshold, the queue occupancy at or above which all green packets are discarded. The third value is the minimum threshold, the queue occupancy below which all yellow packets are admitted to the queue. The fourth value is the maximum threshold, the queue occupancy at or above which all yellow packets are discarded. The default is that all thresholds take the value of the maximum queue size. (R, W) (optional) (8 bytes)

Packet drop max_p: This attribute is a composite of two 1-byte values, the probability of dropping a green or yellow packet when the queue occupancy lies just below the max threshold. The first value is the green packet max_p, and the second value is the yellow packet max_p. The probability, max_p, is determined by adding one to the unsigned value (0..255) of this attribute and dividing the result by 256. The default for each value is 255. (R, W) (optional) (2 bytes)

Queue_drop_w_q: This attribute determines the averaging coefficient, w_q, as described in [b-Floyd]. The averaging coefficient, w_q, is equal to $2^{-Queue\_drop\_w\_q}$. For example, when queue_drop_w_q has the value of 9, the averaging coefficient, w_q, is 0.0019. The default value is 9. (R, W) (optional) (1 byte)

Drop precedence colour marking: This attribute specifies how the drop precedence is marked on the ingress packets to the priority queue. The default value is 0.

0 No marking (treat all packets as green)
1 Internal marking (from GEM traffic descriptor ME)
2 DEI (802.1ad)
3 PCP 8P0D (802.1ad)
4 PCP 7P1D (802.1ad)
5 PCP 6P2D (802.1ad)
6 PCP 5P3D (802.1ad)
7 DSCP AF class [b-IETF RFC 2597]

(R, W) (optional) (1 byte)

40) Clause 9.11.3, GEM traffic descriptor

Replace the existing clause with the following text:

The traffic descriptor allows for traffic management. A priority controlled ONT can point from a MAC bridge port configuration data ME to a GEM traffic descriptor in order to implement traffic management (marking, policing). A rate controlled ONT can point to a GEM traffic descriptor from either a MAC bridge port configuration data ME or GEM port network CTP to implement traffic management (marking, shaping).

Packets are determined to be green, yellow or red as a function of the ingress packet rate and the settings in this ME. The colour indicates drop precedence (eligibility), subsequently used by the priority queue-G ME to drop packets conditionally during congestion conditions. Packet colour is also used by the mode 1 DBA status reporting function described in [ITU-T G.984.3]. Red packets are dropped immediately. Yellow packets are marked as drop eligible, and green packets are marked as not drop eligible, according to the egress colour marking attribute.

The algorithm used to determine the colour marking is specified by the meter type attribute. If [b-IETF RFC 4115] is used, then

CIR_{4115} = CIR

EIR_{4115} = PIR – CIR (EIR: excess information rate)

CBS_{4115} = CBS

EBS_{4115} = PBS – CBS.

Relationships

This ME is associated with a GEM port network CTP or a MAC bridge port configuration data managed entity.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes)

CIR: This attribute specifies committed information rate, in byte/s. The default is 0. (R, W, Set-by-create) (optional) (4 bytes)

PIR: This attribute specifies peak information rate, in byte/s. The default value 0 accepts the ONT's factory policy. (R, W, Set-by-create) (optional) (4 bytes)

CBS: This attribute specifies committed block size, in bytes. The default is 0. (R, W, Set-by-create) (optional) (4 bytes)

PBS: This attribute specifies peak block size, in bytes. The default value 0 accepts the ONT's factory policy. (R, W, Set-by-create) (optional) (4 bytes)

Colour mode: This attribute specifies whether the colour marking algorithm considers pre-existing marking on ingress packets (colour-aware) or ignores it (colour-blind). If colour-aware, packets can only be demoted (from green to yellow or red, or from yellow to red). The default value is 0.

0 Colour-blind
1 Colour-aware

(R, W, Set-by-create) (optional) (1 byte)

Ingress colour marking: This attribute is meaningful in colour-aware mode. It specifies how the pre-existing drop precedence is marked on ingress packets. For DEI and PCP marking, a drop eligible indicator is equivalent to yellow colour; otherwise, the colour is green. For DSCP AF marking, the lowest drop precedence is equivalent to green; otherwise, the colour is yellow. The default value is 0.

0 No marking (ignore ingress marking)
2 DEI (802.1ad)
3 PCP 8P0D (802.1ad)
4 PCP 7P1D (802.1ad)
5 PCP 6P2D (802.1ad)
6 PCP 5P3D (802.1ad)
7 DSCP AF class [b-IETF RFC 2597]

(R, W, Set-by-create) (optional) (1 byte)

Egress colour marking: This attribute specifies how drop precedence is to be marked by the ONT on egress packets. If set to internal marking only, the externally visible packet contents are not modified, but the packet is identified in a vendor-specific local way that indicates its colour to the priority queue-G ME. It is possible for the egress marking to differ from the ingress marking; for example, ingress PCP marking could be translated to DEI egress marking. The default value is 0.

0 No marking
1 Internal marking only
2 DEI (802.1ad)
3 PCP 8P0D (802.1ad)
4 PCP 7P1D (802.1ad)
5 PCP 6P2D (802.1ad)
6 PCP 5P3D (802.1ad)
7 DSCP AF class [b-IETF RFC 2597]

(R, W, Set-by-create) (optional) (1 byte)

Meter type: This attribute specifies the algorithm used to determine the colour of the packet. The default value is 0.

0 Not specified
1 [b-IETF RFC 4115]
2 [b-IETF RFC 2698]

(R, Set-by-create) (optional) (1 byte)

Actions

Create, delete, get, set

Notifications

None.

41) Clause 9.12

Add the following clause at the end of clause 9.12:

9.12.13 File transfer controller

This optional managed entity allows file transfers to be conducted out of band. It is intended to facilitate software image download, but may be extended for other file transfer applications as well.

Relationships

One instance of this managed entity exists in an ONT that supports out of band file transfer.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. There is one instance, whose value is 0. (R) (mandatory) (2 bytes)

Supported transfer protocols: This attribute is a bit map. Each bit indicates that the corresponding protocol is (1) or is not (0) supported for file transfers. TFTP is mandatory; the other protocols are optional. (R) (mandatory) (2 bytes)

Bit	Protocol
1 (LSB)	FTP
2	TFTP
3	SFTP
4	HTTP
5	HTTPS
6	FLUTE ([b-IETF RFC 3926]; multicast, download only)
7	DSM-CC (multicast, download only)
8..12	Reserved
13..16	Vendor-specific use; not to be standardized

File type: This attribute specifies the owner managed entity type of the file to be transferred. It is a value from Table 11-2. For example, for software image download, this attribute has the value 7. File systems on circuit packs are identified with the value 6, and on the ONT-G as a whole with the value 256. (R, W) (mandatory) (2 bytes)

File instance: This attribute specifies the instance of the file to be transferred. This attribute is the same as the ME ID attribute of the owner ME. (R, W) (mandatory) (2 bytes)

Local file name pointer: This attribute designates a large string ME that specifies a local file name. Since naming is not specified for any OMCI files, this attribute should be a null pointer in standard OMCI usage, for example, in the software image case. The use of this attribute for named files is vendor-specific. (R, W) (mandatory) (2 bytes)

Network address pointer: This attribute is a pointer to a network address ME that specifies optional authentication information, along with the URI to be used for the file transfer. The URI should specify the protocol, one from the list of protocols supported by the ONT, and optionally a port. For unidirectional multicast download (e.g., DSM-CC), the URI should specify the multicast IP address (as a text string). (R, W) (mandatory) (2 bytes)

File transfer trigger: This attribute causes the file transfer to begin. If a given set operation writes values to several attributes of this managed entity, the ONT should apply the file transfer trigger after updating all other attributes. Some operations may not be applicable to some files; the ONT should deny commands that request unsupported actions. (R, W) (mandatory) (1 byte)

Value	Meaning
0	Reserved
1	Initiate file download (to the ONT)
2	Initiate file upload (from the ONT)
3	Abort current file transfer
4	Delete target file
5..255	Reserved

File transfer status: This attribute reports the status of a file transfer. (R) (mandatory) (1 byte)

Value	Meaning
0	File transfer completed successfully
1	File transfer aborted successfully
2	File deleted
3	URL undefined or unreachable
4	Failure to authenticate
5	File transfer in progress
6	Remote failure
7	Local failure
8..255	Reserved

MC GEM IWTP pointer: This attribute is a pointer that specifies the multicast GEM interworking termination point to be used for the transfer, assuming multicast protocol. (R, W) (optional) (2 bytes)

VLAN: This attribute specifies the VLAN to be used for the transfer, assuming multicast protocol. The default value 0 indicates that no VLAN is specified. (R, W) (optional) (2 bytes)

File size: This attribute allows the OLT to specify the size of a file to be downloaded, in bytes. The ONT may use this value to reserve memory or to deny the download command if it has insufficient space. The default value 0 does not specify a file size. (R, W) (optional) (4 bytes)

Actions

Get, set

Notifications

Attribute value change

Number	Attribute value change	Description
1..6	N/A	
7	File transfer status	
8..16	Reserved	

42) New clause 9.14

Add new clause 9.14, as follows:

9.14 Mid-span PON reach extender

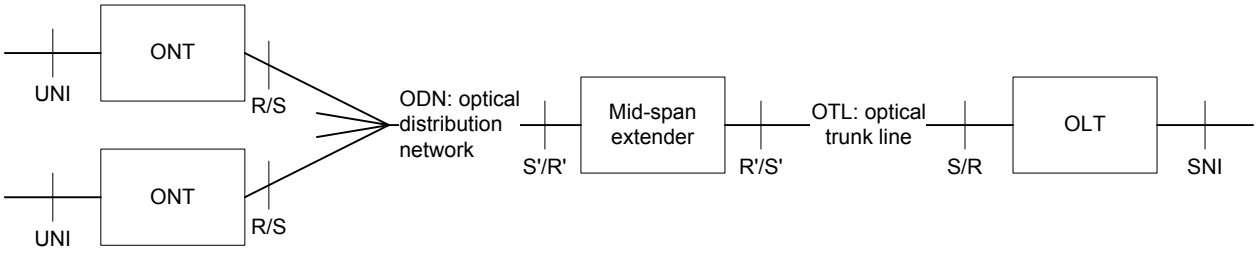


Figure 9.14-1 – Mid-span PON reach extender

[ITU-T G.984.6] defines a mid-span PON reach extender (RE). A reach extender may extend more than one PON, using optical amplification or optical-electrical-optical regeneration technology. For easy reference, Figure 9.14-1 illustrates the interface designations.

The RE model includes one built-in ONT, which serves for management of the RE itself, as well as optional subscriber or craft UNIs. The RE is therefore able to use any of the managed entities defined elsewhere in this Recommendation, including the ANI-G and T-CONT MEs, which represent the built-in ONT's individual uplink.

This clause defines additional managed entities that pertain to the reach extender function separately.

The current scope of the RE model includes the use of either regeneration (OEO) or optical amplification (OA) in the upstream and in the downstream directions, independently. Split ratio enhancement (more than one UNI for every ANI) is also included. This results in eight possible arrangements, as follows.

NOTE – Each amplifier ME is associated with an RE common amplifier parameters ME.

Downstream technology	Upstream technology	Internal optical split	Model
OEO	OEO	1:1	1 PPTP RE UNI pointing to 1 RE ANI-G, all attributes active.
OEO	OEO	1:N	N PPTP RE UNIs pointing to 1 RE ANI-G, all attributes active.
OA	OA	1:1	1 RE upstream amplifier pointing to 1 RE downstream amplifier.
OA	OA	1:N	N RE upstream amplifiers pointing to 1 RE downstream amplifier.

Downstream technology	Upstream technology	Internal optical split	Model
OA	OEO	1:1	1 PPTP RE UNI pointing to 1 RE ANI-G. Downstream optical attributes of the RE ANI-G not used. 1 downstream amplifier, likely sharing ME ID with the RE ANI-G.
OA	OEO	1:N	N PPTP RE UNIs pointing to 1 RE ANI-G. Downstream optical attributes of the RE ANI-G not used. 1 downstream amplifier, likely sharing ME ID with RE ANI-G.
OEO	OA	1:1	1 PPTP RE UNI pointing to 1 RE ANI-G. Upstream optical attributes of the RE UNI not used. 1 upstream amplifier, likely sharing ME ID with the PPTP RE UNI.
OEO	OA	1:N	N PPTP RE UNIs pointing to 1 RE ANI-G. Upstream optical attributes of the RE UNI not used. N upstream amplifiers, likely sharing ME IDs with the PPTP RE UNIs.

9.14.1 RE ANI-G

This managed entity organizes data associated with each R'/S' physical interface supported by the ONT. The ONT automatically creates one instance of this managed entity for each R'/S' physical port (transmit and/or receive).

Relationships

An instance of this managed entity is associated with each R'/S' physical interface, and is associated with one or more instances of PPTP RE UNI.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Its value indicates the physical position of the R'/S' interface. The first byte is the slot id (defined in clause 9.1.5). The second byte is the port id.

NOTE – This ME ID may be identical to that of an RE downstream amplifier if it shares the same physical slot and port.

(R) (mandatory) (2 bytes)

Administrative state: This attribute locks (1) and unlocks (0) the functions performed by this managed entity. When the administrative state is set to lock, all functions of this managed entity are blocked, and alarms, TCAs and AVCs for this managed entity and all dependent managed entities are no longer generated. Selection of a default value for this attribute is outside the scope of this Recommendation. (R, W) (mandatory) (1 byte)

Operational state: This attribute indicates whether or not the managed entity is capable of performing its function. Valid values are enabled (0) and disabled (1). (R) (optional) (1 byte)

ARC: See clause I.1.8. (R, W) (optional) (1 byte)

ARC interval: See clause I.1.8. (R, W) (optional) (1 byte)

Optical signal level: This attribute reports the current measurement of total optical signal level at 1490 nm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (2 bytes)

Lower optical threshold: This attribute specifies the optical level that the ONT uses to declare the 1490 nm low received optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper optical threshold: This attribute specifies the optical level that the ONT uses to declare the 1490 nm high received optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Transmit optical level: This attribute reports the current measurement of the optical transmit power level. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (2 bytes)

Lower transmit power threshold: This attribute specifies the transmit power level that the ONT uses to declare the low transmit optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper transmit power threshold: This attribute specifies the transmit power level that the ONT uses to declare the high transmit optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Usage mode: In a mid-span PON reach extender, an R'/S' interface may be used as the PON interface for the embedded ONT and/or the uplink interface for an S'/R' interface. This attribute specifies the usage of the R'/S' interface. (R, W) (mandatory) (1 byte)

0: Disable
1: This R'/S' interface is used as the uplink for the embedded ONT
2: This R'/S' interface is used as the uplink for one or more PPTP RE UNI(s)
3: This R'/S' interface is used as the uplink for both the embedded ONT and one or more PPTP RE UNI(s) (in a time division fashion).

Actions

Get, set

Test: Test the RE-ANI. The test action can be used to perform optical line supervision tests; refer to Appendix II.

Notifications

Attribute value change

Number	Attribute value change	Description
1	N/A	
2	Op state	Operational state of RE ANI-G
3	ARC	Alarm reporting control cancellation
4..11	N/A	
12..16	Reserved	

Alarm

Number	Alarm	Description
0	Low received optical power	Received 1490 nm optical power below threshold
1	High received optical power	Received 1490 nm optical power above threshold
2	Low transmit optical power	Transmitted 1310 nm optical power below lower threshold
3	High transmit optical power	Transmitted 1310 nm optical power above upper threshold
4	High laser bias current	Laser bias current above threshold determined by vendor; laser end of life pending
5..207	Reserved	
208..223	Vendor-specific alarms	Not to be standardized

Test result: The ONT may report a test result autonomously if it performs self-test functions autonomously.

9.14.2 Physical path termination point RE UNI

This managed entity represents an S'/R' interface in a mid-span PON reach extender, where physical paths terminate and physical path level functions are performed (transmit and/or receive).

The ONT automatically creates an instance of this managed entity for each S'/R' interface port:

- When the ONT has mid-span PON reach extender S'/R' interface ports built into its factory configuration.
- When a cardholder is provisioned to expect a circuit pack of mid-span PON reach extender S'/R' UNI type.
- When a cardholder provisioned for plug and play is equipped with a circuit pack of mid-span PON reach extender UNI type. Note that the installation of a plug and play card may indicate the presence of mid-span PON reach extender UNI port via equipment ID as well as its type, and indeed may cause the ONT to instantiate a port mapping package that specifies mid-span PON reach extender UNI and ANI ports.

The ONT automatically deletes instances of this managed entity when a cardholder is neither provisioned to expect a mid-span PON reach extender UNI circuit pack, nor is it equipped with a mid-span PON reach extender UNI circuit pack.

Relationships

An instance of this managed entity is associated with each instance of a mid-span PON reach extender S'/R' physical interface.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. This 2-byte number indicates the physical position of the UNI. The first byte is the slot ID (defined in clause 9.1.5). The second byte is the port ID, with range 1..255.

NOTE – This ME ID may be identical to that of an RE upstream amplifier if it shares the same physical slot and port.

(R) (mandatory) (2 bytes)

Administrative state: This attribute locks (1) and unlocks (0) the functions performed by this managed entity. When the administrative state is set to lock, all user functions of this UNI are blocked, and alarms, TCAs and AVCs for this managed entity and all dependent managed entities are no longer generated. Selection of a default value for this attribute is outside the scope of this Recommendation. (R, W) (mandatory) (1 byte)

Operational state: This attribute indicates whether or not the managed entity is capable of performing its function. Valid values are enabled (0) and disabled (1). (R) (optional) (1 byte)

ARC: See clause I.1.8. (R, W) (optional) (1 byte)

ARC interval: See clause I.1.8. (R, W) (optional) (1 byte)

RE ANI-G pointer: This attribute points to an RE ANI-G instance. (R, W) (mandatory) (2 bytes)

Total optical receive signal level table: This table attribute reports a series of measurements of time averaged received upstream optical signal level at 1310 nm. The measurement circuit should have a temporal response similar to a simple 1 pole low pass filter, with an effective time constant on the order of a GTC frame time. Each table entry has a two-byte frame counter field (most significant end), and a two-byte power measurement field. The frame counter field contains the least significant 16 bits of the superframe counter received closest to the time of the measurement. The power measurement field is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. The ONT equipment should add entries to this table as frequently as is reasonable. The ONT should clear the table once it is read by the OLT. (R) (optional) (4N bytes, where N is the number of measurements present.)

Per burst receive signal level table: This table attribute reports the most recent measurement of received burst upstream optical signal level at 1310 nm. Each table entry has a one-byte ONT-ID field (most significant end), and a two-byte power measurement field. The power measurement field is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (3N bytes, where N is the number of distinct ONTs connected to the S'/R' interface.)

Lower receive optical threshold: This attribute specifies the optical level that the ONT uses to declare the burst mode 1310 nm low received optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper receive optical threshold: This attribute specifies the optical level that the ONT uses to declare the burst mode 1310 nm high received optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Transmit optical level: This attribute reports the current measurement of optical transmit power level at 1490 nm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (2 bytes)

Lower transmit power threshold: This attribute specifies the transmit power level at 1490 nm in the S'/R' interface that the ONT uses to declare the low transmit optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper transmit power threshold: This attribute specifies the transmit power level at 1490 nm in the S'/R' interface that the ONT uses to declare the high transmit optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Additional preamble: This attribute indicates the number of bytes of PLOu preamble that are unavoidably consumed while passing the reach extender. (R) (mandatory) (1 byte)

Additional guard time: This attribute indicates the number of bytes of extra guard time that are needed to ensure correct operation with the reach extender. (R) (mandatory) (1 byte)

Actions

Get, get next, set

Test: Test the PPTP RE UNI. The test action can be used to perform optical line supervision tests; refer to Appendix II.

Notifications

Attribute value change

Number	Attribute value change	Description
1	N/A	
2	Op state	Operational state of PPTP RE UNI
3	ARC	ARC timer expiration
4..14	N/A	
15..16	Reserved	

Alarm

Number	Alarm	Description
0	Low received optical power	Received 1310 nm optical power of one or more ONTs below threshold
1	High received optical power	Received 1310 nm optical power of one or more ONTs above threshold
2	Low transmit optical power	Transmit 1490 nm optical power below lower threshold
3	High transmit optical power	Transmit 1490 nm optical power above upper threshold
4	High laser bias current	Laser bias current above threshold determined by vendor; laser end of life pending
5	S'/R' LOSS	S'/R' LOSS detected, No optical signal received at the S'/R' upstream interface in 500 µs

Alarm

Number	Alarm	Description
6..207	Reserved	
208..223	Vendor-specific alarms	Not to be standardized

9.14.3 RE upstream amplifier

This managed entity organizes data associated with each upstream reach extender optical amplifier supported by the ONT. The ONT automatically creates one instance of this managed entity for each upstream optical amplifier.

Relationships

An instance of this managed entity is associated with an upstream optical amplifier, and is associated with one instance of the circuit pack.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Its value indicates the physical position of the upstream optical amplifier. The first byte is the slot id (defined in clause 9.1.5). The second byte is the port id.

NOTE – This ME ID may be identical to that of a PPTP RE UNI if it shares the same physical slot and port. (R) (mandatory) (2 bytes)

Administrative state: This attribute locks (1) and unlocks (0) the functions performed by this managed entity. When the administrative state is set to lock, all functions of this managed entity are blocked, and alarms, TCAs and AVCs for this managed entity and all dependent managed entities are no longer generated. Selection of a default value for this attribute is outside the scope of this Recommendation. (R, W) (mandatory) (1 byte)

Operational state: This attribute indicates whether or not the managed entity is capable of performing its function. Valid values are enabled (0) and disabled (1). (R) (optional) (1 byte)

Operational mode: This attribute indicates the operational mode.

0 Constant gain
1 Constant output power
2 Autonomous

(R,W) (mandatory) (1 byte)

ARC: See clause I.1.8. (R, W) (optional) (1 byte)

ARC interval: See clause I.1.8. (R, W) (optional) (1 byte)

RE downstream amplifier pointer: This attribute points to an RE downstream amplifier instance. The default value is 0xFFFF. (R, W) (mandatory) (2 bytes)

Total optical receive signal level table: This table attribute reports a series of measurements of time averaged input upstream optical signal level at 1310 nm. The measurement circuit should have a temporal response similar to a simple 1 pole low pass filter, with an effective time constant on the order of a GTC frame time. Each table entry has a two-byte frame counter field (most significant end), and a two-byte power measurement field. The frame counter field contains the least significant 16 bits of the superframe counter received closest to the time of the measurement. The power measurement field is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. The ONT equipment should add entries to this table as frequently as is reasonable. The ONT should clear the table once it is read by the OLT. (R) (optional) (4N bytes, where N is the number of measurements present.)

Per burst receive signal level table: This table attribute reports the most recent measurement of input burst upstream optical signal level at 1310 nm. Each table entry has a one-byte ONT-ID field (most significant end) and a two-byte power measurement field. The power measurement field is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (3N bytes, where N is the number of distinct ONTs connected to the S'/R' interface.)

Lower receive optical threshold: This attribute specifies the optical level that the ONT uses to declare the low input optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper receive optical threshold: This attribute specifies the optical level that the ONT uses to declare the high input optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Transmit optical signal level: This attribute reports the current measurement of the output optical signal level of the upstream optical amplifier. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (2 bytes)

Lower transmit optical threshold: This attribute specifies the optical level that the ONT uses to declare the low output optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper transmit optical threshold: This attribute specifies the optical level that the ONT uses to declare the high output optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Actions

Get, get next, set

Test: Test the upstream amplifier. The test action can be used to perform optical line supervision tests; refer to Appendix II.

Notifications

Attribute value change

Number	Attribute value change	Description
1	N/A	
2	Op state	Operational state of RE upstream amplifier
3	N/A	
4	ARC	Alarm reporting control cancellation
5..13	N/A	
14..16	Reserved	

Alarm

Number	Alarm	Description
0	Low received optical power	Received 1310 nm optical power of one or more ONTs below threshold
1	High received optical power	Received 1310 nm optical power of one or more ONTs above threshold
2	Low transmit optical power	Transmit 1310 nm optical power below lower threshold
3	High transmit optical power	Transmit 1310 nm optical power above upper threshold
4	High laser bias current	Laser bias current above threshold determined by vendor; laser end of life pending
5	S'/R' LOSS	S'/R' LOSS detected, No optical signal received at the S'/R' upstream interface in 500 μs
6..207	Reserved	
208..223	Vendor-specific alarms	Not to be standardized

Test result: The ONT may report a test result autonomously if it performs self-test functions autonomously.

9.14.4 RE downstream amplifier

This managed entity organizes data associated with each optical amplifier for downstream data supported by the ONT. The ONT automatically creates one instance of this managed entity for each downstream optical amplifier.

Relationships

An instance of this managed entity is associated with a downstream optical amplifier and with one instance of the circuit pack ME.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Its value indicates the physical position of the downstream optical amplifier. The first byte is the slot id (defined in clause 9.1.5). The second byte is the port id.

NOTE – This ME ID may be identical to that of an RE ANI-G if it shares the same physical slot-port.

(R) (mandatory) (2 bytes)

Administrative state: This attribute locks (1) and unlocks (0) the functions performed by this managed entity. When the administrative state is set to lock, all functions of this managed entity are blocked, and alarms, TCAs and AVCs for this managed entity and all dependent managed entities are no longer generated. Selection of a default value for this attribute is outside the scope of this Recommendation. (R, W) (mandatory) (1 byte)

Operational state: This attribute indicates whether or not the managed entity is capable of performing its function. Valid values are enabled (0) and disabled (1). (R) (optional) (1 byte)

ARC: See clause I.1.8. (R, W) (optional) (1 byte)

ARC interval: See clause I.1.8. (R, W) (optional) (1 byte)

Operational mode: This attribute indicates the operational mode.

0 Constant gain
1 Constant output power
2 Autonomous

(R,W) (mandatory) (1 byte)

Input optical signal level: This attribute reports the current measurement of the 1490 nm input optical signal level of the downstream optical amplifier. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (2 bytes)

Lower input optical threshold: This attribute specifies the optical level the ONT uses to declare the low input optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper input optical threshold: This attribute specifies the optical level the ONT uses to declare the high input optical power alarm. Valid values are –127 dBm (coded as 254) to 0 dBm (coded as 0) in 0.5 dB increments. The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Output optical signal level: This attribute reports the current measurement of the output optical signal level of the downstream optical amplifier. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.002 dB granularity. (R) (optional) (2 bytes)

Lower output optical threshold: This attribute specifies the optical level the ONT uses to declare the low output optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper output optical threshold: This attribute specifies the optical level the ONT uses to declare the high output optical power alarm. Its value is a 2s complement integer referred to 1 mW (i.e., dBm), with 0.5 dB granularity. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

R'S' splitter coupling ratio: This attribute reports the coupling ratio of the splitter at the R'S' interface that connects the embedded ONT and the amplifiers to the optical trunk line. Valid values are 99:1 (coded as 99 decimal) to 1:99 (coded as 1 decimal), where the first value is the value encoded and is the percentage of the optical signal connected to the amplifier. The default value 0xFF indicates that there is no splitter connected to this upstream/downstream amplifier pair. (R) (optional) (1 byte)

Actions

Get, set

Test: Test the RE downstream amplifier. The test action can be used to perform optical line supervision tests; refer to Appendix II.

Notifications

Attribute value change

Number	Attribute value change	Description
1	N/A	
2	Op state	Operational state of RE downstream amplifier
3	ARC	Alarm reporting control cancellation
4..12	N/A	
13..16	Reserved	

Alarm

Number	Alarm	Description
0	Low received optical power	Received 1490 nm optical power below threshold
1	High received optical power	Received 1490 nm optical power above threshold
2	Low transmit optical power	Transmit 1490 nm optical power below lower threshold
3	High transmit optical power	Transmit 1490 nm optical power above upper threshold
4	High laser bias current	Laser bias current above threshold determined by vendor; laser end of life pending
5..207	Reserved	
208..223	Vendor-specific alarms	Not to be standardized

Test result: The ONT may report a test result autonomously if it performs self-test functions autonomously.

9.14.5 RE config portal

The RE config portal managed entity provides a way for the OLT to discover the configuration delivered to an ONT by a non-OMCI reach extender configuration method (SNMP, etc.). Text retrieved from this ME is not required to be understood by the OLT or EMS, but it may be useful for human or vendor-specific analysis tools.

An instance of this managed entity may be created by an ONT that supports non-OMCI RE configuration. It is not reported during a MIB upload.

Relationships

One instance of this managed entity is associated with an instance of a TCP/UDP config data managed entity.

Attributes

Managed entity ID: This attribute uniquely identifies each instance of this managed entity. There is one instance, number 0. (R) (mandatory) (2 bytes)

Configuration text table: This attribute is used to pass a textual representation of the RE configuration back to the OLT. The contents are vendor specific. The get, get next sequence must be used with this attribute since its size is unspecified. Upon ME instantiation, the ONT sets this attribute to 0. (R) (mandatory) (x bytes)

TCP/UDP pointer: This pointer associates the RE config portal with the TCP/UDP config data ME to be used for communication with any valid and necessary in-band protocol server. The default value is 0xFFFF. (R, W) (mandatory) (2 bytes)

Actions

Get, get next

Notifications

Attribute value change

Number	Attribute value change	Description
1	Configuration text	Indicates an update to the RE configuration from a non-OMCI interface. Because the attribute is a table, the AVC contains no information about its value. The OLT must use the get, get next action sequence if it wishes to obtain the updated attribute content.
2..16	Reserved	

9.14.6 RE common amplifier parameters

This managed entity organizes data associated with each optical amplifier supported by the ONT. The ONT automatically creates one instance of this managed entity for each upstream or downstream optical amplifier.

Relationships

An instance of this managed entity is associated with an optical amplifier and with one instance of the RE downstream amplifier or RE upstream amplifier ME.

Attributes

Managed entity id: This attribute uniquely identifies each instance of this managed entity. Its value indicates the physical position of the upstream or downstream optical amplifier. The first byte is the slot id (defined in clause 9.1.5). The second byte is the port id. (R) (mandatory) (2 bytes)

Gain: This attribute reports the current measurement of gain, in dB, of the optical amplifier. Its value is a 2s complement integer with 0.25 dB granularity, having a range from –32 dB to 31.5 dB. The value 0x7F indicates that the current measured gain is 0, i.e., negative infinity in dB terms. (R) (optional) (1 byte)

Lower gain threshold: This attribute specifies the gain the ONT uses to declare the low gain alarm. Valid values are 0 dB (coded as 0x00) to 63.5 dB (coded as 0xFE). The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper gain threshold: This attribute specifies the gain the ONT uses to declare the high gain alarm. Valid values are 0 dB (coded as 0x00) to 63.5 dB (coded as 0xFE). The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Target gain: This attribute specifies the target gain, when the operational mode of the parent RE downstream or upstream amplifier is set to constant gain mode. Valid values are 0 dB (coded as 0x00) to 63.5 dB (coded as 0xFE). The default value 0xFF selects the ONT's internal policy. (R, W) (optional) (1 byte)

Device temperature: This attribute reports the temperature in °C of the active device (SOA or pump) in the optical amplifier. Its value is a 2s complement integer with granularity 1/256°C. (R) (optional) (2 bytes)

Lower device temperature threshold: This attribute is a 2s complement integer that specifies the temperature the ONT uses to declare the low device temperature alarm. Valid values are –64 to +63°C in 0.5°C increments. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Upper device temperature threshold: This attribute is a 2s complement integer that specifies the temperature the ONT uses to declare the high device temperature optical power alarm. Valid values are –64 to +63°C in 0.5°C increments. The default value 0x7F selects the ONT's internal policy. (R, W) (optional) (1 byte)

Device bias current: This attribute contains the measured bias current applied to the SOA or pump laser. Its value is an unsigned integer with granularity 2 mA. Valid values are 0 mA to 512 mA. (R) (optional) (1 byte)

Amplifier saturation output power: This attribute reports the saturation output power of the amplifier as specified by the manufacturer. Its value is an unsigned integer referred to 1 mW (i.e., dBm), with 0.1 dB granularity. (R) (optional) (2 bytes)

Amplifier noise figure: This attribute reports the intrinsic noise figure of the amplifier, as specified by the manufacturer. Its value is an unsigned integer with 0.1 dB granularity (R) (optional) (1 byte)

Amplifier saturation gain: This attribute reports the gain of the amplifier at saturation, as specified by the manufacturer. Its value is an unsigned integer with 0.25 dB granularity, having a range from 0 dB to 63.75 dB. (R) (optional) (1 byte)

Actions

Get, set

Notifications

Alarm

Number	Alarm	Description
0	Low gain	Gain below lower threshold
1	High gain	Gain above upper threshold
2	Low temperature	Device temperature below lower threshold
3	High temperature	Device temperature above upper threshold
4	High bias current	Device bias current above threshold determined by vendor; device end of life pending
5	High temperature shutdown	Device has shut down due to temperature exceeding manufacturer's specifications
6	High current shutdown	Device has shut down due to bias current exceeding manufacturer's specifications
7..207	Reserved	
208..223	Vendor specific alarms	Not to be standardized

43) Clause 11.1.6, Message identifier

Add entries to Table 11-2 and adjust the reserved space at the end, as follows:

Table 11-2 – Managed entity identifiers

Managed entity class value	Managed entity
313	RE ANI-G
314	Physical path termination point RE UNI
315	RE upstream amplifier
316	RE downstream amplifier
317	RE config portal
318	File transfer controller
319	CES physical interface performance monitoring history data 2
320	CES physical interface performance monitoring history data 3
321	Ethernet frame performance monitoring history data downstream
322	Ethernet frame performance monitoring history data upstream
323	VDSL2 line configuration extensions 2
324	xDSL impulse noise monitor performance monitoring history data
325	xDSL line inventory and status data part 5
326	xDSL line inventory and status data part 6
327	xDSL line inventory and status data part 7
328	RE common amplifier parameters
329-65279	Reserved for future standardization

44) Clause I.1.1, MIB data sync increase

Add the following at the end of the clause:

The ONT should increment the MIB data sync attribute when a set or create command succeeds, and should not increment the attribute when such a command fails. This may be determined by the value of the result, reason field in the set/create message response, as follows:

Code	Meaning	Update sync?
0000	Command processed successfully	Y
0001	Command processing error	N
0010	Command not supported	N
0011	Parameter error	N
0100	Unknown managed entity	N
0101	Unknown managed entity instance	N
0110	Device busy	N
1001	Attribute(s) failed or unknown	Y (Note)
NOTE – If the ONT rolls back a partial execution such that the MIB is left unchanged, it should not update MIB sync, and should respond to the set or create command with the parameter error code.		

45) Clause I.1.4, Alarm audit and resynchronization

Correct the introductory text as shown:

When the OLT detects a gap in the received sequence, as shown in Figure I.1.4-1, it asks the ONT for an alarm status report by sending a Get all alarms command targeted at the ONT data ME. This command is acknowledged by a response that contains the number of managed entity instances that have outstanding alarms. The OLT will request the alarm status of all these managed entity instances via the Get all alarms next command targeted at the ONT data ME. The OLT will compare the alarm statuses of all these instances with its own view, and will notify the network manager of the changes. The alarm sequence number is reset by the ONT when it receives the Get all alarms request.

46) Clause I.1.5, Table attributes

Add the following text at the end of this clause:

The OLT should get and get-next only one attribute at a time. If more than one bit is set in the get-next command attribute mask, the ONT should respond with a parameter error result code.

In each get-next command, the OLT generates a sequence number, starting from 0. The sequence number resets to 0 for each attribute, even if successive attributes are part of the same managed entity parent.

47) Clause I.1.9, Performance monitoring

Add the following paragraph at the end of the clause:

The value 0xFF in all bytes of a PM attribute may be used to indicate that the particular attribute is not supported. It is recognized that this value may be ambiguous, indicating either an actual count, a counter overflow, or an unsupported attribute.

48) Clause I.2.7, Software image download

Replace the entirety of this clause with the following:

The software image download operation is a file transfer from the OLT to the ONT. The atomic unit of file transfer is the **section**, the 31 bytes of data that can be transferred in a single download section message. The last section in a software download may be padded with null bytes as needed.

A number of sections comprise a so-called **window**. The size of a window may not exceed 256 sections. During the initial softward download message exchange, the OLT proposes a maximum window size, but a lower value can be stipulated by the ONT, which must be accepted by the OLT. The OLT may send windows with fewer sections than this negotiated maximum, but may not exceed the maximum. Though it is not a preferred choice, the OLT may send all windows at the full negotiated maximum size, with the final window of the download operation padded out with download section messages containing only null pad bytes.

Each download section message contains a sequence number, which begins anew at 0 with each window. By tracking the incrementing sequence numbers, the ONT can confirm that it has in fact received each section of code.

In the OMCI message header of the last download section message of the window, the OLT indicates the end of the window by setting the AR (acknowledgement request) bit – prior download section messages are unacknowledged. If the ONT has not received the entire window correctly, i.e., if it misses a sequence number or discards a download section because of a CRC error, it acknowledges with a command processing error result, whereupon the OLT falls back to the beginning of the window and tries again. To improve the chance of successful transmission, the OLT may choose to reduce the size of the window on its next attempt.

When the final window has been successfully downloaded, the OLT sends an end software download message whose contents include the size of the downloaded image in bytes, along with a CRC-32 computed according to [ITU-T I.363.5], across the entire image but excluding pad bytes that may have been transmitted. If the ONT agrees with both of these values, it acknowledges successful completion of the download and updates the software image validity attribute to indicate that the newly downloaded image is valid.

The ONT should not positively acknowledge an end download message until it has confirmed image size and CRC, and performed whatever operations may be necessary – such as non-volatile storage – to accept an immediate activate or commit message from the OLT. The ONT should respond with a device busy result code until these operations are complete, and the OLT should periodically re-try the end download command.

The nested state machines in OLT and ONT can conceivably get out of step in a number of unspecified ways, nor is it specified how to escape from a loop of transmission failure and retry. As a recovery mechanism from detectable state errors, it is recommended that the ONT reply with command processing error result codes to both acknowledged download section and end software download commands, and that the OLT send a final end software download command with known bad CRC and image size (e.g., all 0), whereupon both OLT and ONT should reset to the state in which no download is in progress, that is, state S1/S1' of Figure 9.1.4-1. Likewise, the OLT should be able to abort the download operation at any time by sending an end software download message with invalid CRC and image size.

As well as the download of an image to the ONT as a whole, the download messages allow an option to download an image to each of several circuit packs in parallel. The starting assumption is that the OLT knows the set of circuit packs that require the same download file, so that it can specify this set in the download command sequence.

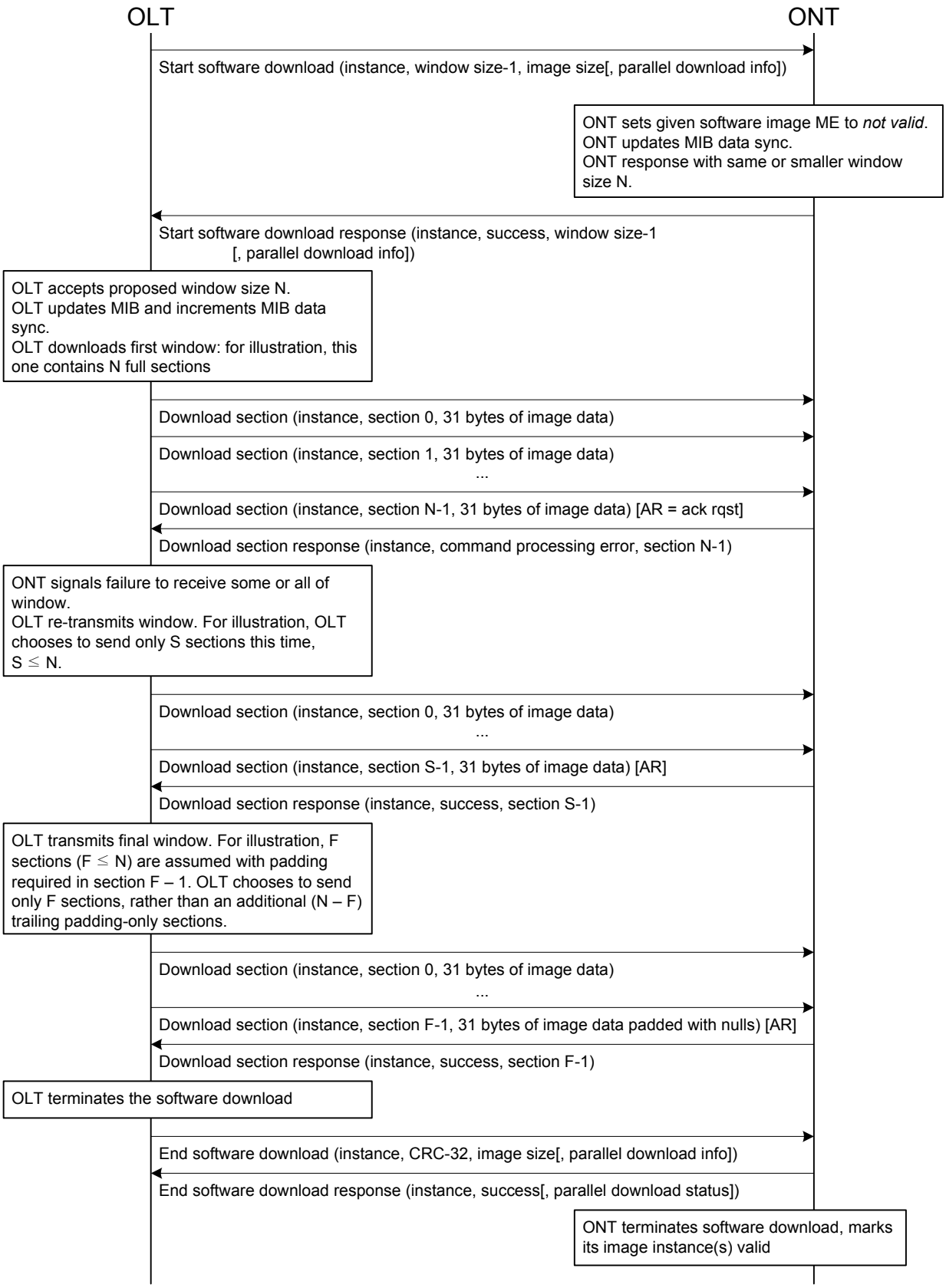


Figure I.2.7-1 – Software download

49) Clause II.2.33, End software download

Replace:

Message contents	14-17									CRC-32

With:

Message contents	14-17									CRC-32, computed over all bytes of the software image (excluding padding), as specified in [ITU-T I.363.5].

50) Clause II.2.27, Test

Replace:

Format for ONT-G, ANI-G and circuit pack entity classes

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	1	0						DB = 0, AR = 1, AK = 0 bits 5-1: action = test
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10-11									Entity class. NOTE – This format applies to entity classes ONT-G, ANI-G and circuit pack.

With:

Format for ONT-G, ANI-G, RE ANI-G, PPTP RE UNI, RE upstream amplifier, RE downstream amplifier and circuit pack entity classes

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	1	0						DB = 0, AR = 1, AK = 0 bits 5-1: action = test
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10-11									Entity class. NOTE – This format applies to entity classes ONT-G, ANI-G, RE ANI-G, PPTP RE UNI, RE upstream amplifier, RE downstream amplifier and circuit pack.

51) Clause II.2.45, Test result

a) Replace:

Several formats are currently defined. They are used as follows:

- Self-test results, ONT-G, circuit pack, or any other ME that supports self test.
- Vendor-specific test results, generic format, any ME that supports it.

- POTS (or BRI) test results, either MLT, dial tone draw-break or vendor-specific POTS tests that use a general purpose buffer.
- ICMP tests, either ping or traceroute.
- The results of an optical line supervision test on the ANI-G.

With:

Several formats are currently defined. They are used as follows:

- Self-test results, ONT-G, circuit pack, or any other ME that supports self test.
- Vendor-specific test results, generic format, any ME that supports it.
- POTS (or BRI) test results, either MLT, dial tone draw-break or vendor-specific POTS tests that use a general purpose buffer.
- ICMP tests, either ping or traceroute.
- The results of an optical line supervision test on the ANI-G, RE ANI-G, PPTP RE UNI, RE upstream amplifier or RE downstream amplifier.

b) Replace:

Format for optical line supervision test action invoked against ANI-G entity class

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	0	0						DB = 0, AR = 0, AK =0 bits 5 – 1: action = test result
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10-11									Entity class. NOTE – This message format pertains to ANI-G entity class.

With:

Format for optical line supervision test action invoked against ANI-G, RE ANI-G, PPTP RE UNI, RE upstream amplifier or RE downstream amplifier entity class

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	0	1						DB = 0, AR = 0, AK =0 bits 5 – 1: action = test result
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10-11									Entity class. NOTE – This message format pertains to ANI-G, RE ANI-G, PPTP RE UNI, RE upstream amplifier or RE downstream amplifier entity class.

52) Appendix III

Appendix III

Traffic management options

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

Replace the entirety of this appendix with the following text:

Depending on the trade-off between the complexity and the number of supported features, the ONT can have various traffic management options. Examples of traffic management implementation in the ONT are described in the following clauses. This appendix also indicates how the MIB defined in clause 9 is used for each implementation.

It should be pointed out that the ONT traffic management is not limited to these examples. ONT traffic management is likely a place where every vendor searches for a proprietary feature to give it a competitive advantage. However, every proprietary feature requires some kind of management that affects OMCI. In fact, it is difficult for the specification given in this Recommendation to keep up with technological and feature innovations. It is envisioned that vendor specific managed entities will be needed to manage the traffic management related functions in the ONT.

III.1 Priority queue configuration

When the focus is on low complexity implementation, the ONT uses the priority controlled upstream traffic method. This configuration is used when the traffic management option attribute in the ONT-G ME is 0 (priority controlled). In this case, the ONT has no traffic contract or QoS awareness. The ONT is configured by the OLT with a priority for each connection for both directions.

Theoretically, UPC is needed at every multiplexing point, including the ONT. A system with the UPC function has to monitor the traffic volume entering the network from all active connections to ensure that the agreed parameters are not violated and to deploy a frame discard or tag policy. In the priority queue implementation, the UPC function is moved to the OLT, where it protects the core network. The PON is protected by the "UPC-like" MAC (via the DBA process). The MAC manages all connections from a T-CONT as a whole. Essentially, the MAC isolates T-CONTs from each other.

As such, CPEs sharing one T-CONT may have to regulate their own connection streams to maintain quality. A CPE sending out more traffic on one connection will do so at the expense of other connections established via the same T-CONT.

III.2 Explicit traffic scheduler configuration

In slightly more complex implementations, ONTs may implement some level of traffic scheduling within each T-CONT. These are described using priority queues and one or more levels of traffic scheduler MEs. The arrangement of priority queues and traffic schedulers is determined by the ONT, and is generally not controllable by the OLT. An example of the configuration of the traffic scheduler appears in Figure III.2-1. This model consists of three stages, such as two-delay control and one guaranteed rate control stages. A delay control stage can be worked by HOL (head of line) scheduling. A guaranteed rate control stage can be worked by WRR. This configuration may also be used when the traffic management option attribute in the ONT-G ME is 0 (priority controlled).

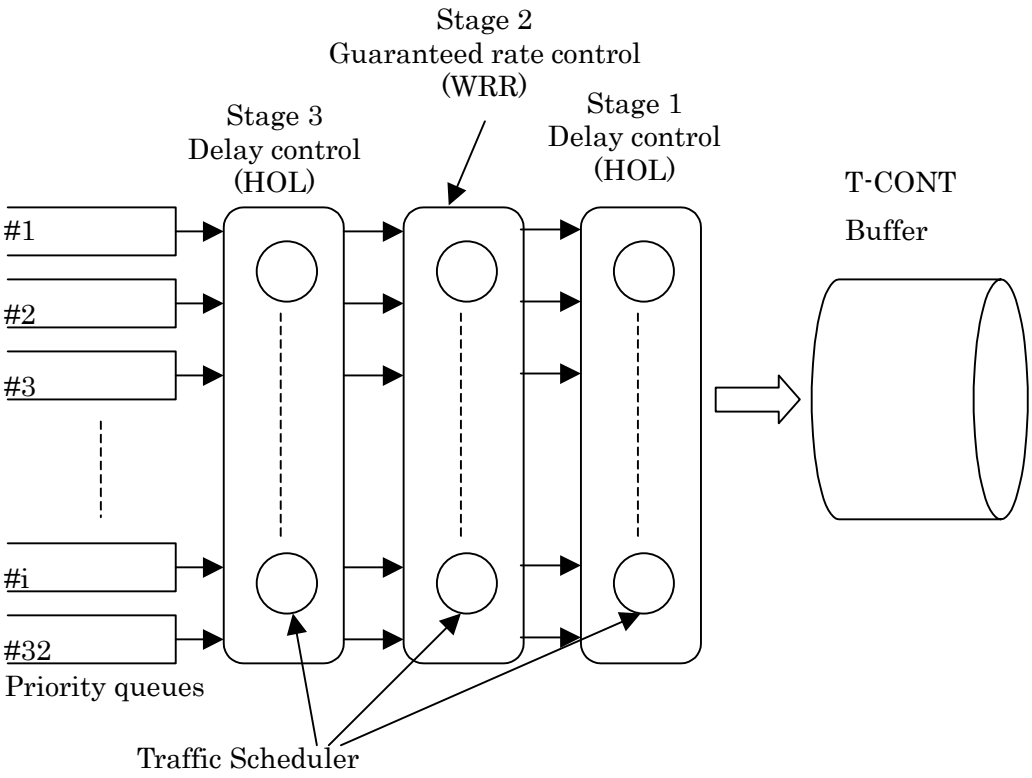


Figure III.2-1 – Architectural model in ONT

III.3 Traffic descriptor configuration

An alternative method of controlling traffic in ONTs is to provide traffic descriptors to the ONT, and leave the details of honouring and enforcing these contracts to the ONT implementation. This is controlled using GEM traffic descriptor MEs. This method makes the theoretical assumption that a work-conserving scheduling methodology will be used. In this configuration, traffic is shaped to conform to PIR and PBS in the GEM traffic descriptor ME. This configuration is used when the traffic management option attribute in the ONT-G ME is 1 (rate controlled).

III.4 Priority and rate controlled configuration

Another method of controlling traffic in ONTs is to provide not only priority control with traffic scheduling, but also traffic descriptors. This is controlled using GEM traffic descriptor, priority queue-G and traffic scheduler-G MEs. This method makes the theoretical assumption that a work-conserving scheduling methodology will be used. In this configuration, traffic is policed to conform to PIR and PBS, and may be marked green or yellow according to CIR/CBS/PIR/PBS in the GEM traffic descriptor ME. This configuration is used when the traffic management option attribute in the ONT-G ME is 2 (priority and rate controlled).

53) Bibliography

Add the following to the Bibliography:

Bibliography

[b-Floyd] Floyd, S, and Jacobson, V (1993), *Random early detection gateways for congestion avoidance*. IEEE/ACM Transactions on Networking, V.1 N.4, August, pp. 397-413.

[b-ATIS 0300231] ATIS 0300231-2003, *Layer 1 In-Service Digital Transmission Performance Monitoring*.

[b-IETF RFC 2597] IETF RFC 2597 (1999), *Assured Forwarding PHB Group*.

[b-IETF RFC 2698] IETF RFC 2698 (1999), *A Two Rate Three Color Marker*.

[b-IETF RFC 3926] IETF RFC 3926 (2004), *FLUTE – File Delivery Over Unidirectional Transport*.

[b-IETF RFC 4115] IETF RFC 4115 (2005), *A Differentiated Service Two-Rate, Three-Color Marker With Efficient Handling Of In-Profile Traffic*.

SERIES OF ITU-T RECOMMENDATIONS

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

Printed in Switzerland
Geneva, 2010