INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.983.2

(06/2002)

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

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

ONT management and control interface specification for B-PON

ITU-T Recommendation G.983.2

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
TESTING EQUIPMENTS	G.500–G.599
TRANSMISSION MEDIA 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
QUALITY OF SERVICE AND PERFORMANCE	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DIGITAL TERMINAL EQUIPMENTS	G.7000–G.7999
DIGITAL NETWORKS	G.8000–G.8999

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

ITU-T Recommendation G.983.2

ONT management and control interface specification for B-PON

Summary

In the B-PON system defined in ITU-T Rec. G.983.1 [3] (called ATM-PON in ITU-T Rec. G.983.1), the ONTs are located at the customer site. The B-PON element management system will only manage ONTs as part of the B-PON system through the OLT using the ONT management and control interface (OMCI).

This Recommendation presents requirements for the OMCI. First, it specifies managed entities of a protocol-independent Management Information Base (MIB) that models the exchange of information between the OLT and ONT. Then, it covers the ONT management and control channel, protocol and detailed messages. This revised version of ITU-T Rec. G.983.2 incorporates the material from ITU-T Rec. G.983.2 Amendments 1 and 2.

Source

ITU-T Recommendation G.983.2 was revised by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 June 2002.

FOREWORD

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

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

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.

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 not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

© ITU 2003

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

		Page
1	Scope	1
2	References	1
3	Abbreviations	2
4	Reference model and terms	4
4.1	OMCI in ITU-T Rec. G.983.1	4
4.2	ONT functions	5
4.3	VP Mux functionality in the ONT	6
5	Requirements of the management interface specification	6
5.1	Configuration management	6
5.2	Fault management	7
5.3	Performance management	8
5.4	Security management	8
6	Protocol-independent MIB for the OMCI	8
6.1	Managed entities	8
6.2	Managed entity relation diagrams	12
7	MIB description	20
7.1	ONT equipment management	22
7.2	ANI management	37
7.3	UNI management	38
7.4	VP MUX management	89
7.5	Traffic management	92
8	ONT Management and Control Channel (OMCC)	104
9	ONT management and control protocol	104
9.1	ONT management and control protocol cell format	104
9.2	Message flow control and error recovery	109
9.3	OMCI handling within the ONT	111
Appendix I – OMCI common mechanisms and services		113
I.1	Common mechanisms	113
I.2	Common services	121
Appendix II – OMCI message set		151
II.1	General remarks	151
II.2	Message layout	153

Page

Appendix III – Support of F4/F5 maintenance flows in the ONT 178
III.1 General principle 178
III.2 Definition of the F4/F5 segment and end-to-end applicability 178
III.3 OMCI support of F4/F5 flows in the ONT 179

Appendix IV – Traffic management options 180
IV.1 Priority $queue_{B}$-PON 180
IV.2 Clarification of ONT functional blocks 180

Appendix V – Bibliography 183

ITU-T Recommendation G.983.2

ONT management and control interface specification for B-PON

1 Scope

This Recommendation specifies the ONT Management and Control Interface (OMCI) for the B-PON system defined in ITU-T Rec. G.983.1 [3] (called ATM-PON in ITU-T Rec. G.983.1) to enable multi-vendor interoperability between the OLT and the ONT.

The OMCI specification addresses the ONT configuration management, fault management and performance management for B-PON system operation and for several services including:

- ATM adaptation layers 1, 2, and 5;
- Circuit Emulation Service;
- Ethernet services, including MAC Bridged LAN;
- Voice services;
- Wavelength division multiplexing.

The focus of this OMCI specification is on FTTH and FTTBusiness ONTs. The Recommendation defines a protocol necessary to support the capabilities identified for these ONTs. It also allows optional components and future extensions.

2 References

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

[1] ITU-T Recommendation G.784 (1999), *Synchronous digital hierarchy (SDH) management*.

[2] ITU-T Recommendation G.774 (2001), *Synchronous digital hierarchy (SDH) management information model for the network element view*.

[3] ITU-T Recommendation G.983.1 (1998), *Broadband optical access systems based on Passive Optical Networks (PON)*.

[4] ITU-T Recommendation I.321 (1991), *B-ISDN protocol reference model and its application*.

[5] ITU-T Recommendation I.363.1 (1996), *B-ISDN ATM Adaptation Layer specification: Type 1 AAL*.

[6] ITU-T Recommendation I.363.5 (1996), *B-ISDN ATM Adaptation Layer specification: Type 5 AAL*.

[7] ITU-T Recommendation I.371 (2000), *Traffic control and congestion control in B-ISDN*.

[8] ITU-T Recommendation I.610 (1999), *B-ISDN operation and maintenance principles and functions*.

[9] ITU-T Recommendation I.751 (1996), *Asynchronous transfer mode management of the network element view*.

[10] ITU-T Recommendation Q.824.6 (1998), *Stage 2 and stage 3 description for the Q3 interface – Customer administration: Broadband Switch Management*.

[11] ITU-T Recommendation I.432.1 (1999), *B-ISDN user-network interface – Physical layer specification: General characteristics*.

[12] ITU-T Recommendation I.356 (2000), *B-ISDN ATM layer cell transfer performance*.

[13] ITU-T Recommendation I.371.1 (2000), *Guaranteed frame rate ATM transfer capability*.

[14] IEEE 802.1D, *Media Access Control (MAC) Bridges*.

[15] ITU-T Recommendation I.363.2 (2000), *B-ISDN ATM Adaptation layer specification: Type 2 AAL*.

[16] ITU-T Recommendation I.366.1 (1998), *Segmentation and Reassembly service specific convergence sublayer for the AAL type 2*.

[17] ITU-T Recommendation I.366.2 (2000), *AAL type 2 service specific convergence sublayer for narrow-band services*.

3 Abbreviations

This Recommendation uses the following abbreviations:

AAL	ATM Adaptation Layer
ABR	Available Bit Rate
ABT/DT	ATM Block Transfer Delayed Transmission
ABT/IT	ATM Block Transfer Immediate Transmission
AN	Access Node
ANI	Access Node Interface
APON	ATM over Passive Optical Network
ATC	ATM Transfer Capabilities
ATM	Asynchronous Transfer Mode
AVC	Attribute Value Change
BES	Block Errored Second
B-ISDN	Broadband Integrated Services Digital Network
B-PON	Broadband Passive Optical Network
CBR	Constant Bit Rate
CES	Circuit Emulation Service
CRC	Cyclic Redundancy Check
CSS	Controlled Slip Second
DBR	Deterministic Bit Rate
ES	Errored Second
FEC	Forward Error Correction
FTTB	Fibre to the Building
FTTBusiness	Fibre to the Business

FTTC	Fibre to the Curb
FTTCab	Fibre to the Cabinet
FTTH	Fibre to the Home
GFR	Guaranteed Frame Rate
HN	Home Network
IP	Internet Protocol
ISDN	Integrated Services Digital Network
LAN	Local Area Network
LIM	Line Interface Module
LSB	Least Significant Bit
LT	Line Terminal
MAC	Media Access Control
ME	Managed Entity
MIB	Management Information Base
MSB	Most Significant Bit
MTU	Maximum Transmission Unit
NT	Network Terminal
OAN	Optical Access Network
ODN	Optical Distribution Network
OLT	Optical Line Termination
OMCC	ONT Management and Control Channel
OMCI	ONT Management and Control Interface
ONT	Optical Network Termination
ONU	Optical Network Unit
OpS	Operations System
PHY	Physical Interface
PON	Passive Optical Network
QoS	Quality of Service
RM	Resource Management
SBR	Statistical Bit Rate
SDP	Simple Device Protocol
SDT	Structured Data Transfer
SES	Severely Errored Second
SNI	Service Node Interface
TCA	Threshold Crossing Alert
TE	Terminal Equipment
UAS	Unavailable Seconds

UBR	Unspecified Bit Rate
UNI	User Network Interface
VBR	Variable Bit Rate
VC	Virtual Channel
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VP	Virtual Path
VPC	Virtual Path Connection
VPI	Virtual Path Identifier
xDSL	x Digital Subscriber Line

4 Reference model and terms

4.1 OMCI in ITU-T Rec. G.983.1

The network architecture reference model for B-PON is described in ITU-T Rec. G.983.1 [3] and shown in Figure 1. The B-PON fits various access network architectures, i.e. Fibre to the Home (FTTH), Fibre to the Building/Curb (FTTB/C) and Fibre to the Cabinet (FTTCab).

The terminology of ONT, which will be used throughout this Recommendation, is more broadly defined as an ONU used for the FTTH and Fibre to the Business (FTTBusiness) configurations. In general, the differences between FTTH and FTTBusiness are that FTTBusiness will serve more than one end user, have stricter availability requirements, and be able to afford for more features and functions than FTTH.

The OMCI specification fits into the overall G.983.1 [3] model for an access network system as illustrated in Figure 1.

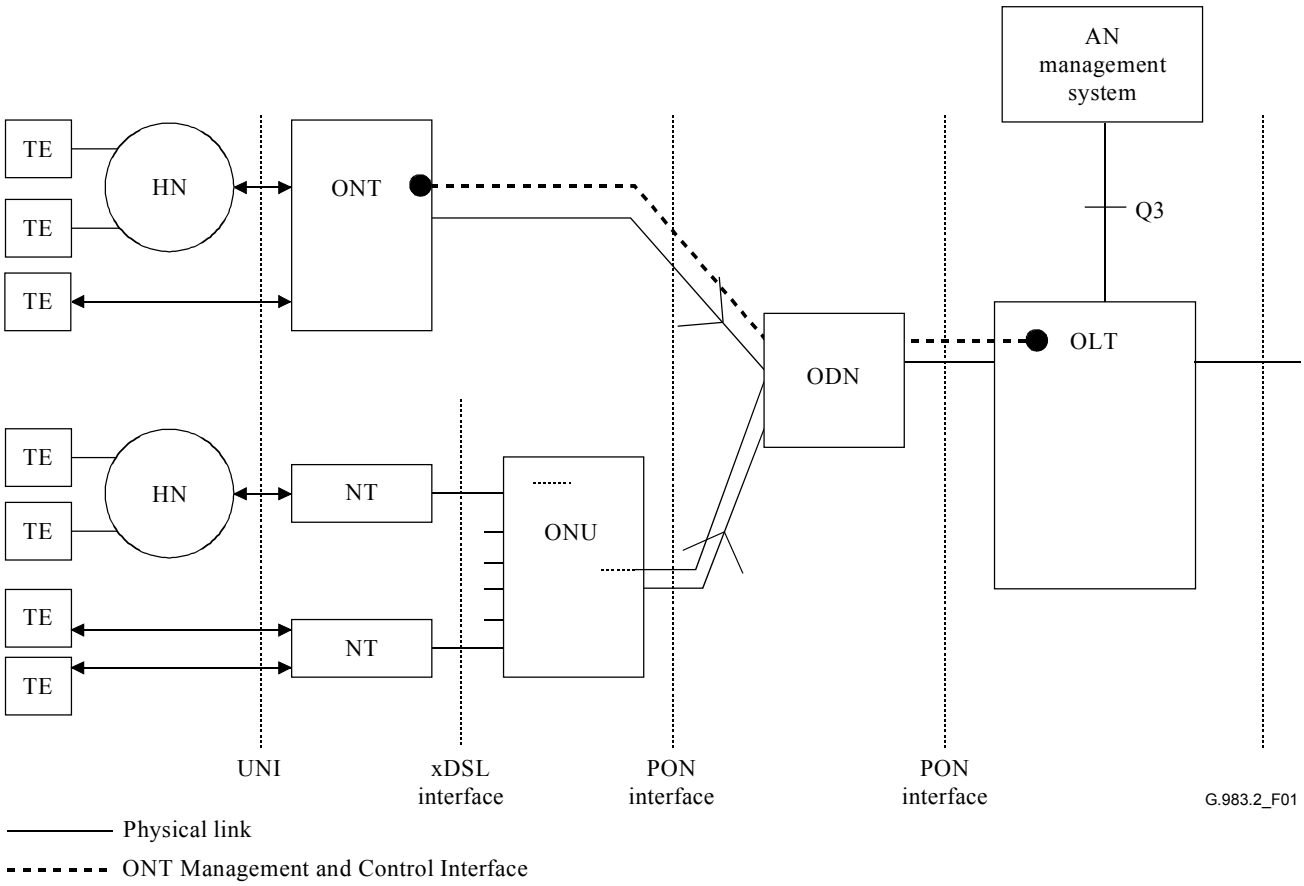


Figure 1/G.983.2 – Reference model

4.2 ONT functions

As shown in Figure 2a, the functions of the ONT are:

a) access network line termination function (AN-LT);

b) user network interface line termination function (UNI-LT), noting that in the Fibre to the Business case, the UNIs from one ONT may belong to different users;

c) ATM multiplexing and de-multiplexing function (ATM-Mux).

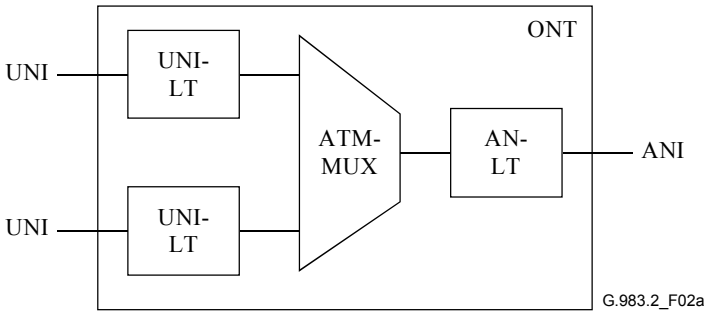


Figure 2a/G.983.2 – ONT functional diagram

4.3 VP Mux functionality in the ONT

In ITU-T Rec. G.983.1 [3], the end-to-end B-PON system (i.e. OLT, ODN and ONT) can function as an ATM VP cross-connection with both provisioned and on-demand connectivity. The configuration of the ATM VP Cross-Connection can be initiated by:

a) the network element operations system via the management interface (e.g. Q3);

b) the Service Node (SN) over a VB5.2 Broadband Bearer Connection Control (B-BCC) protocol.

The ONT, however, always acts as a provisioned ATM multiplexer. The OMCI itself does not distinguish between these two cases. The OLT can, however, assign different priorities to OMCI messages such that in case b) a fast response time of the OMCI is achieved.

The OLT and ONT as a whole can function as a VP as well as a VC switch. However, the low-cost ONT addressed in this Recommendation multiplexes and de-multiplexes ATM connections on the VP level only. Thus, only VPI translation is supported in the ONT.

5 Requirements of the management interface specification

The OMCI is used by the OLT to control an ONT. This protocol allows the OLT to:

a) establish and release connections across the ONT;

b) manage the UNIs at the ONT;

c) request configuration information and performance statistics;

d) autonomously inform the system operator of events such as link failures.

The OMCI protocol runs across an ATM connection between the OLT controller and the ONT controller that is established at ONT initialization. The OMCI protocol is asymmetric: the controller in the OLT is the master and the one in the ONT is the slave. A single OLT controller using multiple instances of the protocol over separate control channels may control multiple ONTs.

The ONT management and control interface requirements given in this Recommendation are needed to manage the ONT in the following areas:

a) Configuration management;

b) Fault management;

c) Performance management;

d) Security management.

5.1 Configuration management

Configuration management provides functions to exercise control over, identify, collect data from and provide data to the ONT. This involves the following:

a) Configuration of equipment;

b) Configuration of the UNIs;

c) Configuration of the VP Network $CTP_{B\text{-}PON}$s and ATM Cross-Connections;

d) Configuration of Interworking VCC Termination Points (non-ATM UNIs only);

e) Configuration of the OAM flows;

f) Configuration of the physical ports;

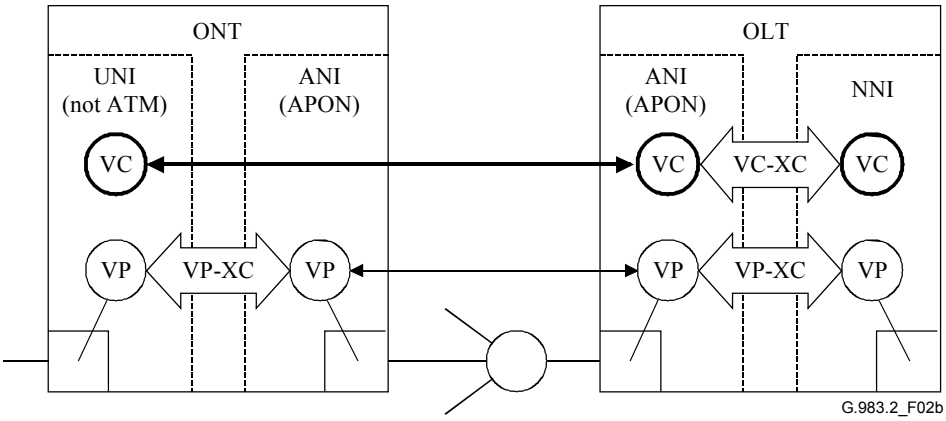
g) Configuration of AAL profiles;

h) Configuration of service profiles;

i) Configuration of traffic descriptors.

ATM VC management is not a part of this Recommendation (see [App.V-1] and ITU-T Rec. I.751 [9].

VC cross-connection capability is not necessary for the ONT, as VC cross-connection is handled by the OLT. Note that the ONT handles VP cross-connection in order to free VPI values on the UNI (the VPI value on the ANI is not free because the same VPI value cannot be assigned to different ONTs due to specification of ITU-T Rec. G.983.1, and VP cross-connection on the ONT resolves this limitation for the UNI). In the case of the OMCI, VC termination and interworkingVCCTP are unified to the InterworkingVCC Termination Point ME. Figure 2b shows the termination model. For non-ATM LIMs, the aggregate of traffic parameters for the various VC terminations is represented by the Traffic Descriptor Profile Pointer associated with the VP Network CTP that contains the VC terminations.



NOTE – VC represents unification of VCCTP and Interworking VCCTP.

Figure 2b/G.983.2 – Cross-connection termination model

5.2 Fault management

The ONT supports *limited* fault management only. Most of the operations are limited to failure indication. The OMCI supports failure reporting on the following managed entities that are described throughout clause 7:

a) $ONT_{B\text{-}PON}$;

b) Subscriber Line Cardholder;

c) Subscriber Line Card;

d) Physical Path Termination Point ATM UNI;

e) Physical Path Termination Point Ethernet UNI;

f) Physical Path Termination Point CES UNI;

g) $TC\ Adapter_{B\text{-}PON}$;

h) Interworking VCC Termination Point;

i) VP Network $CTP_{B\text{-}PON}$;

j) Physical Path Termination Point POTS UNI.

An alarm table is defined for each of these entities.

The ONT shall also support selective OAM cell loop-back testing at the UNI. The ONT diagnostics are limited to the ONT self test. The OLT or element manager will process the information from the ONT; for example, the OLT will determine the severity of each alarm when reporting it to the network operator. ATM management of continuity monitoring is not a part of this Recommendation (see [App.V-1] and ITU-T Rec. I.751 [9]).

5.3 Performance management

The ONT has only *limited* performance monitoring. For the low-cost FTTH ONT, the performance monitoring is limited to PMD and TC layer performance monitoring. However, for the FTTBusiness ONT, ATM cell level protocol monitoring, traffic management and UPC disagreement monitoring may be required. The following are related managed entities:

a) UPC Disagreement Monitoring History Data$_{B\text{-}PON}$;

b) AAL 1 Protocol Monitoring History Data$_{B\text{-}PON}$;

c) AAL 5 Protocol Monitoring History Data$_{B\text{-}PON}$;

d) Ethernet Performance Monitoring History Data;

e) CES Physical Interface Monitoring History Data;

f) TC Adapter Protocol Monitoring History Data;

g) AAL 2 CPS Protocol Monitoring History Data$_{B\text{-}PON}$;

h) Priority Queue$_{B\text{-}PON}$;

i) MAC Bridge PM History Data;

j) MAC Bridge Port PM History Data;

k) Voice PM History Data;

l) VP PM History Data.

Note that it is not required to upload all the performance monitoring related managed entities during the MIB upload (see 7.1.2).

All the history data shall be maintained in the OLT. ATM management of performance monitoring is not a part of this Recommendation (see [App.V-1] and ITU-T Rec. I.751 [9]).

5.4 Security management

This is for further study.

6 Protocol-independent MIB for the OMCI

The OMCI should be defined to allow vendors to offer modular, incremental capabilities to meet different levels of customer needs. This Recommendation first targets FTTH and FTTBusiness ONTs. It defines a protocol necessary to support capabilities identified by ITU-T Rec. G.983.1 [3]. It is important for early deployment and interoperability, yet it allows for optional components and future extensions.

A protocol-independent MIB is used to describe the exchange of information across the OMCI and forms the basis from which protocol-specific models (e.g. Simple Device Protocol for the ONT) are defined. This MIB has as much commonality as possible with the related generic MIB as defined in other ITU-T Recommendations. It is intended to make the OMCI relatively simple while maintaining consistency with the MIB used by the interface between the network-element manager and the OLT.

6.1 Managed entities

The protocol-independent MIB presented in this Recommendation has been defined in terms of *managed entities*. The managed entities are abstract representations of resources and services in an ONT.

This Recommendation uses three levels for indicating the degree of compliance necessary for specific functions and managed entities associated with the OMCI specification:

- **Requirement (R)**: Entities necessary for operational compatibility;

- **Conditional Requirements (CR)**: Entities necessary when the specified optional function is implemented;
- **Option (O)**: Entities that may be useful and required by an operator but that are not necessary for operational compatibility.

The possible managed entities are listed in Table 1.

Table 1/G.983.2 – Managed entities in the OMCI

Managed entity	Required/Optional	Description
AAL 1 Profile$_{B\text{-}PON}$	CR	Used when the ONT supports CES UNIs
AAL 1 Protocol Monitoring History Data$_{B\text{-}PON}$	O	Used when AAL 1 layer performance monitoring is supported
AAL 2 Profile$_{B\text{-}PON}$	CR	Used when the ONT supports AAL 2
AAL 2 CPS Protocol Monitoring History Data$_{B\text{-}PON}$	O	Used when AAL 2 layer performance monitoring is supported
AAL 2 PVC Profile$_{B\text{-}PON}$	CR	Used when the ONT supports AAL 2 PVC
AAL 2 SSCS Parameter Profile 1	CR	Used when the ONT supports AAL 2 SSCS
AAL 2 SSCS Parameter Profile 2	CR	Used when the ONT supports AAL 2 SSCS
AAL 2 SSCS Protocol Monitoring History Data$_{B\text{-}PON}$	CR	Used when AAL 2 layer performance monitoring is supported
AAL 5 Profile$_{B\text{-}PON}$	CR	Used when the ONT supports LAN UNIs
AAL 5 Protocol Monitoring History Data$_{B\text{-}PON}$	O	Used when AAL 5 layer performance monitoring is supported
ANI	O	PON IF, description purposes only, see 7.2 (ANI Management)
ATM VP Cross-Connection	CR	Used for VP multiplexing with VPI translation in the ONT
CES Service Profile$_{B\text{-}PON}$	CR	Used for CES services supported by the ONT
CES Physical Interface Monitoring History Data	O	Used for the CES interface performance monitoring
Interworking VCC Termination Point	CR	Used for non-ATM UNIs
LES Service Profile	CR	Used for LES services supported by the ONT
Logical N × 64 kbit/s Subport ConnectionTermination Point	CR	Used as logical interface for structured CES
MAC Bridge Configuration Data	CR	Used for MAC bridge supported by the ONT
MAC Bridge PM History Data	O	Used for MAC bridge performance monitoring
MAC Bridge Port Configuration Data	CR	Used for MAC bridge supported by the ONT
MAC Bridge Port Designation Data	CR	Used for MAC bridge supported by the ONT
MAC Bridge Port Filter Table Data	CR	Used for MAC bridge supported by the ONT

Table 1/G.983.2 – Managed entities in the OMCI

Managed entity	Required/Optional	Description
MAC Bridge Port Bridge Table Data	CR	Used for MAC bridge supported by the ONT
MAC Bridge Port PM History Data	O	Used for MAC bridge port performance monitoring
MAC Bridge Service Profile	CR	Used for MAC bridge supported by the ONT
Ethernet Performance Monitoring History Data	O	Used for Ethernet interface performance monitoring
$ONT_{B\text{-}PON}$	R	Used for ONT equipment management
ONT Data	R	Used for OMCI MIB management
Physical Path Termination Point ATM UNI	CR	Used for physical path termination point at the ATM UNI
Physical Path Termination Point CES UNI	CR	Used for physical path termination point at the CES UNI
Physical Path Termination Point Ethernet UNI	CR	Used for physical path termination point at the Ethernet UNI
Physical Path Termination Point POTS UNI	CR	Used for physical path trail termination point at the POTS UNI
PON IF Line Card	CR	Used for the PON line card plug-in, only used if PON interface is implemented on a plug-in unit
PON IF Line Cardholder	CR	Used for the PON line card plug-in slot, only used if PON interface is implemented on a plug-in unit
PON Physical Path Termination Point	O	Used for physical path at the ANI, description purpose only, see 7.2 (ANI Management)
PON TC Adapter	O	Used for TC layer at PON interface, description purpose only, see 7.2 (ANI Management)
Priority $Queue_{B\text{-}PON}$	CR	Used for ONTs that support priority queues to multiplex ATM traffic flows
Software Image	R	Used for the software image of the ONT. Software image for the subscriber line cards is optional
Subscriber Line Card	CR (Note)	Used for the UNI line card plug-in
Subscriber Line Cardholder	CR (Note)	Used for the UNI line card plug-in slot
TC $Adapter_{B\text{-}PON}$	CR	Used for TC layer at the UNI side for the ATM UNI
TC Adapter Protocol Monitoring History Data	O	Used when TC layer performance monitoring is supported
Threshold $Data_{B\text{-}PON}$	CR	Used for the set-up of threshold values

Table 1/G.983.2 – Managed entities in the OMCI

Managed entity	Required/Optional	Description
Traffic Descriptors	CR	Used for the ONT that supports traffic shaper to specify ATM layer traffic characteristics in the case of accommodation of non-ATM UNI. Moreover, in the case of accommodation of ATM UNI, Traffic Descriptors may be used for the UPC function in the ONT, if it is required.
Voice CTP	CR	Used for Voice termination point supported by the ONT
Voice PM History Data	O	Used for voice performance monitoring
$UNI_{B\text{-}PON}$	R	User network interface
UPC Disagreement Monitoring History $Data_{B\text{-}PON}$	CR	Used for the ONT that supports UPC
Voice CTP	CR	Used for Voice termination point supported by the ONT
Voice PM History Data	O	Used for voice performance monitoring
Voice Service Profile AAL	CR	Used for AAL Voice services supported by the ONT
VP Network $CTP_{B\text{-}PON}$	R	Used for the VP link termination in the VP Mux
VP PM History Data	O	Used for VP performance monitoring
NOTE – The preferred solution is that the Subscriber Line Card and Subscriber Line Cardholder managed entities should always be modelled, regardless of whether or not the ONT has integrated interfaces; however, for reasons of backward compatibility, these managed entities remain as "CR."		

6.2 Managed entity relation diagrams

The relationships between the required managed entities are given in Figures 3 to 9c.

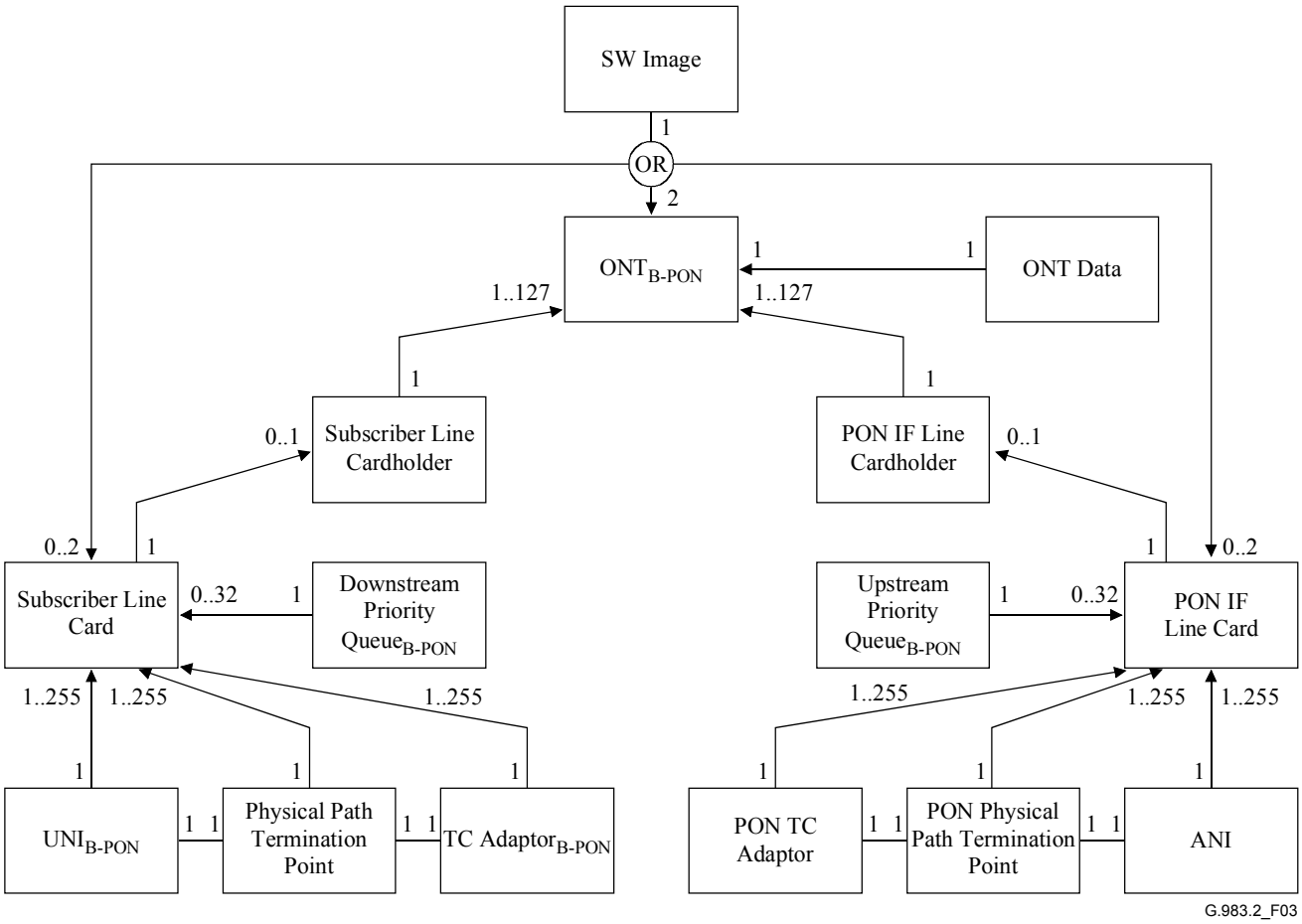


Figure 3/G.983.2 – Managed entity relation diagram for non-integrated interfaces

The "OR" in Figure 3 reflects that one Software Image instance can be contained in one of the following: the ONT, the Subscriber Line Card, or PON IF Line Card.

NOTE 1 – Physical Path Termination Point refers to any/all actual physical trails (CES, Ethernet, ATM, etc.). However, the relationship between Physical Path Termination Point and TC Adapter$_{B\text{-}PON}$ is only applied for Physical Path Termination Point ATM UNI.

Figure 3 shows an ONT with cardholders on both UNI and ANI side (an ONT with integrated interfaces on the UNI and/or ANI side can be modelled by Figure 3 as well, since integrated interfaces use "pseudo" Subscriber Line Cards and Cardholders). Note that extensions of Figure 3 are possible as well, e.g. an ONT with several Subscriber Line Cardholders on the UNI side and one integrated PON interface.

As for the ATM VP Cross-Connection function, two models are valid to meet the various application requirements. One model is a set of Figures 5 and 7; the other is a set of Figures 6 and 8. Only one of the models needs to be implemented.

NOTE 2 – Physical Path Termination Point refers to any/all actual physical trails (CES, Ethernet, ATM, etc.). However, the relationship between Physical Path Termination Point and TC Adapter$_{B\text{-}PON}$ is only applied for Physical Path Termination Point ATM UNI.

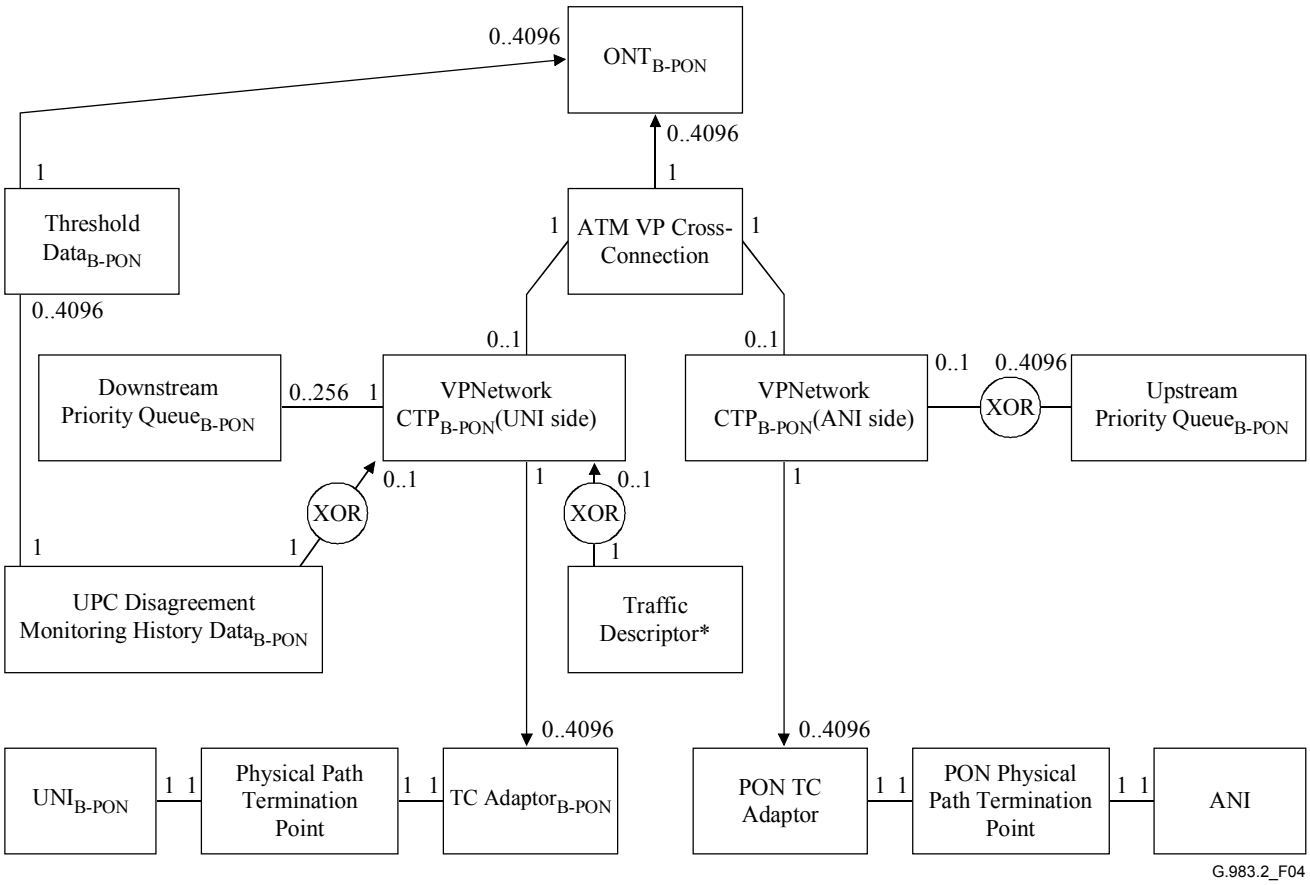


Figure 4/G.983.2 – Managed entity relation diagram – ATM service

The "*" in Figure 4 indicates that the Traffic Descriptor can be one of the specific Traffic Descriptor managed entities defined in 7.5.2.

NOTE 3 – Physical Path Termination Point refers to any/all actual physical trails (CES, Ethernet, ATM, etc.). However, the relationship between Physical Path Termination Point and TC Adapter$_{B\text{-}PON}$ is only applied for Physical Path Termination Point ATM UNI.

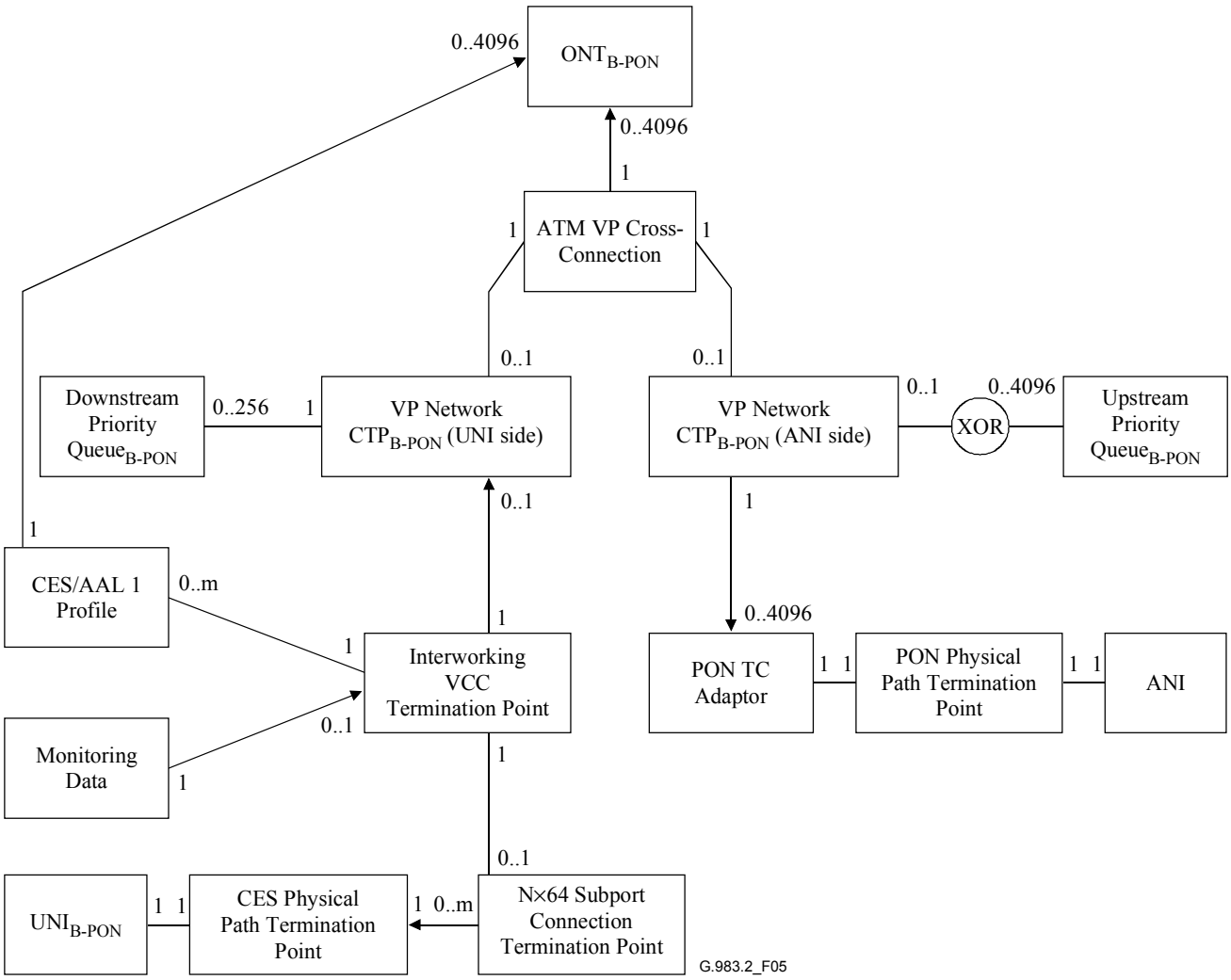


Figure 5/G.983.2 – Managed entity relation diagram – Structured CES service in an ONT that models VP cross-connect function

Note that the value of m equals 31 for CES interworking to E1.

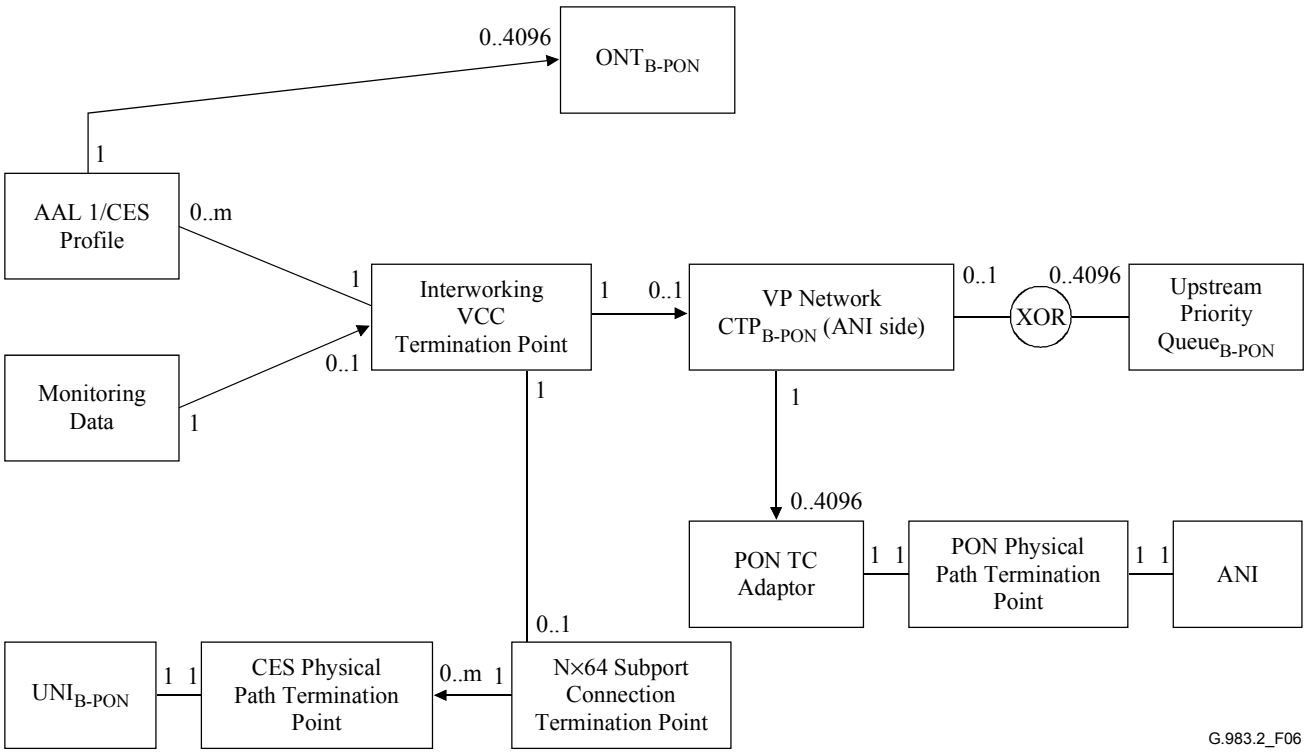


Figure 6/G.983.2 – Managed entity relation diagram – Structured CES service in an ONT that does not model VP cross-connect function

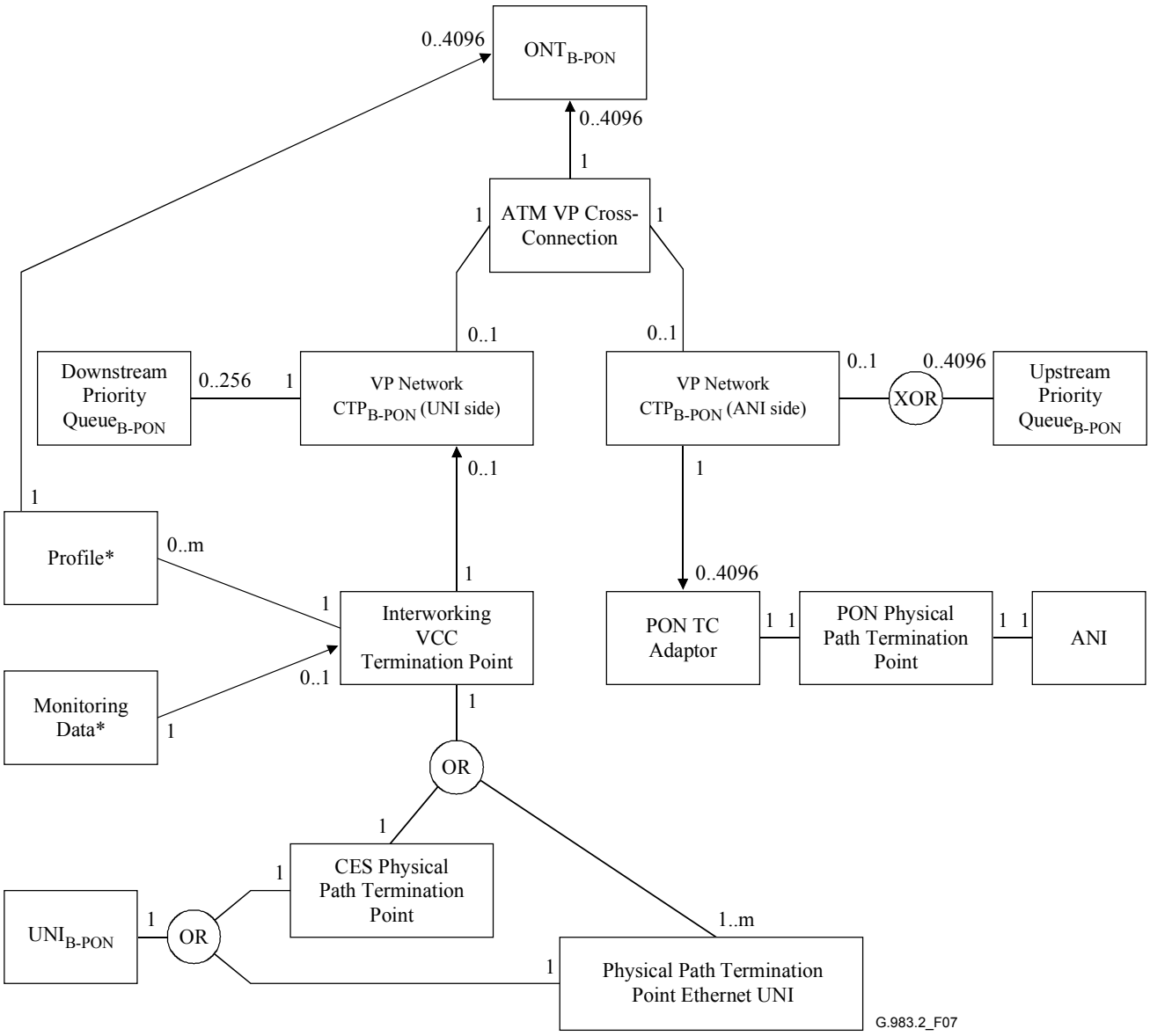


Figure 7/G.983.2 – Managed entity relation diagram – Unstructured CES and LAN service in an ONT that models VP cross-connect function

The choice of a specific Service Profile and Monitoring Data is service specific. The "*" in Figure 7 indicates that the choice can be one of the Service Profile managed entities and one of the Monitoring Data managed entities defined in clause 7.

The "OR" in Figure 7 reflects the choice of the associated managed entity based on the type of service (Circuit Emulation Service or Ethernet service).

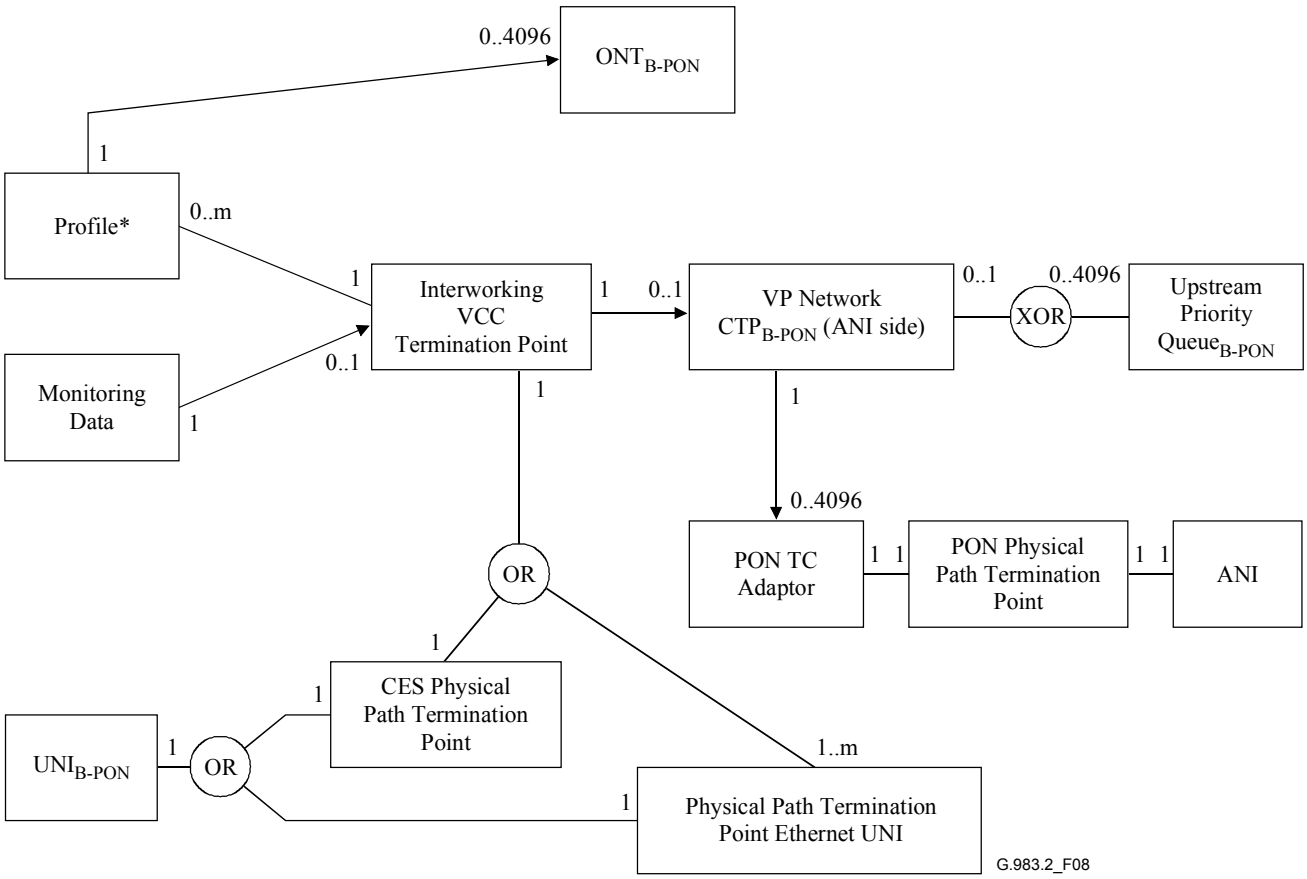


Figure 8/G.983.2 – Managed entity relation diagram – Unstructured CES and LAN service in an ONT that does not model VP cross-connect function

The choice of a specific Service Profile and Monitoring Data is service specific. The "*" in Figure 8 indicates that the choice can be one of the Service Profile managed entities and one of the Monitoring Data managed entities defined in clause 7.

The "OR" in Figure 8 reflects the choice of the associated managed entity based on the type of service (Circuit Emulation Service or Ethernet service).

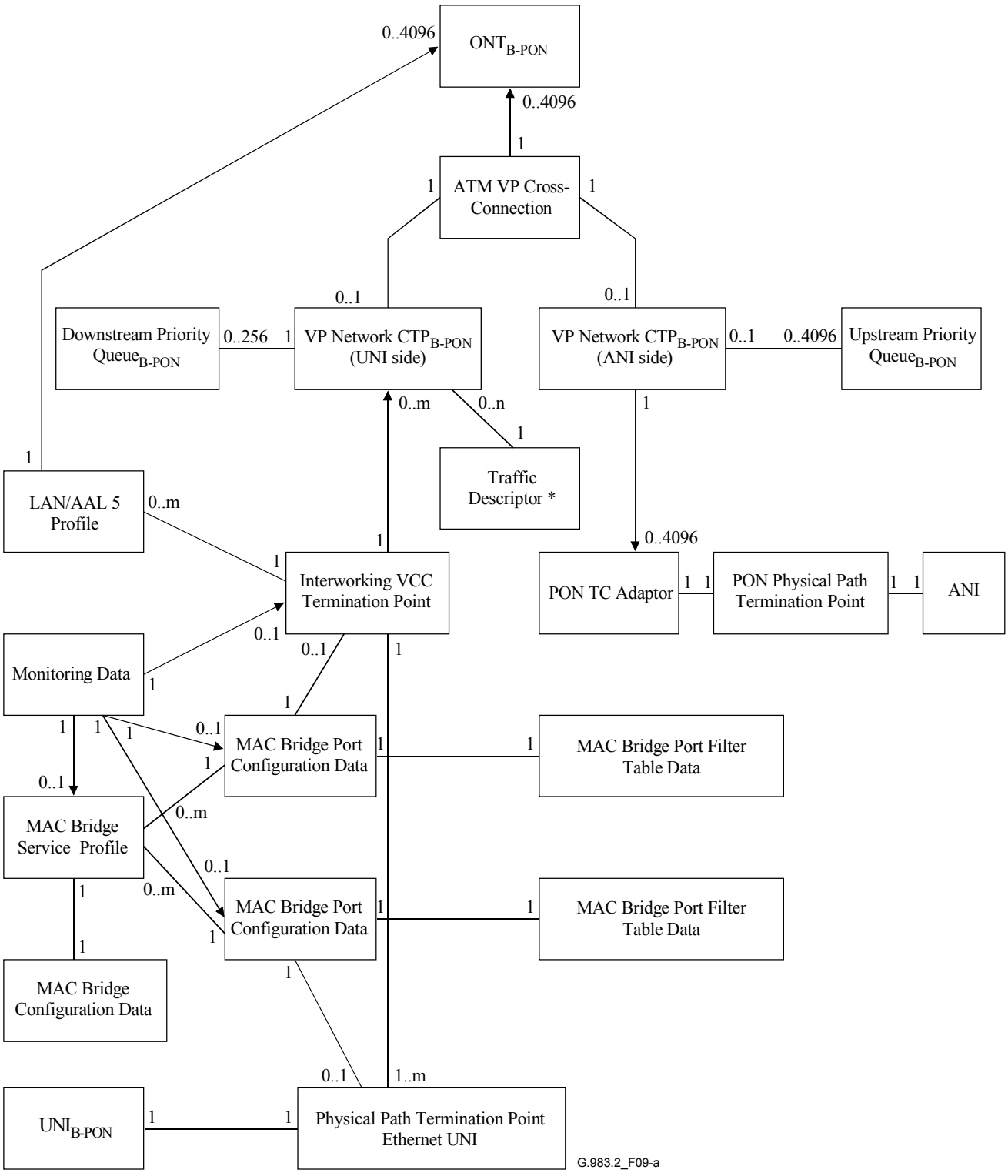


Figure 9a/G.983.2 – Managed entity relation diagram – MAC bridge service in an ONT that models VP cross-connect function

NOTE 4 – In Figure 9a, the MAC Bridge Port Configuration Data ME related to the Interworking VCC Termination Point represents the bridge port on the ATM side. The MAC Bridge Port Configuration Data ME related to Physical Path Termination Point Ethernet UNI represents the bridge port on the Ethernet side.

The "*" in Figure 9a indicates that the Traffic Descriptor can be one of the specific Traffic Descriptor managed entities defined in 7.5.2.

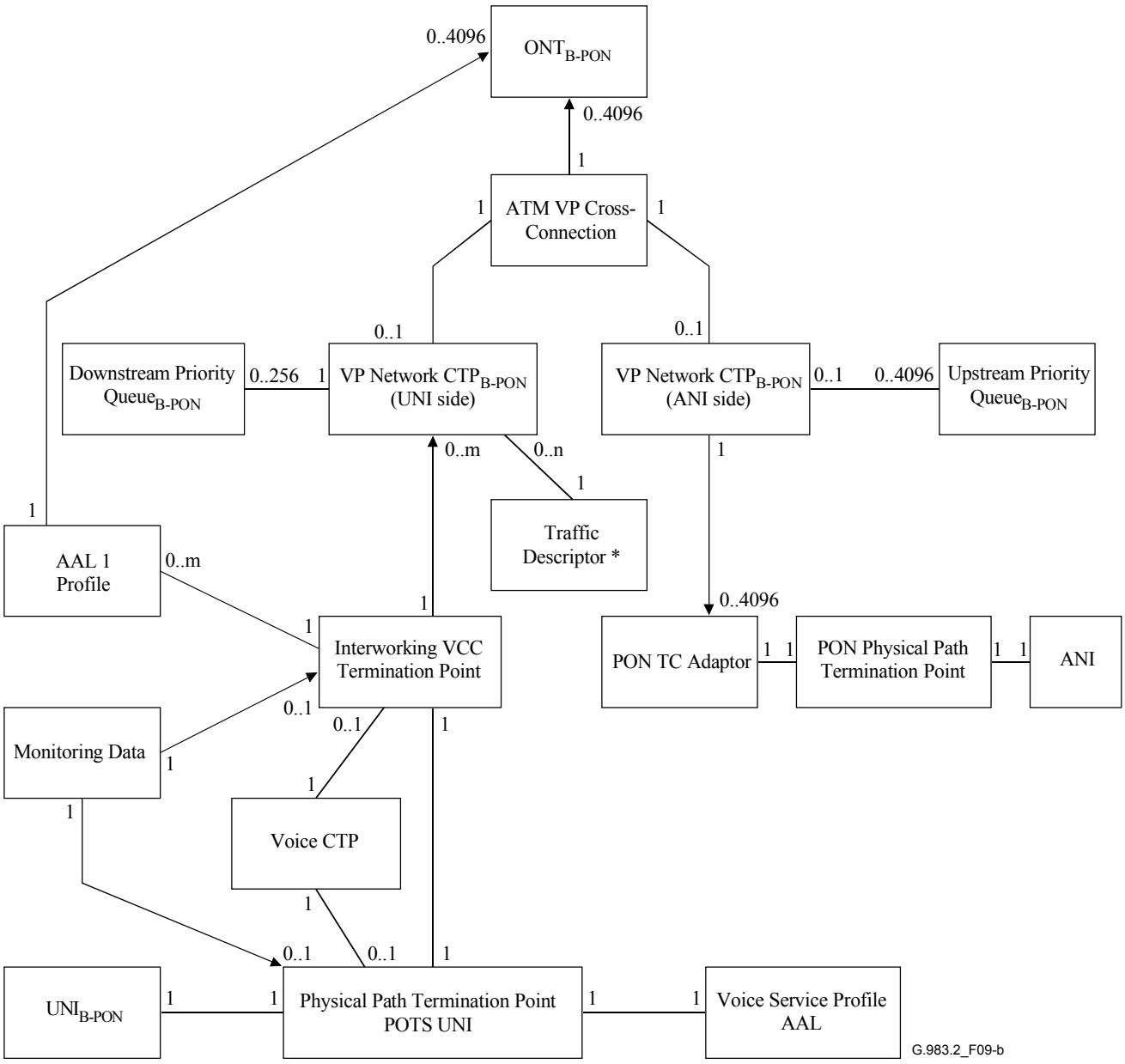


Figure 9b/G.983.2 – Managed entity relation diagram – Voice over AAL 2 service in an ONT that models VP cross-connect function

The "*" in Figure 9b indicates that the Traffic Descriptor can be one of the specific Traffic Descriptor managed entities defined in 7.5.2.

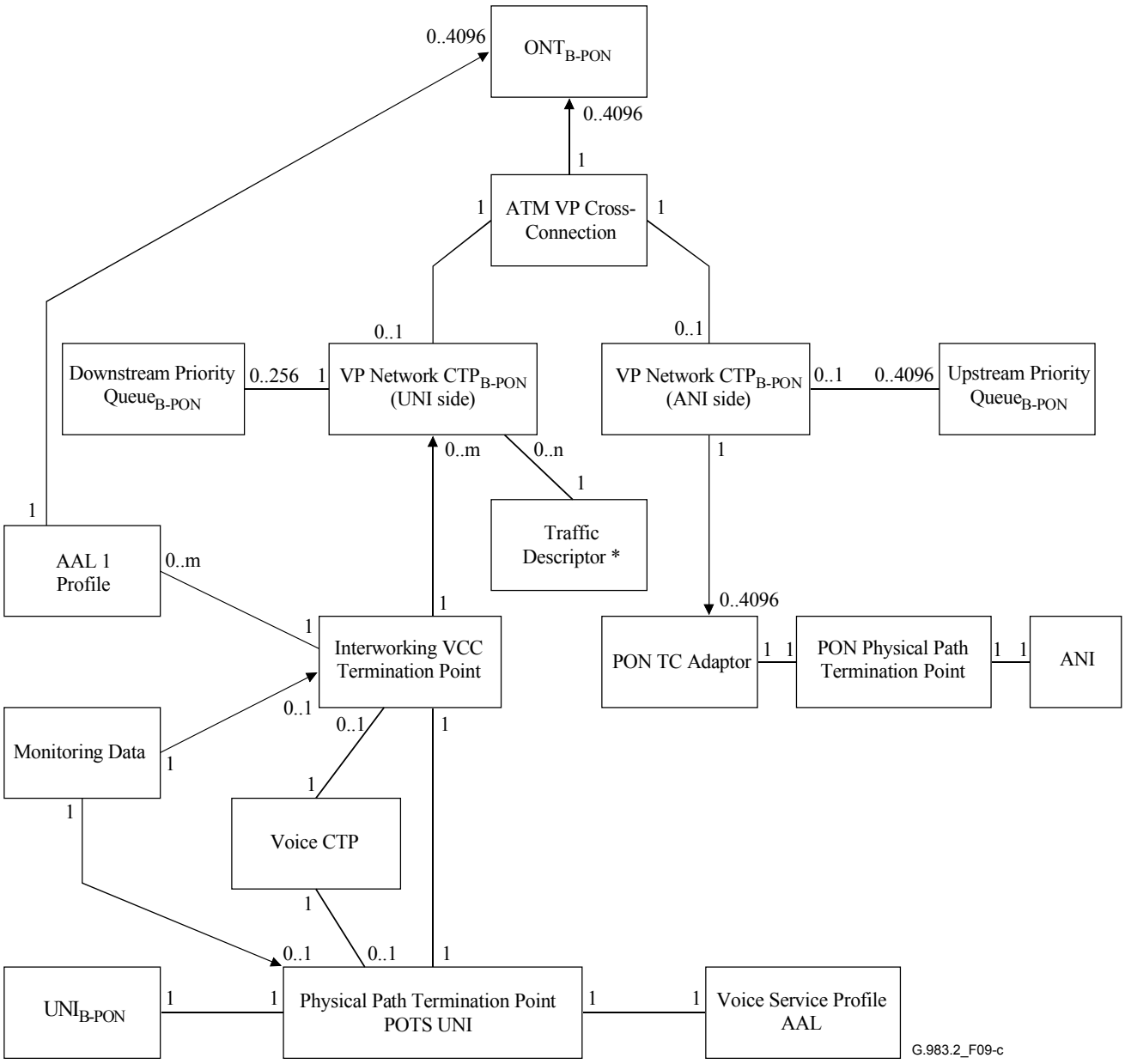


Figure 9c/G.983.2 – Managed entity relation diagram – Voice over AAL 1 service in an ONT that models VP cross-connect function

The "*" in Figure 9c indicates that the Traffic Descriptor can be one of the specific Traffic Descriptor managed entities defined in 7.5.2.

7 MIB description

A detailed description of all ONT managed entities is provided in the clauses that follow. The descriptions include:

a) the purpose of the entity;

b) the relationship(s) that the entity supports with other managed entities;

c) the attributes of the entity;

d) the management operations that may be performed on the entity;

e) the notifications generated by the managed entity.

These clauses are organized as follows:

a) ONT equipment management;

b) ANI (i.e. PON IF) management;

c) UNI management;

d) VP layer management;

e) traffic management.

A managed entity can be instantiated by the ONT autonomously or on explicit request of the OLT via a create command.

Attributes of a managed entity for which no create action exists (i.e. a managed entity which is auto-instantiated by the ONT) can be (R), (W), or (R, W). On the other hand, attributes of a managed entity for which a create action exists (i.e. a managed entity which is instantiated on explicit request by the OLT) can be either (R), (W), (R, W), (R, Set-by-create), (W, Set-by-create), or (R, W, Set-by-create). For attributes that are not "Set-by-create", a default value will be specified in this Recommendation which will be assigned to the attribute on instantiation of the managed entity.

The following gives a more detailed explanation for each of the possible cases:

(R): On instantiation of the managed entity (either autonomously or on request of the OLT via a create action), the ONT sets the attribute to a default value. The OLT can only read the value of the attribute. In case of an autonomous attribute value change, the ONT will send an attribute value change notification to the OLT.

(W): On instantiation of the managed entity (either autonomously or on request of the OLT via a create action), the ONT sets the attribute to a default value. The OLT can only write the value of the attribute. In case of an autonomous attribute value change, the ONT will NOT send an attribute value change notification to the OLT.

(R, W): On instantiation of the managed entity (either autonomously or on request of the OLT via a create action), the ONT sets the attribute to a default value. The OLT can both read and write the value of the attribute. In case of an autonomous attribute value change, the ONT will send an attribute value change notification to the OLT.

(R, Set-by-create): On instantiation of the managed entity (by necessity on request of the OLT via a create action), the ONT sets the attribute to the value specified in the create command. Subsequently, the OLT can only read the value of the attribute. In case of an autonomous attribute value change, the ONT will send an attribute value change notification to the OLT.

(W, Set-by-create): On instantiation of the managed entity (by necessity on request of the OLT via a create action), the ONT sets the attribute to the value specified in the create command. Subsequently, the OLT can only write the value of the attribute. In case of an autonomous attribute value change, the ONT will NOT send an attribute value change notification to the OLT.

(R, W, Set-by-create): On instantiation of the managed entity (by necessity on request of the OLT via a create action), the ONT sets the attribute to the value specified in the create command. Subsequently, the OLT can both read and write the value of the attribute. In case of an autonomous attribute value change, the ONT will send an attribute value change notification to the OLT.

In all bit vectors indicated in this Recommendation, bit 1 represents the least significant bit, while bit 8 represents the most significant bit within a byte. If the bit vector is made up of more than one byte, then the numbering starts from the least significant byte onwards.

In all attribute descriptions that refer to the Boolean values "true" and "false", true will be coded as 0x01 and false will be coded as 0x00.

In all attribute descriptions that refer to spaces, the value 0x20 must be used for the entire size of the attribute.

The notifications generated by a managed entity stem from the following events: Alarms, Attribute Value Changes (AVCs), Threshold Crossing Alerts (TCAs), and Test results. Alarms, TCAs, and failures of autonomous self tests are all reported via "Alarm" messages. AVCs are reported via "Attribute Value Change" messages. Test results are reported:

a) via a "Test result" message if the test is invoked by a "Test" command from the OLT; or

b) via an "Alarm" message in the case of failure of an autonomous self test (in start-up phase). Details about these messages and the related coding are in Appendix II.

7.1 ONT equipment management

7.1.1 $ONT_{B\text{-}PON}$

This managed entity represents the ONT as equipment.

An instance of this managed entity is automatically created by the ONT after initialization. After the creation of this managed entity, the associated attributes are updated according to the data within the ONT itself.

Relationships

All other managed entities in this Recommendation are related directly or indirectly to the $ONT_{B\text{-}PON}$ entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. There is only one instance and it has the number 0x0000. (R) (mandatory) (2 bytes).

Vendor id: This attribute identifies the vendor of the ONT. Upon autonomous instantiation, this attribute consists of all spaces. (R) (mandatory) (4 bytes).

Version: This attribute identifies the version of the ONT as defined by the vendor. The printable value of "0" shall be used when version information is not available or applicable to the ONT being represented. Upon autonomous instantiation, this attribute consists of all spaces. (R) (mandatory) (14 bytes).

Serial number: The serial number is unique for each ONT. Note that the serial number of the ONT is already defined in ITU-T Rec. G.983.1 [3] and contains the vendor id and/or the version number. Upon autonomous instantiation, this attribute consists of all spaces. (R) (mandatory) (8 bytes).

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

1) "Priority controlled upstream traffic" (0x00): the upstream traffic coming from the user is given a priority.
2) "Cell rate controlled upstream traffic" (0x01): the maximum upstream traffic of each individual connection is guaranteed.

Note that the Traffic management option will not apply to downstream traffic. In other words, there is no need for a traffic descriptor for the downstream direction and downstream priority queues can be used. Upon autonomous instantiation, this attribute is set to 0x00. (R) (mandatory) (1 byte).

VP cross-connection function option: This attribute identifies the support of ATM VP cross-connection management functions for the interworking connections to non-ATM UNIs. The value is set to 0x00 if ATM VP cross-connection management functions are not modelled. The value is set to 0x01 if the ATM VP cross-connection management functions are modelled. The default value of this attribute is 0x01. (R) (mandatory) (1 byte).

Battery backup: This attribute provides a Boolean indication of whether or not the ONT/NT supports battery backup. False will indicate that no battery is provisioned; true indicates that a battery is provisioned. Upon autonomous instantiation, this attribute is set to false. (R, W) (mandatory) (1 byte).

Administrative state: This attribute is used to activate (unlock: value 0x00) and deactivate (lock: value 0x01) the functions performed by instances of this managed entity. Selection of a default value for this attribute is outside the scope of this Recommendation as it is normally handled through supplier-operator negotiations. (R, W) (mandatory) (1 byte).

Operational state: This attribute indicates whether or not a managed entity is capable of performing its task. Valid values are enabled (0x00) and disabled (0x01). (R) (optional) (1 byte).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Reboot: Reboot the ONT.

Test: This action is used to initiate an ONT self test. Test outcome is "Pass" or "Fail."

Synchronize time: This action is used to synchronize the start time of all Monitoring managed entities of the ONT with the reference time of the OLT and to reset the registers of the Monitoring managed entities. The effect of this action is that all counters of all Monitoring managed entities are set to 0x00 and restart counting. Also, the value of the Interval End Time attribute of the Monitoring managed entities is set to 0x00 and restarts counting.

Note that no other OMCI action has the same effect: synchronization of the start time is not guaranteed at start-up or after a MIB reset command (optional).

Notifications

Attribute value change: This notification is used to report autonomous changes to the attributes of this managed entity. The attribute value change notification shall identify the attribute changed and its new value. The list of AVCs for this managed entity is given in Table 2a.

Alarm: This notification is used to notify the managed system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 2b.

Test result: For the "Test result" event, notification is sent to the OLT via an alarm ONLY if the ME fails the autonomous self test.

Table 2a/G.983.2 – AVC list for $ONT_{B\text{-}PON}$

Number	Attribute value change	Description
1-7	N/A	
8	OpState	Operational state of $ONT_{B\text{-}PON}$
9-16	Reserved	

Table 2b/G.983.2 – Alarm list for $ONT_{B\text{-}PON}$

Number	Event	Description
Alarm		
0	EquipmentAlarm	A functional failure on an internal interface
1	PoweringAlarm	Loss of external power
2	BatteryMissing	Battery is provisioned but missing
3	BatteryFailure	Battery is provisioned and present but cannot recharge
4	BatteryLow	Battery is provisioned and present but its voltage is too low
5	PhysicalIntrusionAlarm	Applies if the ONT is supported with detection such as door or box open
Test result		
6	ONTSelfTestFailure	ONT has failed autonomous self test
7-255	Reserved	

7.1.2 ONT data

This managed entity is contained in the ONT managed entity and is used to model the MIB itself. I.1.2 explains the use of this managed entity with respect to MIB synchronization. I.1.4 explains the alarm synchronization process, also issued on this managed entity.

An instance of this managed entity is automatically created by the ONT after initialization. After the creation of this managed entity, the associated attributes are updated according to the data within the ONT itself.

Relationships

One instance of this managed entity is contained in the instance of the ONT managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. There is only one instance and it has the number 0x0000. (R) (mandatory) (2 bytes).

MIB data sync: This attribute is used to check the alignment of the MIB of the ONT with the corresponding MIB within the OLT. MIB data sync is a "sequence number" checked by the OLT to see if the MIB snapshots for the OLT and ONT have the same sequence number. Refer to I.1.1 for a detailed description of this attribute. Upon autonomous instantiation, this attribute is set to 0x00. (R, W) (mandatory) (1 byte).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Get all alarms: Latch a snapshot (i.e. copy) of the current alarm statuses of all managed entities and reset the alarm message counter.

Get all alarms next: Get the latched alarm status of the next managed entity within the current snapshot.

MIB reset: Reset the MIB data sync attributes to 0x00 and reset the MIB of the ONT to its default state. This default MIB consists of one instance of the $ONT_{B\text{-}PON}$ managed entity, one instance of the ONT Data managed entity, two instances of the Software Image managed entity, zero or more instances of the Subscriber Line Cardholder managed entity, zero or more instances of the PON IF Line Cardholder, and zero or more instances of the Priority $Queue_{B\text{-}PON}$ managed entity (for the priority queues that reside in the ONT).

MIB upload: Latch a snapshot (i.e. copy) of the current MIB.

MIB upload next: Get the latched attribute values of the managed entity within the current snapshot.

Notifications

None.

7.1.3 Subscriber line cardholder

This managed entity represents the slots of the ONT that are capable of holding Subscriber Line Cards.

An instance of this managed entity shall exist for each slot. Instances of this managed entity are created automatically by the ONT after the ONT initialization. After the creation of this managed entity, the associated attributes are updated according to the data within the ONT itself.

Instances of this managed entity are also created for ONTs with integrated interfaces on the UNI side. They then represent virtual Subscriber Line Cardholders.

Relationships

An instance of the Subscriber Line Cardholder may contain instances of the Subscriber Line Card managed entity to model the containment of Subscriber Line Cards within slots of the ONT.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The first byte of this two-byte identifier is set to:

- 0x00 if the ONT has non-integrated interfaces on the UNI side;
- 0x01 if the ONT has integrated interfaces on the UNI side.

The second byte of this identifier is the slot id.

To accommodate a universal code for the ONT slot id for both PON and UNI interfaces, one could interpret the least significant 7 bits of the slot id as the actual physical slot number with the most significant bit serving as an interface type (UNI/ANI) indicator. Therefore, the coding of the UNI slot id is in the range of 0x01-0x7F (1-127). For reasons of backward compatibility, integrated Subscriber Line interfaces (i.e. no plug-in UNI cards) can also be associated with a "pseudo" slot id 0x00. The code 0x01 is used for the leftmost lower slot of the ONT when looking at the side where the Subscriber Line Cards are plugged in, 0x02 is

used for the next slot just to the right of the previous one, and so forth; numbering on the next higher shelf continues at its left edge.

NOTE 1 – Up to 127 slots are supported. (R) (mandatory) (2 bytes).

Actual plug-in unit type: This attribute is equal to the type of the LIM in the cardholder or equal to a value of 0x00 (= no LIM) if the cardholder is empty. This attribute will then be redundant with attribute "Type" of the managed entity Subscriber Line Card. (R) (mandatory) (1 byte).

Expected plug-in unit type: This attribute identifies which type of plug-in unit is provisioned for the slot. For type coding, see Table 3. The value of 0x00 (no LIM) means that the Subscriber Line Cardholder is not provisioned to contain a LIM. The value of 0xFF (255) means that the Subscriber Line Cardholder is configured for plug-and-play. Upon autonomous instantiation, this attribute is set to 0x00. For integrated interfaces, this attribute represents the type of interface. (R, W) (mandatory) (1 byte).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes of the Actual Plug-in unit type. The attribute value change notification shall identify the attribute changed and its new value. The AVCs for this managed entity are listed in Table 4a. For ONTs with integrated interfaces, AVCs are not supported.

NOTE 2 – In the AVC tables, the numbering follows that of the Attribute mask coding found in Table II.1. Accordingly, each AVC table has a maximum of 16 entries. If an existing attribute does not emit AVCs, then "N/A" (not applicable) is listed in the AVC column. "Reserved" is used for numbers that do not correspond to an existing attribute."

Alarm: This notification is used to notify the management system that there is something wrong with the provisioned plug-in unit. Both ONT and OLT should know the alarm list (see Table 4b) used by this entity. In case of no provisioning (no LIM configured) or in case the SubscriberLine Cardholder has been configured for plug-and-play, no alarms are raised. If the plugInLIMMissingAlarm is active, the plugInTypeMismatchAlarm shall not be raised. For ONTs with integrated interfaces, alarms are not supported.

Table 3/G.983.2 – Subscriber line card types

Coding	Contents	Description
0	no LIM	Default value
1	A1.5	ATM 1.544 Mbit/s module
2	A2	ATM 2.048 Mbit/s
3	A6.3	ATM 6.312 Mbit/s module
4	A6.3U	ATM 6.312 Mbit/s module, Remote (U-interface)
5	A8	ATM 8.448 Mbit/s
6	A25	ATM 25.6 Mbit/s module
7	A34	ATM 34.368 Mbit/s module
8	A45	ATM 44.736 Mbit/s module
9	A45/34	Configurable ATM 44.736/34.368 Mbit/s module

Table 3/G.983.2 – Subscriber line card types

Coding	Contents	Description
10	A150SMF SDH	ATM STM-1 SMF UNI
11	A150MMF SDH	ATM STM-1 MMF UNI
12	A150UTP SDH	ATM STM-1 UTP UNI
13	C1.5 (DS1)	1.544 Mbit/s Local (T-interface) AAL 1 module
14	C2.0 (E1)	2.048 Mbit/s Local (T-interface) AAL 1 module
15	C6.3 (J2)	6.312 Mbit/s Local (T-interface) AAL 1 module
16	C-DS1/E1	Configurable DS1/E1 AAL 1 module
17	C-DS1/E1/J1	Configurable DS1/E1/J1 AAL 1 module
18	C6.3U (J2)	6.312 Mbit/s Remote (U-interface) AAL 1 module
19	C192k	192 kbit/s Local (T-interface) AAL 1 module
20	C44.7 (DS3)	44.736 Mbit/s Local (T-interface) AAL 1 module
21	C34.3 (E3)	34.368 Mbit/s Local (T-interface) AAL 1 module
22	10Base-T	10 Base-T Ethernet LAN IF
23	100Base-T	100 Base-T Ethernet LAN IF
24	10/100Base-T	10/100 Base-T Ethernet LAN IF
25	Token Ring	Token Ring LAN IF
26	FDDI	FDDI LAN IF
27	FR	Frame relay
28	C1.5 (J1)	1.544 Mbit/s Local (T-interface) AAL 1 module
29	A150SMF SONET	ATM OC-3 SMF UNI
30	A150MMF SONET	ATM OC-3 MMF UNI
31	A150UTP SONET	ATM OC-3 UTP UNI
32	POTS	Plain Old Telephony Service
33	ISDN-BRI	ISDN Basic Rate Interface
34	Gigabit Ethernet	Gigabit Ethernet IF
35	ADSL	ADSL IF
36	SHDSL	SHDSL IF
37	VDSL	VDSL IF
38	Video Service	Video module
39..251	Reserved	
252	PON622symm	Symmetric 622/622 Mbit/s PON IF
253	PON155	Symmetric 155/155 Mbit/s PON IF
254	PON622	Asymmetric 155/622 Mbit/s PON IF
255	Plug-and-play/Unknown	Plug-and-play (for the Subscriber Line Cardholder managed entity only) Unrecognized module (for the Subscriber Line Card managed entity only)

Table 4a/G.983.2 – AVC list for subscriber line cardholder

Number	Attribute value change	Description
1	ActualType	Actual type of LIM in cardholder
2-16	Reserved	

Table 4b/G.983.2 – Alarm list for subscriber line cardholder

Number	Alarm	Description
0	plugInLimMissingAlarm	Configured Plug-in LIM is not present
1	plugInTypeMismatchAlarm	Inserted Plug-in LIM is wrong type
2	improperCardRemoval	Card has been removed without being deprovisioned. (This is a redundant alarm that is used to help the OLT distinguish between transitions from state S2 to state S1 and transitions from state S4 to state S1. This alarm is sent only when a transition occurs from state S2 to state S1. See Table 10 for state diagrams.)
2-255	Reserved	

Figure 10 shows a state diagram of the various behaviours of inserting/removing a particular Subscriber Line Card into/from a Subscriber Line Cardholder that is provisioned to a specific type or to plug-and-play.

In Figure 10, state S3' is conceptually identical to state S3 except in the behaviour when entering or leaving this state upon provisioning or deprovisioning.

In order to avoid a cluttered picture, the following state transitions, although possible, are not shown in the figure: from S3 to S9 on provisioning of plug-and-play mode, from S3' to S8 on provisioning of plug-and-play mode, from S9 to S3 on deprovisioning of plug and play-mode, and from S8 to S3' on deprovisioning of plug-and-play mode.

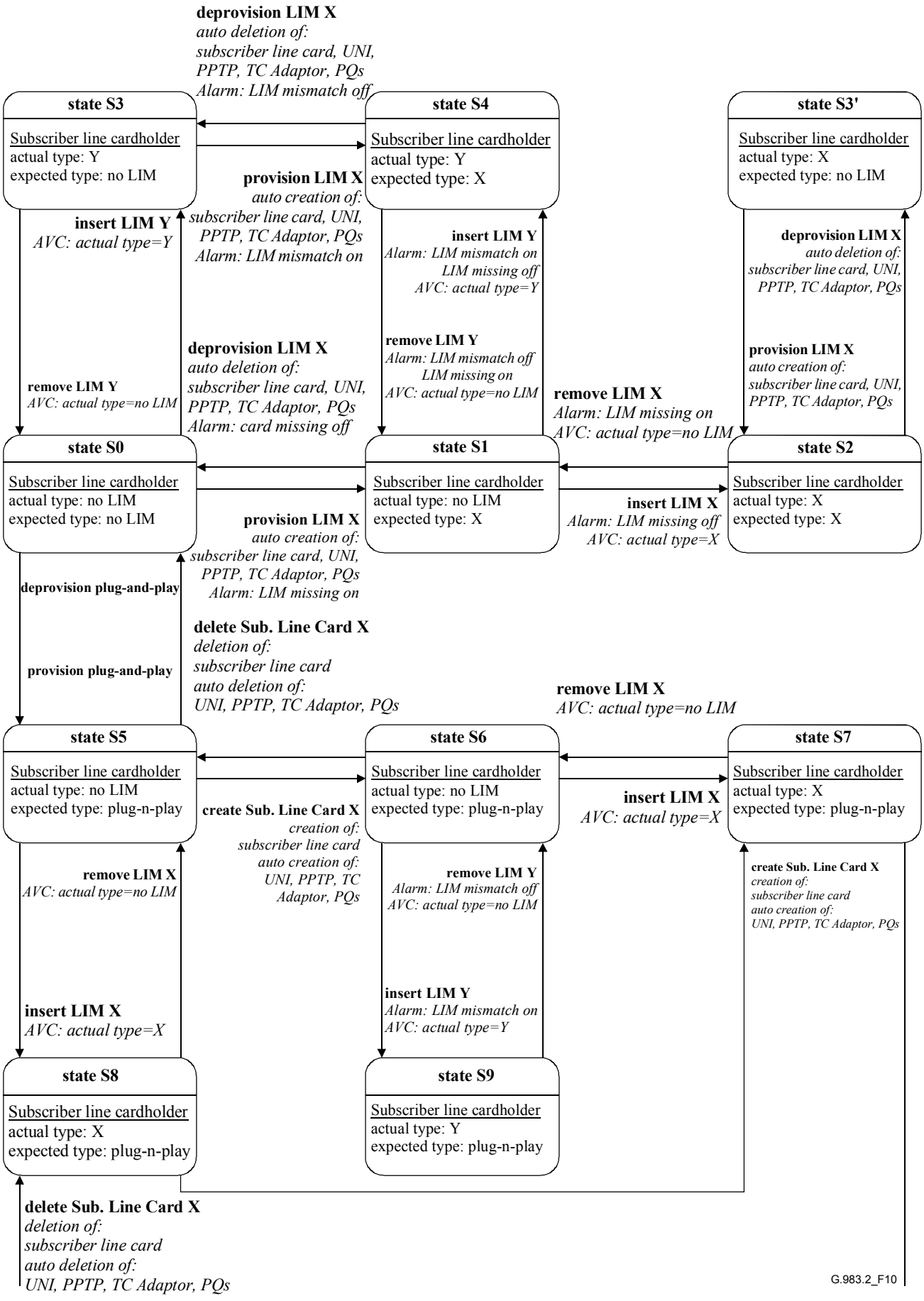


Figure 10/G.983.2 – Subscriber line cardholder state diagram

NOTE 3 – The state diagram presented in Figure 10 is not applicable for ONTs with integrated interfaces.

7.1.4 Subscriber line card

This managed entity is used to represent the subscriber line card that is provisioned in an ONT slot. For ONTs with integrated interfaces on the UNI side, this managed entity represents available types of interfaces. An instance of this managed entity shall be automatically created by the ONT when the OLT has provisioned the subscriber line card (i.e. when the OLT has set attribute "Expected Plug-in Unit Type" of the Subscriber Line Cardholder to a specific LIM type). See 7.1.3. Moreover, an instance of this managed entity can also be created by the ONT at the request of the OLT if the attribute "Expected Plug-in Unit Type" of the corresponding Subscriber Line Cardholder is equal to the value 0xFF (255), which corresponds to "plug-and-play". For ONTs with integrated interfaces on the UNI side, an instance of this managed entity is automatically created for each instance of the Subscriber Line Cardholder managed entity.

An instance of this managed entity shall be deleted by the ONT when the OLT has deprovisioned the subscriber line card (i.e. when the OLT has set attribute "Expected Plug-in Unit Type" of the Subscriber Line Cardholder to 0x00, i.e. "no LIM"). Moreover, an instance of this managed entity can also be deleted by the ONT on request of the OLT if the attribute "Expected Plug-in Unit Type" of the corresponding Subscriber Line Cardholder is equal to the value 0xFF, i.e. "plug-and-play". For ONTs with integrated interfaces on the UNI side, an instance of this managed entity cannot be deleted by an OLT request.

Relationships

One instance of this managed entity is contained by an instance of the Subscriber Line Cardholder.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The number used is the same as the instance number used for the Subscriber Line Cardholder managed entity instance containing this Subscriber Line Card instance. (R, Set-by-create (if applicable)) (mandatory) (2 bytes).

Type: This attribute identifies the Subscriber Line Card type. This attribute is a unique code as defined in Table 3. The value of 0xFF (255) means "unknown", i.e. the inserted Subscriber Line Card cannot be recognized by the ONT. In this case, the attribute's Serial Number, Version and Vendor id do not contain valid information. Upon autonomous instantiation, this attribute is set to 0x00. (R, Set-by-create (if applicable)) (mandatory) (1 byte).

Number of ports: This attribute gives the quantity of access ports on the Subscriber Line Card. Upon instantiation, this attribute is set equal to 0x01. (R) (optional) (1 byte).

Serial number: The serial number is unique for each Subscriber Line Card. Note that the serial number may contain the vendor id and/or version number. For ONTs with integrated interfaces on the UNI side, this value is identical to the value of the Serial Number attribute of the $ONT_{B\text{-}PON}$ managed entity Upon instantiation, this attribute consists of all spaces. (R) (mandatory) (8 bytes).

Version: This attribute identifies the version of the Subscriber Line Card as defined by the vendor. A value of 0x00 shall be used when version information is not available or applicable to the ONT being represented. For ONTs with integrated interfaces on the UNI side, this value is identical to the value of the Version attribute of the $ONT_{B\text{-}PON}$ managed entity. Upon autonomous instantiation, this attribute consists of all spaces. (R) (mandatory) (14 bytes).

Vendor id: This attribute identifies the vendor of the Subscriber Line Card. For ONTs with integrated interfaces on the UNI side, this value is identical to the value of the Vendor id attribute of the $ONT_{B\text{-}PON}$ managed entity. Upon instantiation, this attribute consists of all spaces. (R) (optional) (4 bytes).

Administrative state: This attribute is used to "unlock" (value 0x00) and "lock" (value 0x01) the functions performed by the Subscriber Line Card. When the administrative state is set to "lock", all user traffic to and from this Subscriber Line Card is blocked and alarms for this Subscriber Line Card and all associated managed entities are no longer generated. Selection of a default value for this attribute is outside the scope of this Recommendation as it is normally handled through supplier-operator negotiations. (R, W, Set-by-create (if applicable)) (mandatory) (1 byte).

Operational state: This attribute indicates whether or not the managed entity is capable of performing its task. Valid values are enabled (0x00), disabled (0x01), and unknown (0x02). Upon instantiation, this attribute is set to (0x02). (R) (optional) (1 byte).

BridgedorIPInd: This attribute indicates whether the Ethernet interface is bridged or derived from an IP router function (Bridged: 0x00; IP router: 0x01; 0x02 Bridged and IP Router). 0x02 means that both bridged and IP router functions are supported by the subscriber line card. Upon autonomous instantiation, the value 0x00 is used. (R, W) (optional, only applicable for subscriber line cards with Ethernet interfaces) (1 byte).

Actions

Create: Create an instance of this managed entity (optional, only when plug-and-play is supported).

Delete: Delete an instance of this managed entity (optional, only when plug-and-play is supported).

Get: Get one or more attributes.

Set: Set one or more attributes.

Reboot: Reboot the Subscriber Line Card.

Test: Test the Subscriber Line Card (this action is optional).

Notifications

Attribute value change: This notification is used to report autonomous changes of attributes of this managed entity. The notification shall identify the attribute and its new value. The list of AVCs for this managed entity is given in Table 5a.

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 5b.

NOTE – For ONTs with integrated interfaces on the UNI side, alarms are not applicable except perhaps for video support. Use of alarms for video support is considered optional and is for future study.

Test result: For the "Test result" event, notification is sent to the OLT via an alarm ONLY if the ME fails the autonomous self test.

Table 5a/G.983.2 – AVC list for subscriber line card

Number	Attribute value change	Description
1-6	N/A	
7	OpState	Operational state of Subscriber Line Card
8	N/A	
2-16	Reserved	

Table 5b/G.983.2 – Alarms list for subscriber line card

Number	Event	Description
Alarm		
0	EquipmentAlarm	A failure on an internal interface or failed self test
1	PoweringAlarm	LIM fuse failure or failure of LIM DC/DC converter
Test result		
2	SelfTestFailure	Failure of Subscriber Line Card autonomous self test
3-255	Reserved	

7.1.5 PON IF line cardholder

This managed entity represents slots of the ONT that are capable of holding a network card on the ANI side. An instance of this managed entity shall exist for each slot. Instances of this managed entity are created automatically by an ONT that supports PON IF plug-in after the ONT initialization. (For integrated PON interfaces, no instances of this managed entity will be created.)

NOTE 1 – This definition merely provides a placeholder to facilitate equipment management of removable PON IF line cards.

Relationships

An instance of the PON IF Line Cardholder may contain instances of the PON IF Line Card managed entity to model the containment of PON IF Line Cards within slots of the ONT.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The first byte of this two-byte identifier is always 0x00. The second byte of this identifier is the slot id.

To accommodate a universal code of the ONT slot id for both PON and UNI interfaces, one must interpret the least significant 7 bits of the slot id as the actual physical slot number with the most significant bit serving as an interface type (UNI/ANI) indicator. Therefore, the coding of the PON IF Line Card slot id is in the range of 0x81-0xFF (129-255). The code 0x81 (129) is used for the leftmost lower slot of the ONT when looking at the side where the PON IF Line Cards are plugged in, 0x82 (130) is used for the next slot just to the right of the previous one, and so forth; numbering on the next higher shelf continues at its left edge. (R) (mandatory) (2 bytes).

NOTE 2 – Only up to 127 slots are supported.

Actions

Get: Get one or more attributes.

Notifications

None.

7.1.6 PON IF line card

This managed entity is used to model a field-replaceable PON IF Line Card contained within an ONT.

An instance of this managed entity shall be automatically created by the ONT. (For integrated PON interfaces, no instances of this managed entity will be created.)

NOTE – This definition merely provides a placeholder to facilitate equipment management of removable PON IF line cards.

Relationships

One instance of this managed entity is contained by an instance of the PON IF Line Cardholder.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The number used is the same as the instance number used for the PON IF Line Cardholder managed entity instance containing this PON IF Line Card instance. (R) (mandatory) (2 bytes).

Serial number: The serial number is unique for each PON IF Line Card. Upon autonomous instantiation, this attribute consists of all spaces. (R) (mandatory) (8 bytes).

Version: This attribute identifies the version of the PON IF Line Card as defined by the vendor. Upon autonomous instantiation, this attribute consists of all spaces. (R) (mandatory) (14 bytes).

Vendor id: This attribute identifies the vendor of the PON IF Line Card. Upon autonomous instantiation, this attribute consists of all spaces. (R) (optional) (4 bytes).

Actions

Get: Get one or more attributes.

Reboot: Reboot the PON IF Line Card.

Test: Test the PON IF Line Card (this action is optional and for further study). If testing is used, a "Test Result" event should be added to the notifications and event list.

Notifications

Attribute value change: This notification is used to report autonomous changes to the attributes of this managed entity. The notification shall identify the attribute that changed and its new value. If additional attributes are added, any relevant AVCs should be listed in a table.

Alarm: Alarms on the PON IF are also transmitted to the OLT by PLOAM messages (see ITU-T Rec. G.983.1 [3]). Alarms for redundant PON IFs are for further study.

7.1.7 Software image

This managed entity represents a program stored in the ONT.

Two instances of this managed entity shall be automatically created by the ONT after the creation of an ONT managed entity (mandatory) and each Subscriber Line Card managed entity (optional – not applicable for ONTs with integrated interfaces on the UNI side). It is used to report to the management system the software currently installed in non-volatile memory. After the creation of the instances of this managed entity, the associated attributes are updated according to the data within the ONT and Subscriber Line Cards.

Relationships

Two instances of this managed entity are contained in an instance of the ONT and Subscriber Line Card managed entities.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The number consists of a two-byte field. The first field (MSB) identifies the ME instance (ONT (value 0x00) or removable Subscriber/PON IF Line Card (value 0x01-0x7F/0x81-0xFF)) containing the associated Software Image ME. The second field (LSB) distinguishes between the two (redundant) Software Image ME instances (values 0x00 and 0x01). (R) (mandatory) (2 bytes).

Version: This attribute identifies the version of the software. Upon autonomous instantiation, this attribute consists of all spaces. (R) (mandatory) (14 bytes).

Is committed: This attribute indicates whether the associated software image is "committed" (value 0x01) or "uncommitted" (value 0x00). By definition, the "committed" software image will be loaded and executed upon a reboot of the ONT and/or associated removable Subscriber/PON IF Line Card ME. During normal operation, one software image will always be "committed" while the other is "uncommitted". Under no circumstances are both software images allowed to be "committed" at the same time. On the other hand, both software images are only allowed to be non-committed at the same time if both are invalid. Upon autonomous instantiation, this attribute of instance 0 shall be initialized to "committed" and this attribute of instance 1 shall be initialized to "uncommitted". (R) (mandatory) (1 byte).

Is active: This attribute indicates whether the associated software image is "active" (value 0x01) or "inactive" (value 0x00). By definition, the active software image is one that is currently loaded and executing in the ONT (or associated Subscriber/PON IF Line Card). Under normal operation, one software image will always be "active" while the other is "inactive". Under no circumstances are both software images allowed to be "active" at the same time. On the other hand, both software images are only allowed to be inactive at the same time if both are invalid. Upon autonomous instantiation, this attribute of instance 0 shall be initialized to "active" and this attribute of instance 1 shall be initialized to "inactive". (R) (mandatory) (1 byte).

Is valid: This attribute indicates whether the associated software image is "valid" (value 0x01) or "invalid" (value 0x00). By definition, a software image is "valid" if it has been verified to be an executable code image. The verification mechanism is not subject to standardization; however, at a minimum it must include a data integrity (CRC) check of the entire code image. Upon autonomous instantiation, the associated code image is verified and this attribute is set according to the result of this verification. (R) (mandatory) (1 byte).

Actions

Get: Get one or more attributes.

Start download: Initiate a software download sequence to the alternate (i.e. currently inactive) software image. This action is only valid for a software image that is currently inactive and is not committed (i.e. is not selected as the bootable image). (optional).

Download section: Download a section of a software image. This action is only valid for a software image that is currently being downloaded (image 1 in state S2/image 0 in state S2'). (optional).

End download: Signal the completion of a download sequence, providing both the valid CRC and version information for a final verification of an associated downloaded software image. This action is only valid for a software image that is currently being downloaded (image 1 in state S2/image 0 in state S2'). (optional).

Activate image: Load/execute a valid software image. When this action is applied to a software image that is currently inactive, execution of the current code image is suspended; the associated software image is loaded from non-volatile memory; and execution of this new code image is initiated. When this action is applied to a software image that is already active, a soft restart is performed (i.e. the software image is not reloaded from non-volatile memory, execution of the current volatile code image is simply restarted). This action is only valid for a valid software image. (optional).

Commit image: Select a valid software image to be the default image to be loaded and executed by the boot code upon start-up (i.e. set the Is_committed attribute value to 0x01 for the associated Software Image ME and set the Is_committed attribute value to 0x00 for the other Software Image ME). This action is only valid for a valid software image. (optional).

In Figure 11, a state diagram is given, showing an example of the "life cycle" of software images under the actions given above. State S0 is a conceptual initialization state when neither of the software images is valid (i.e. executable). During S0, the OMCC is not functional.

Notifications

None.

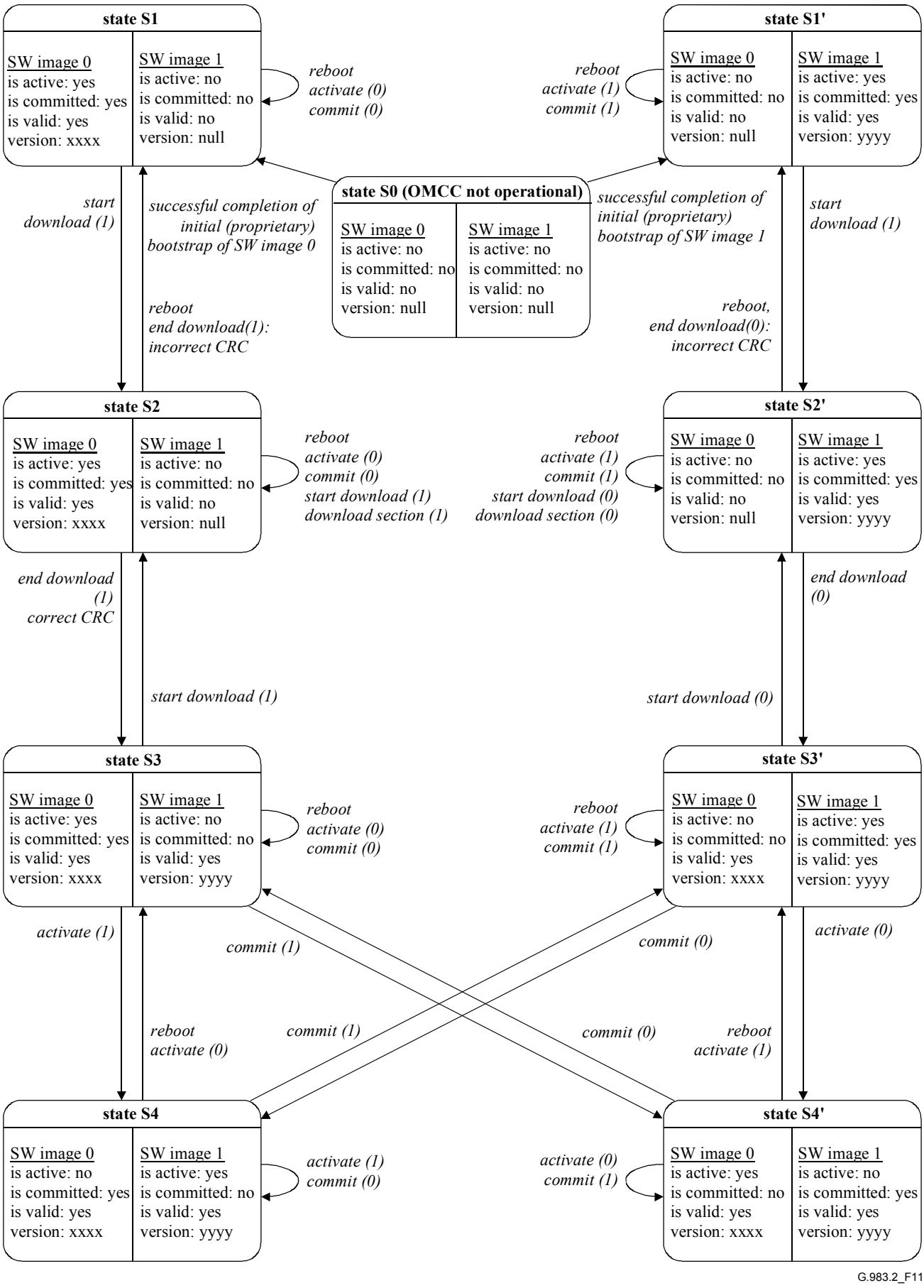


Figure 11/G.983.2 – Software image state diagram

7.2 ANI management

The OMCI will not maintain the PON interface information. The OLT will maintain the PON interface related managed entities and will get all the ONT-related information needed for those managed entities via PLOAM cells (e.g. Transmit Failure) as specified in ITU-T G.983.1 [3]. However, for the purpose of description, the ONT will autonomously create one instance of each of the managed entities "PON Physical Path Termination Point", "ANI" and "PON TC Adapter" upon creation of the $ONT_{B\text{-}PON}$ managed entity. Additionally, these managed entities will not have any attributes (except for the Managed Entity id), nor have any actions or notifications associated with them, and will not be uploaded in the MIB upload.

7.2.1 PON physical path termination point

An instance of this managed entity represents a point in the ONT where a PON Physical Path terminates and physical path level functions (e.g. path overhead functions) are performed.

An instance of this managed entity is automatically created by the ONT after initialization. However, this instance will not be reported during a MIB upload.

Relationships

One or more instances of this managed entity are contained in an instance of the ONT or PON IF Line Card (not applicable for ONTs with integrated interfaces on the UNI side) managed entities.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the physical position of the PON IF. The first byte is the slot id (defined in 7.1.5). If the PON IF is integrated, this value is 0x80 (128). The second byte is the port id with value range from 0x01 to 0xFF (1 to 255): 0x01 is used for the leftmost/lowest port on a PON IF Line Card, 0x02 is used for the next right/upper port, and so forth. (R) (mandatory) (2 bytes).

Actions

None.

Notifications

None.

7.2.2 ANI

This managed entity is used to organize data associated with the Access Network Interface (ANI) supported by the ONT. One instance of this managed entity shall exist for each ONT.

An instance of this managed entity is automatically created by the ONT after initialization. However, this instance will not be reported during a MIB upload.

Relationships

One or more instances of this managed entity are contained in an instance of the $ONT_{B\text{-}PON}$ or PON IF Line Card (not applicable for ONTs with integrated interfaces on the UNI side) managed entities.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the physical position of the PON IF. The assigned number is the same as the id of the PON Physical Path Termination Point with which this ANI is associated. (R) (mandatory) (2 bytes).

Actions

None.

Notifications

None.

7.2.3 PON TC adapter

An instance of this managed entity represents a point in the ONT where the adaptation of the ATM Layer to the underlying physical infrastructure (i.e. the PON) takes place. One instance of this managed entity shall exist for each ONT.

An instance of this managed entity is automatically created by the ONT after initialization. However, this instance will not be reported during an MIB upload.

Relationships

One instance of this managed entity will exist for the PON Physical Path Termination Point managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the PON Physical Path Termination Point with which this PON TC Adapter is associated. (R) (mandatory) (2 bytes)

Actions

None.

Notifications

None.

7.3 UNI management

7.3.1 Physical path termination point ATM UNI

This managed entity represents the point at an ATM UNI in the ONT where physical paths terminate and physical path level functions (e.g. path overhead functions) are performed.

An instance of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a Subscriber Line Card of ATM type.

Relationships

One or more instances of this managed entity shall be contained in an instance of a Subscriber Line Card managed entity classified as ATM type.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the physical position of the UNI. The first byte is the slot id (defined in 7.1.3). The second byte is the port id with a value range from 0x01 to 0xFF (1 to 255): 0x01 is used for the leftmost/lowest port on a subscriber line card, 0x02 is used for the next right/upper port, and so forth. (R) (mandatory) (2 bytes).

Expected type: The following coding is used for this attribute: 0x00 = by autosensing, 0x01 to 0xFE (1 to 254) = one of the values from Table 3 that is compatible with the type of the LIM. Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

Sensed type: If the value of "Expected type" is not equal to 0x00, then the value of "Sensed type" equals the value of "Expected type". If the value of "Expected type" equals 0x00, then the value of "Sensed type" equals one of the values from Table 3 (0x01 to 0xFE) and by necessity is compatible with the Type of the Subscriber Line Card managed entity. Upon autonomous instantiation, the value 0x00 is used. (R) (mandatory if the ONT supports LIMs with configurable interface types, e.g. ATM45/34) (1 byte).

Cable configuration: For an ATM45 interface, there are two options for the cable length. This attribute is used to select the option. Value 0x00: cable length ≤ 68.6 m; value 0x01 cable length > 68.6 m. (R, W) (mandatory for interfaces with cable configuration options) (1 byte).

Loopback configuration: This attribute represents the loopback configuration of this physical interface. Value 0x00: no loopback; value 0x01: loopback2 ("Loopback2" refers to a loopback at the ONT to the OLT. The OLT can execute a physical level loopback test after loopback2 is set.). Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

Administrative state: This attribute is used to activate (unlock: value 0x00) and deactivate (lock: value 0x01) the functions performed by instances of this managed entity. Selection of a default value for this attribute is outside the scope of this Recommendation as it is normally handled through supplier-operator negotiations. (R, W) (mandatory) (1 byte)

Operational state: This attribute indicates whether or not this managed entity is capable of performing its task. The operational state reflects the perceived ability to receive or to generate a valid signal. Valid values are enabled (0x00) and disabled (0x01). (R) (optional) (1 byte).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes of attributes of this managed entity. The notification shall identify the attribute and its new value. The AVCs for this managed entity are given in Table 6a.

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarms for this entity are given in Table 6b. The SDH and SONET interface related alarm should be consistent with the existing standards. The relevant Recommendations are ITU-T Recs G.744, M.3100 and Q.834.1.

Table 6a/G.983.2 – AVC list for physical path termination point ATM UNI

Number	Attribute value change	Description
1	N/A	
2	SensedType	Sensed SLC type (values given in Table 3)
3	N/A	
4	N/A	
5	N/A	
6	OpState	Operational state
7-16	Reserved	

Table 6b/G.983.2 – Alarm list for physical path termination point ATM UNI

Number	Alarm	Description
0	TF	Transmitter failure
1	LOS	Loss of signal
2	LOF	Loss of frame
3	OOF	Out of frame
4	RAI	Remote alarm indication
5	ERR	Block error
6	OOF (PLCP)	Out of frame (physical layer convergence protocol)
7	RAI (PLCP)	Remote alarm indication (physical layer convergence protocol)
8	ERR (PLCP)	Block error (physical layer convergence protocol)
9	REI (PLCP)	Remote error indication (physical layer convergence protocol)
10	MS-SD	Multiplex section – signal degraded
11	MS-RDI	Multiplex section – remote defect indication
12	MS-ERR	Multiplex section – block error
13	MS-REI	Multiplex section – remote error indication
14	MS-AIS	Multiplex section – alarm indication signal
15	P-RDI	Path – remote defect indication
16	P-ERR	Path – block error
17	P-REI	Path – remote error indication
18	P-AIS	Path-alarm indication signal
19	LOP	Loss of pointer in the VC4
20	1.5M REC	1.544 Mbit/s receive alarm
21	1.5 AIS	1.544 Mbit/s alarm indication signal
22	1.5 M BAIS	1.544 Mbit/s back alarm indication signal
23	6M REC	6.312 Mbit/s receive alarm
24	6M SEND	6.312 Mbit/s send alarm
25	6M ERR	6.312 Mbit/s block error
26	2M RDI	2.048 Mbit/s remote defect indication
27	2M E-ERR	2.048 Mbit/s CRC-4 error indication
28	2M AIS	2.048 Mbit/s alarm indication signal
29	8M RDI	8.448 Mbit/s remote defect indication
30	8M AIS	8.448 Mbit/s alarm indication signal
31	34M RDI	34.368 Mbit/s remote defect indication
32	34M AIS	34.368 Mbit/s alarm indication signal
33	34M FEBE	34.368 Mbit/s far end block error
34	45M RDI	44.736 Mbit/s remote defect indication
35	45M AIS	44.736 Mbit/s alarm indication signal
36	45 IDOL	44.736 Mbit/s idol
37-255	Reserved	

7.3.2 Physical path termination point ethernet UNI

This managed entity represents the points at an Ethernet UNI in the ONT where physical paths terminate and physical path level functions (e.g. Ethernet function) are performed.

An instance of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a Subscriber Line Card of Ethernet type.

Relationships

One or more instances of this managed entity shall be contained in an instance of a Subscriber Line Card managed entity classified as a native LAN type (e.g. Ethernet).

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the physical position of the UNI. The first byte is the slot id (defined in 7.1.3). The second byte is the port id with value range from 0x01 to 0xFF (1 to 255): 0x01 is used for the leftmost/lowest port on a subscriber line card, 0x02 is used for the next right/upper port, and so forth. (R) (mandatory) (2 bytes).

Expected type: The following coding is used for this attribute: 0x00 = by autosensing, 0x01 to 0xFE (1 to 254) equals one of the values from Table 3 that is compatible with the type of the LIM. Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

Sensed type: If the value of "Expected type" is not equal to 0x00, then the value of "Sensed type" equals the value of "Expected type". If the value of "Expected type" equals 0x00, then the value of "Sensed type" = one of the values from Table 3 and by necessity is compatible with the Type of Subscriber Line Card managed entity. Upon autonomous instantiation, the value 0x00 is used. (R) (mandatory if the ONT supports LIMs with configurable interface types, e.g. 10/100 Base-T card) (1 byte).

Auto detection configuration: For 10/100 Base-T Ethernet interfaces, this attribute is used to set the configuration options: Auto-sensing: 0x00; 10Base-T: 0x01; 100Base-T: 0x02: Gigabit Ethernet: 0x03. (R, W) (mandatory for interfaces with auto detection options) (1 byte).

Ethernet loopback configuration: This attribute is used to set the Ethernet loopback configuration: No loopback (value 0x00), Loop3 (value 0x03, Loopback of downstream traffic after PHY transceiver). Loop 3 is depicted in Figure 11a. Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

Administrative state: This attribute is used to activate (unlock: value 0x00) and deactivate (lock: value 0x01) the functions performed by instances of this managed entity. Selection of a default value for this attribute is outside the scope of this Recommendation as it is normally handled through supplier-operator negotiations. (R, W) (mandatory) (1 byte).

Operational state: This attribute indicates whether or not this managed entity is capable of performing its task. The operational state reflects the perceived ability to receive or to generate a valid signal. Valid values are enabled (0x00) and disabled (0x01). (R) (optional) (1 byte).

DuplexInd: This attribute indicates whether full duplex (= TRUE, value 0x01) or half duplex mode (= FALSE, value 0x00) is employed. Upon autonomous instantiation, the value 0x00 is used. (R) (mandatory) (1 byte).

MaxFrameSize: This attribute denotes the maximum allowed frame size to be transmitted across this interface. Upon autonomous instantiation, the value 1518 is used. (R,W) (mandatory) (2 bytes).

DTEorDCEInd: This attribute indicates whether the Ethernet interface wiring is DTE or DCE (DCE: 0x00; DTE: 0x01). Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

PauseTime: This attribute allows the ONT line card to request that the customer terminal temporarily suspend sending data. Units are in "pause_quanta" (1 pause_quantum equals 512 bits times of the particular implementation). Values: 0x0000 to 0xFFFF. Upon autonomous instantiation, the value 0x0000 is used. (R, W) (optional) (2 bytes).

BridgedorIPInd: This attribute indicates whether the Ethernet interface is bridged or derived from an IP router function (Bridged: 0x00; IP router: 0x01; 0x02: depends on Subscriber Line Card.) 0x02 means that the SLC "BridgedorIPInd" attribute will be either 0x00 or 0x01. Upon autonomous instantiation, the value 0x02 is used. (R, W) (optional) (1 byte).

ARC: This attribute is used to control alarm reporting from this managed entity. Valid values are "off" (alarm reporting allowed immediately) and "on" (alarm reporting inhibited). Upon initial installation and provisioning of the ONT, this attribute may be set to "on" or "off" for the time interval specified by "ARCInterval." Similarly, this attribute may be set to "off". If the attribute is set to "on", then alarm reporting is inhibited until this managed entity detects a valid signal for the time interval specified by "ARCInterval." (R, W) (optional) (1 byte).

ARCInterval: This attribute provides a provisionable length of time. Units are given in minutes. (R, W) (optional) (1 byte).

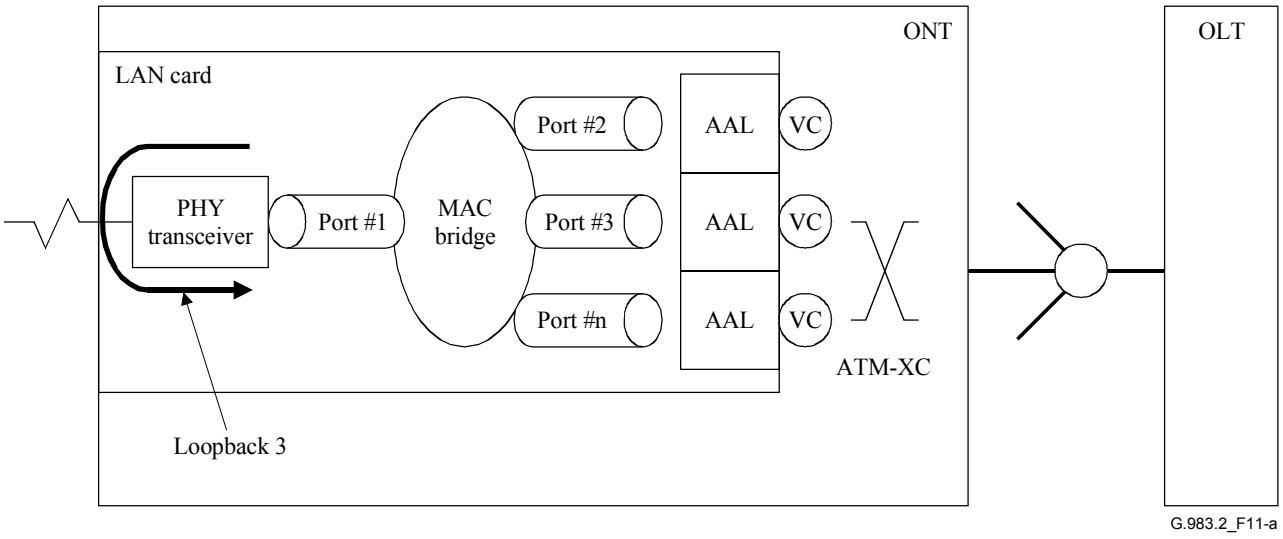


Figure 11a/G.983.2 – Schematic diagram of Loop 3

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes of attributes of this managed entity. The notification shall identify its new value. The AVC list is given in Table 6c.

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 6d. See also Appendix III.

Table 6c/G.983.2 – AVC list for physical path termination point Ethernet UNI

Number	Attribute value change	Description
1	N/A	
2	SensedType	Sensed type of Ethernet interface. Valid values are 0x01 (10Base-T), 0x02 (100Base-T) and 0x03 (Gigabit).
3	N/A	
4	N/A	
5	N/A	
6	OpState	Operational state
7-10	N/A	
11-16	Reserved	

Table 6d/G.983.2 – Alarm list for physical path termination point Ethernet UNI

Number	Alarm	Description
0	LAN-LOS	No carrier at the Ethernet UNI
1-255	Reserved	

7.3.3 Physical path termination point CES UNI

This managed entity represents the points at a CES UNI in the ONT where physical paths terminate and physical path level functions are performed.

An instance of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a Subscriber Line Card of CES type.

Relationships

One or more instances of this managed entity shall be contained in an instance of a Subscriber Line Card managed entity classified as CES type.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the physical position of the UNI. The first byte is the slot id (defined in 7.1.3). The second byte is the port id with a value range from 0x01 to 0xFF (1 to 255): 0x01 is used for the leftmost/lowest port on a subscriber line card, 0x02 is used for the next right/upper port, and so forth. (R) (mandatory) (2 bytes).

Expected type: The following coding is used for this attribute: 0x00 = by autosensing, 0x01 to 0xFE (1 to 254) equals one of the values from Table 3 that is compatible with the type of the LIM. Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

Sensed type: If the value of "Expected type" is not equal to 0x00, then the value of "Sensed type" equals the value of "Expected type". If the value of "Expected type" equals 0x00, then the value of "Sensed type" = one of the values from Table 3 and by necessity is compatible with the Type of the Subscriber Line Card managed entity. Upon autonomous instantiation,

the value 0x00 is used. (R) (mandatory for the case of ONT supports LIMs with configurable interface types, e.g. C1.5/2/6.3) (1 byte).

CES loopback configuration: This attribute represents the loopback configuration of the physical interface. Its values are:

0x00: no loopback;

0x01: payload loopback;

0x02: line loopback;

0x03: OpS-directed loopback1 (loopback from/to ATM network side);

0x04: OpS-directed loopback2 (loopback from/to CES UNI side);

0x05: OpS-directed loopback3 (loopback of both ATM network side and CES UNI side);

0x06: Manual button-directed loopback (Read only);

0x07: Network-side Code inband-directed loopback (Read only);

0x08: SmartJack-directed loopback (Read only);

0x09: Network-side Code inband-directed loopback. (ARMED) (Read only).

Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

Administrative state: This attribute is used to activate (unlock: value 0x00) and deactivate (lock: value 0x01) the functions performed by instances of this managed entity. Selection of a default value for this attribute is outside the scope of this Recommendation as it is normally handled through supplier-operator negotiations. (R, W) (mandatory) (1 byte).

Operational state: This attribute indicates whether or not this managed entity is capable of performing its task. The operational state reflects the perceived ability to receive or to generate a valid signal. Valid values are enabled (0x00) and disabled (0x01). (R) (optional) (1 byte).

Framing: This attribute indicates the framing structure used. Valid values are "ExtendedSuperFrame" (0x00), "SuperFrame" (0x01), "UnFrame" (0x02), "G.704" (0x03) and "JT-G.704" (0x04). Upon autonomous instantiation, the value 0x00 is used. (R, W) (1 byte) (mandatory).

Encoding: This attribute denotes the encoding scheme required. Valid values are "B8ZS" (value 0x00), "AMI" (value 0x01), and "HDB3" (0x02). Upon autonomous instantiation, the value 0x00 is used. (R, W) (1 byte) (mandatory).

LineLength: This attribute provides the length of the twisted pair cable from the physicalPathTTP of type "DS1" interface to the DSX1 cross-connect point. Valid values are given in Table 6e. Upon autonomous instantiation, the value 0x00 is used for non-power feet type DS1, and the value 0x06 is used for power feet type DS1. (R, W) (1 byte) (optional).

DS1Mode: This attribute indicates the mode of DS1 used. The valid values are "Mode#1" (value 0x00), "Mode#2" (value 0x01), "Mode#3" (value 0x02), and "Mode#4" (value 0x03). Moreover, each Mode is defined as described in Table 6f. Upon autonomous instantiation, the value 0x00 is used. (R,W) (optional) (1 byte).

ARC: This attribute is used to control alarm reporting from this managed entity. Valid values are "off" (alarm reporting allowed immediately) and "on" (alarm reporting inhibited). Upon initial installation and provisioning of the ONT, this attribute may be set to "on" or "off" for the time interval specified by "ARCInterval." Similarly, this attribute may be set to "off". If the attribute is set to "on", then alarm reporting is inhibited until this managed entity

detects a valid signal for the time interval specified by "ARCInterval." (R, W) (optional) (1 byte).

ARCInterval: This attribute provides a provisionable length of time. Units are given in minutes. (R, W) (optional) (1 byte).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes of attributes of this managed entity. The notification shall identify its new value. The list of AVCs for this managed entity is given in Table 7a.

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 7b. These alarms should be consistent with the existing standards.

Table 6e/G.983.2 – Valid values for LineLength attribute

Value	Power Feed	Line Length
0x00	Non-power feet type DS1	0-33.5 m (0-110 ft)
0x01	Non-power feet type DS1	33.5-67.1 m (110-220 ft)
0x02	Non-power feet type DS1	67.1-100.6 m (220-330 ft)
0x03	Non-power feet type DS1	100.6-134.1 m (330-440 ft)
0x04	Non-power feet type DS1	134.1-167.6 m (440-550 ft)
0x05	Non-power feet type DS1	167.6-201.2 m (550-660 ft)
0x06	Power feet type DS1 (Wet-T1), short haul	0-40.5 m (0-133 ft)
0x07	Power feet type DS1 (Wet-T1), short haul	40.5-81.1 m (133-266 ft)
0x08	Power feet type DS1 (Wet-T1), short haul	81.1-121.6 m (266-399 ft)
0x09	Power feet type DS1 (Wet-T1), short haul	121.6-162.5 m (399-533 ft)
0x0A	Power feet type DS1 (Wet-T1), short haul	162.5-199.6 m (533-655 ft)
0x0B	Power feet type DS1 (Wet-T1), long haul	0 dB
0x0C	Power feet type DS1 (Wet-T1), long haul	7.5 dB
0x0D	Power feet type DS1 (Wet-T1), long haul	15 dB
0x0E	Power feet type DS1 (Wet-T1), long haul	22.5 dB

Table 6f/G.983.2 – Coding of DS1Mode attribute

Mode	Connect	Line length	Power feed	Loop back
#1	DS1-CPE	Short Haul	Without power feet	Smart Jack
#2	DS1-CPE	Long Haul	Without power feet	Smart Jack
#3	DS1-NIU-CPE	Long Haul	Without power feet	Intelligent Office Repeater
#4	DS1-NIU-CPE	Long Haul	With power feet	Intelligent Office Repeater

Table 7a/G.983.2 – AVC list for physical path termination point CES UNI

Number	Attribute value change	Description
1	N/A	
2	SensedType	Sensed SLC type (values given in Table 3)
3	CESLoopbackConfig	Loopback configuration of physical interface
4	N/A	
5	OpState	Operational state
6-8	N/A	
9-16	Reserved	

Table 7b/G.983.2 – Alarm list for physical path termination point CES UNI

Number	Alarm	Description
0	TF	Transmitter failure
1	LOS	Loss of signal
2	LOF	Loss of frame
3	OOF	Out of frame
4	RAI	Remote alarm indication
5	1.5 M BAIS	1.544 Mbit/s back alarm indication signal
6	R-INH	Receive alarm – inhibit
7	6M REC	6.312 Mbit/s receive alarm
8	6M SEND	6.312 Mbit/s send alarm
9	6M ERR	6.312 Mbit/s block error
10	6M BERR	6.312 Mbit/s back error
11	34M REC	34.368 Mbit/s receive alarm
12	34M AIS	34.368 Mbit/s alarm indication signal
13	2M REC	2.048 Mbit/s receive alarm
14	2M AIS	2.048 Mbit/s alarm indication signal
15	1.5M REC	1.544 Mbit/s receive alarm
16	1.5 AIS	1.544 Mbit/s alarm indication signal
17	INFO0	INFO0 reception (INFO0)
18	45M RDI	44.736 Mbit/s remote defect indication
19	45M AIS	44.736 Mbit/s alarm indication signal
20-255	Reserved	

7.3.4 Logical N × 64 kbit/s subport connection termination point

This managed entity is used to generically model *logical* subports contained within a higher level physical layer interface (e.g. DS0s within a DS1, DS1s within a DS3, etc.). A single instance of this managed entity can represent an arbitrary (i.e. consecutive or non-consecutive) group of multiple channels/time slots (e.g. multiple DS0/DS1) at the user side as an integral bundle.

An instance of this managed entity shall be created by the OLT before the creation of an associated Interworking VCC Termination Pointer (see 7.3.7 Interworking VCC Termination Point).

Relationships

Zero or more instances of this ME shall be contained in an instance of the Physical Path Termination Point CES UNI.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Physical path termination pointer: This attribute provides a pointer to the instance of the corresponding Physical Path Termination Point CES UNI managed entity id. (R, Set-by-create) (mandatory) (2 bytes).

List of time slots: This attribute provides a bitmap, which indicates the time slots. Each bit indicates whether the corresponding time slot is included in the connection or not. The correspondence is as indicated in Table 8. (R, Set-by-create) (mandatory) (12 bytes).

Table 8/G.983.2 – Coding list of time slots

Byte	Bit							
	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	TS 0	TS 1	TS 2	TS 3	TS 4	TS 5	TS 6	TS 7
2	TS 8	TS 9	TS 10	TS 11	TS 12	TS 13	TS 14	TS 15
...								
12	TS 88	TS 89	TS 90	TS 91	TS 92	TS 93	TS 94	TS 95

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.5 $UNI_{B\text{-}PON}$

This managed entity is used to organize data associated with the ATM User Network Interfaces (UNIs) supported by the ONT. For non-ATM UNIs, this is used as a logical ATM UNI. One instance of this managed entity shall exist for each UNI supported by the ONT.

Instances of this managed entity shall be automatically created/deleted by the ONT immediately following the creation/deletion of a Subscriber Line Card managed entity. After the creation of an instance of this managed entity, the associated attributes are updated according to the data within the Subscriber Line Card (if present) or within the ONT for the case of integrated interfaces on the UNI side.

Note that this managed entity is an aggregation of UNI and UNIinfo managed entities.

Relationships

Zero or more instances of the $UNI_{B\text{-}PON}$ managed entity may be contained in an instance of a Subscriber Line Card managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the physical position of the UNI. The assigned number is the same as the id of the Physical Path Termination Point with which this UNI is associated. (R) (mandatory) (2 bytes).

Local maximum number of supportable VPCs: This attribute identifies the number of VPCs that can be supported by the ONT at this end of the interface. Default is 0x0100 (256). (R) (mandatory) (2 bytes).

Local maximum number of allocated VPI bits: This attribute identifies the maximum number of allocated bits of the VPI sub-field that can be supported by the ONT at this UNI. Default is 0x08. (R) (mandatory) (1 byte).

Loopback location code: This attribute provides the code that identifies incoming ATM layer OAM loopback cells that are to be looped-back at this UNI (see also Appendix III). The default of this attribute consists of all 0xFFs. (R, W) (mandatory) (16 bytes).

Configuration option status: This attribute holds the UNI Configuration Code field. Its bits are assigned as described in Table 9. (R, W) (mandatory) (2 bytes).

Administrative state: This attribute is used to "unlock" (value 0x00) and "lock" (value 0x01) the functions performed by the UNI. When the Administrative State attribute is set to "lock", all user traffic to and from this UNI is blocked and alarms for this UNI and all associated managed entities are no longer generated. Selection of a default value for this attribute is outside the scope of this Recommendation as it is normally handled through supplier-operator negotiations. (R, W) (mandatory) (1 byte).

Table 9/G.983.2 – Coding of the configuration option status attribute

Bit	Name	Setting
1	ServerTrailFaultPropagation ATM layer	0: Upstream VP-AIS generation in the ATM cell flow is deactivated 1: Upstream VP-AIS generation in the ATM cell flow is activated
2	ServerTrailFaultPropagation TC layer	0: All TC layer alarm reporting through the OMCC is inhibited 1: All TC layer alarm reporting through the OMCC is not inhibited
3	ServerTrailFaultPropagation PHY layer	0: All PHY layer alarm reporting through the OMCC is inhibited 1: All PHY layer alarm reporting through the OMCC is not inhibited
4	ServerTrailFaultPropagation AAL layer	0: All AAL layer alarm reporting through the OMCC is inhibited 1: All AAL layer alarm reporting through the OMCC is not inhibited
5-16	Reserved	

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.6 TC Adapter$_{B\text{-}PON}$

An instance of this managed entity represents a point in the ATM subscriber line card where the adaptation of the ATM layer to the underlying physical infrastructure (e.g. SDH or PDH transport network) takes place. ITU-T Rec. I.321 [4] identifies this adaptation function as one of many functions performed at the Transmission Convergence (TC) Sublayer of the B-ISDN protocol stack. This managed entity is responsible for generating alarms that report the (in)ability of the managed entity to delineate ATM cells from the payload of a terminated digital transmission path.

An instance of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of an ATM UNI and its Physical Path Termination Point.

Relationships

Zero or more instances of this managed entity shall be contained in the Subscriber Line Card managed entity. One instance of this managed entity shall exist for each instance of the Physical Path Termination Point managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the Physical Path Termination Point with which this TC Adapter$_{B\text{-}PON}$ is associated. (R) (mandatory) (2 bytes).

Framer configuration: Some UNIs such as the ATM45 have two methods of mapping ATM cells into the payload of a DS3 frame: physical layer convergence protocol (PLCP) based mapping and HEC based mapping. This attribute is used to select the "PLCP option" (value 0x01) or the "HEC option" (value 0x00). Upon autonomous instantiation, this attribute is set to "PLCP option". (R, W) (mandatory for interfaces with framer configuration options) (1 byte).

Cell scrambling control: This attribute is used to activate/deactivate the ATM cell scrambling function. This attribute is only present for ATM interfaces where ATM cell scrambling may be controlled, i.e. "activated" (value 0x01) or "deactivated" (value 0x00). [App.V-7] requires cell scrambling for ATM/SONET interfaces but allows cell scrambling to be controlled (i.e. turned on and off) for ATM/DS3 interfaces. Upon autonomous instantiation, this attribute is set to "activated". (R, W) (mandatory for interfaces with scrambling options) (1 byte).

Cell rate decoupling type: This attribute is used to select the cell rate decoupling type whenever clause 2/I.432.1 [11] and [App.V-8] give different definitions. ITU-T defined type: 0x00; ATM Forum defined type: 0x01. Upon autonomous instantiation, 0x00 is used. (R, W) (mandatory for interfaces with decoupling options) (1 byte).

Operational state: This attribute indicates whether or not this managed entity is capable of performing its task. The operational state reflects the perceived ability to receive or to generate a valid signal. Valid values are enabled (0x00) and disabled (0x01). (R) (optional) (1 byte).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes of attributes of this managed entity. The notification shall identify the attribute and its new value. The list of AVCs for this managed entity is given in Table 10a.

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 10b.

Table 10a/G.983.2 – AVC list for TC adapter$_{B\text{-}PON}$

Number	Attribute value change	Description
1-3	N/A	
4	OpState	Operational state of TC Adapter$_{B\text{-}PON}$
5-16	Reserved	

Table 10b/G.983.2 – Alarm list for TC adapter$_{B\text{-}PON}$

Number	Alarm	Description
0	LCD	Loss of cell delineation
1-255	Reserved	

7.3.7 Interworking VCC termination point

An instance of this managed entity represents a point in the ONT where the interworking of a service (e.g. CES, IP) or underlying physical infrastructure (e.g. nxDS0/DS1/DS3/E3/Ethernet) takes place. At this point, ATM cells are generated from a bit stream (e.g. nxDS0/DS1/DS3/E3/Frame Relay/Ethernet) or a bit stream is reconstructed from ATM cells.

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

Establishment of a "CES interworking connection"

Since it is more complicated to introduce the "pointer list" as an attribute, the following mechanism will be used to create a CES interworking connection:

- for structured service: Create first a VP Network CTP$_{B\text{-}PON}$ instance and an N × 64 kbit/s Subport Connection Termination Point instance, and then create an Interworking VCC Termination Point; the latter would contain a reference to the VP Network CTP$_{B\text{-}PON}$ instance on one hand and the N × 64 kbit/s Subport Connection Termination Point instance on the other hand; or
- for unstructured service: Create first a VP Network CTP$_{B\text{-}PON}$ instance, and then create an interworking VCC Termination Point; the latter would contain a reference to the VP Network CTP$_{B\text{-}PON}$ instance on one hand and to the Physical Path Termination Point CES UNI instance on the other hand.

Establishment of an "Ethernet interworking connection"

Create first a VP Network CTP$_{B\text{-}PON}$ instance, and then create an interworking VCC Termination Point. The latter would contain a reference to the VP Network CTP$_{B\text{-}PON}$ instance on one hand and to the Physical Path Termination Point Ethernet UNI instance on the other hand.

Relationships

One instance of this managed entity shall exist for each occurrence of transformation of a data stream into ATM cells and vice versa. Note that the attributes "AAL Profile pointer" and "Service Profile pointer" imply relationships to these managed entities.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

VCI value: This attribute identifies the VCI value associated with this Interworking VCC Termination Point. (R, Set-by-create) (mandatory) (2 bytes).

VPNetworkCTP connectivity pointer: This attribute provides an instance identifier of the VP Network $CTP_{B\text{-}PON}$ that is associated with this Interworking VCC Termination Point. (R, Set-by-create) (mandatory) (2 bytes).

Interworking option: This attribute identifies the type of non-ATM function that is being interworked; the option can be CES (0x00), MAC Bridge LAN (0x01), or Voice (0x02) service. (R, Set-by-create) (mandatory) (1 byte).

Service profile pointer: This attribute provides the service profile type and a pointer to the instance of a service profile, such as the CES Service $Profile_{B\text{-}PON}$ (if the interworking option = 0x00), MAC Bridge Service Profile (if the interworking option = 0x01), or Voice Service Profile AAL (if the interworking option = 0x02). (R, Set-by-create) (mandatory) (2 bytes).

AAL profile pointer: This attribute provides the AAL profile type and a pointer to an instance of AAL Profile such as AAL 1 $Profile_{B\text{-}PON}$ if the interworking option = 0x00, AAL 1 $Profile_{B\text{-}PON}$ or AAL 2 $Profile_{B\text{-}PON}$ if the interworking option = 0x02, or AAL 5 $Profile_{B\text{-}PON}$ if the interworking option = 0x01. (R, Set-by-create) (mandatory) (2 bytes).

Interworking termination point pointer: This attribute provides a pointer to the associated instance(s) of the following managed entities (depending on the service provided):

- Physical Path Termination Point Ethernet UNI;
- Physical Path Termination Point POTS UNI;
- Physical Path Termination Point CES UNI;
- logical N × 64 kbit/s subport Connection Termination Point;
- (Physical Path Termination Point ISDN UNI – This is for future study).

NOTE – For the case utilizing the multiplexing function of AAL 2, this attribute is assigned a special value:

- 0x00XX will be used for pseudo slotIDs,
- 0xXX00 will be used for pseudo portIDs.

Therefore, 0x0000 will be used only if the integrated interfaces (integrated type of ONT) support AAL 2 multiple functions. (R, Set-by-create) (mandatory) (2 bytes).

AAL loopback configuration: This attribute is used to set the loopback configuration: No loopback (value 0x00), Loopback 1 (value 0x01, loopback of downstream traffic before FEC of AAL 1), Loopback 2 (value 0x02, loopback of downstream traffic after FEC of AAL 1), loopback after AAL (value 0x03, loopback of downstream traffic after any AAL). Loopback after AAL is depicted in Figure 11b. Upon autonomous instantiation, the value 0x00 is used. (R, W) (mandatory) (1 byte).

PPTP counter: This attribute represents the number of instances of PPTP managed entities associated with this instance of the Interworking VCC Termination Point managed entity. If only one instance of a PPTP managed entity is associated with this instance of the Interworking VCC Termination Point managed entity, this attribute is set to 0x01. If multiple instances of PPTP managed entities are associated with this instance of the Interworking VCC Termination Point managed entity (i.e. in case of AAL 2 multiplexing), this attribute is set to 0xZZ, where ZZ represents the number of associated PPTP instances. (R) (optional) (1 byte).

Operational state: This attribute indicates whether or not this managed entity is capable of performing its task. The operational state reflects the perceived ability to receive or to generate a valid signal. Valid values are enabled (0x00) and disabled (0x01). (R) (optional) (1 byte).

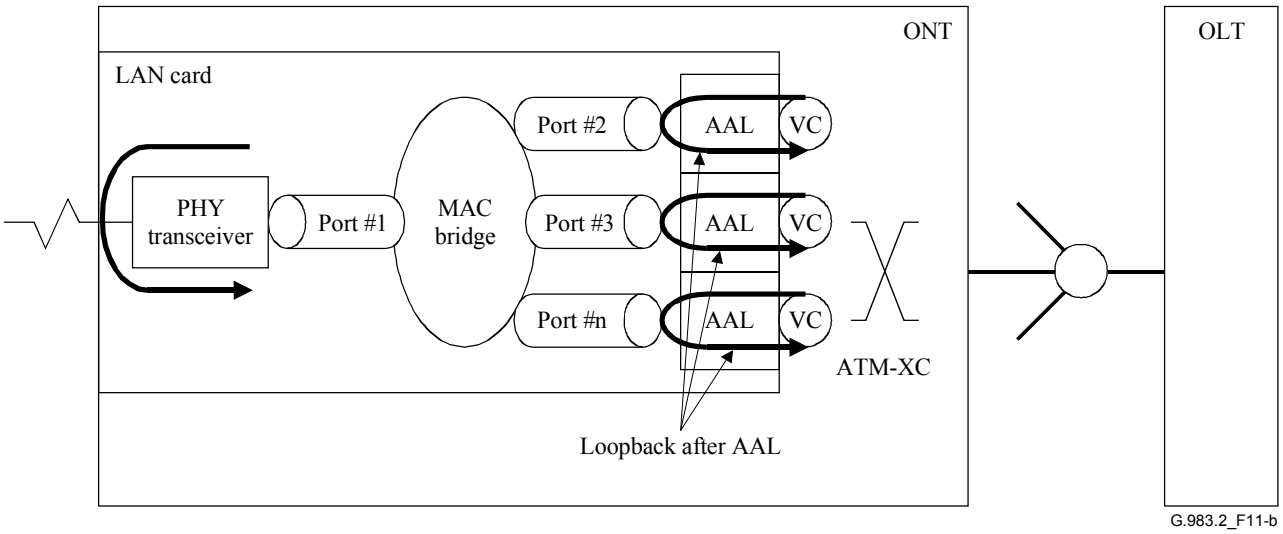


Figure 11b/G.983.2 – Schematic diagram of loopback after AAL

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes of attributes of this managed entity. The notification shall identify the attribute and its new value. The list of AVCs for this managed entity is given in Table 11a.

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 11b. See also Appendix III.

Table 11a/G.983.2 – AVC list for interworking VCC termination point

Number	Attribute value change	Description
1-9	N/A	
10	OpState	Operational state of Interworking VCC Termination Point
11-16	Reserved	

Table 11b/G.983.2 – Alarm list for interworking VCC termination point

Number	Alarm	Description
0	End-to-end VC-AIS-LMIR	End-to-end VC-AIS receiving indication (optional)
1	End-to-end VC-RDI-LMIR	End-to-end VC-RDI receiving indication (optional)
2	End-to-end VC-AIS-LMIG	End-to-end VC-AIS generation indication (optional)
3	End-to-end VC-RDI-LMIG	End-to-end VC-RDI generation indication (optional)
4	Segment Loss of Continuity	Loss of continuity is detected when the Interworking VCC Termination Point is a segment end point (optional)
5	End-to-End Loss of Continuity	Loss of continuity is detected at the Interworking VCC Termination Point (optional)
6	CSA	Cell starvation alarm
7-255	Reserved	

7.3.8 AAL 1 Profile$_{B\text{-}PON}$

This managed entity organizes data that describes the AAL Type 1 processing functions of the ONT. It is used with the Interworking VCC Termination Point managed entity.

In an ATM environment, AAL Type 1 configuration parameters are associated with an Interworking VCC Termination Point managed entity through a pointer relationship. Each instance of this managed entity defines a combination of parameter values that may be associated with multiple Interworking VCC Termination Point instances.

This managed entity is instantiated/deleted on request of the OLT.

Relationships

One instance of this managed entity shall exist for each combination of AAL 1 parameter values used within an ONT and may be associated with zero or more instances of the Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Subtype: This attribute identifies the AAL subtype. Valid values for this attribute are "null" (value 0x00), "voice-band based on 64 kbit/s" (value 0x01), "Synchronous Circuit Emulation" (value 0x02), "Asynchronous Circuit Emulation" (value 0x03), "High-quality Audio" (value 0x04) and "Video" (value 0x05). (R, Set-by-create) (mandatory) (1 byte).

CBR rate: This attribute represents the rate of the CBR service supported by the AAL. Allowed values are 64 kbit/s (value 0x40), 1544 kbit/s (value 0x0608), 44 736 kbit/s (value 0xAEC0), n × 64 kbit/s (value n × 0x40), 2048 kbit/s (value 0x0800), etc. (R, Set-by-create) (mandatory) (2 bytes).

Forward error correction type: This attribute indicates the FEC method: no FEC (value 0x00), FEC for Loss Sensitive Signal Transport (value 0x01), or FEC for Delay Sensitive Signal Transport (value 0x02). (R, Set-by-create) (optional) (1 byte).

Structured data transfer: This attribute indicates whether Structured Data Transfer (SDT) has been configured at the AAL. A value of 0x01 means SDT has been selected. A value of 0x00 means that no SDT has been selected. This attribute value cannot be set to 0x01 when the Forward Error Correction Type attribute equals 0x01. (R, Set-by-create) (optional) (1 byte).

Partially filled cells: This attribute identifies the number of leading octets in use. (R, Set-by-create) (optional) (1 byte).

Clock recovery type: This attribute indicates whether the clock recovery type is "synchronous" (value 0x00), which indicates that timing is derived from the physical interface, "SRTS" (Synchronous Residual Time Stamp, value 0x01), or "ACR" (Adaptive Clock Recovery, value 0x02). (R, Set-by-create) (mandatory) (1 byte).

Cell loss integration period: This attribute represents the duration in milliseconds of the cell loss integration period. If the cell loss persists for such a period, the Interworking VCC Termination Point managed entity associated with this entity will generate a cell starvation alarm. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.9 AAL 1 Protocol monitoring history data$_{B\text{-}PON}$

This managed entity contains the last completed 15-minute interval performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring. All the attribute counters, e.g. the Header Errors, are only updated at the end of each period. Instances of this managed entity are created by the OLT whenever an instance of the Interworking VCC Termination Point managed entity is created that represents AAL 1 functions. Instances of this managed entity are deleted by the OLT.

Relationships

One instance of this managed entity can exist for each instance of the Interworking VCC Termination Point managed entity that represents AAL 1 functions.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the Managed Entity id of the corresponding Interworking VCC Termination Point. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created

after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

Header errors: This attribute represents a count of the number of AAL 1 header errors detected, including those corrected. Header errors include correctable and not correctable CRC and parity errors. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Sequence violations: This attribute represents a count of incoming AAL Type 1 SAR-PDUs where the sequence count in the PDU header causes a transition from the SYNC state to the OUT OF SEQUENCE state as defined by ITU-T Rec. I.363.1. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Cell loss: This attribute represents a count of the number of lost cells, as detected by the AAL 1 sequence number processing, for example. This count records the number of cells detected as lost in the network prior to the destination interworking function AAL 1 layer processing. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Cell misinsertion: This attribute represents a count of sequence violation events that the AAL CS interprets as misinserted cells as defined by ITU-T Rec. I.363.1. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Buffer underflows: This attribute represents a count of the number of times the reassembly buffer underflows. In the case of a continuous underflow caused by a loss of ATM cell flow, a single buffer underflow should be counted. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit level buffer, then either buffer underflow will cause this count to be incremented. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Buffer overflows: This attribute represents a count of the number of times the reassembly buffer overflows. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit level buffer, then either buffer overflow will cause this count to be incremented. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

SDT Pointer reframes: This attribute represents a count of the number of events in which the AAL 1 reassembler finds that a structured data pointer is not where it is expected and must be reacquired. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (optional) (4 bytes).

SDT pointer parity check failures: This attribute represents a count of the number of times the AAL reassembler detects a parity check failure at the point where a structured data pointer is expected. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (optional) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a Threshold Crossing Alert (TCA) has been detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the actual counters are reset to 0x00. The event list for this entity is given in Table 12.

Table 12/G.983.2 – Alarm list for AAL 1 protocol monitoring history data$_{B\text{-}PON}$

Number	Event	Description
	Threshold Crossing Alert	
0	Header errors	Header errors threshold crossing
1	Sequence Violation	Sequence Violation threshold crossing
2	Cell loss	Cell loss threshold crossing
3	Cell misinsertion	Cell misinsertion threshold crossing
4	Buffer Underflows	Buffer Underflows threshold crossing
5	Buffer Overflows	Buffer Overflows threshold crossing
6	SDT Pointer Reframes	SDT Pointer Reframes threshold crossing
7	SDT Pointer Parity Check Failures	SDT Pointer Parity Check Failures threshold crossing
8-255	Reserved	

7.3.10 AAL 5 Profile$_{B\text{-}PON}$

This managed entity organizes data that describe the AAL Type 5 processing functions of the ONT. It is used with the Interworking VCC Termination Point managed entity.

In an ATM environment, AAL Type 5 configuration parameters are associated with an Interworking VCC Termination Point managed entity through a pointer relationship. Each instance of the managed entity defines a combination of parameter values that may be associated with multiple Interworking VCC Termination Point instances.

This managed entity is instantiated/deleted on request of the OLT.

Relationships

One instance of this managed entity shall exist for each combination of AAL 5 parameter values used within an ONT and may be associated with zero or more instances of the Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Max CPCS PDU size: This multi-valued attribute represents the maximum CPCS PDU size that will be transmitted over the connection in both the upstream and downstream direction of transmission. (R, Set-by-create) (mandatory) (2 bytes).

AAL mode: This attribute indicates whether the AAL for the supporting VPC is operating in one of the following optional modes: message assured (0x00), message unassured (0x01), streaming assured (0x02), or streaming non-assured (0x03). (R, Set-by-create) (mandatory) (1 byte).

SSCS type: This attribute identifies the SSCS type for the AAL. Valid values are "null" (0x00), "Data SSCS based on SSCOP, assured operation" (0x01), "Data SSCS based on SSCOP, non-assured operation" (0x02), or "Frame Relay SSCS" (0x03). (R, Set-by-create) (mandatory) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.11 AAL 5 protocol monitoring history data$_{B\text{-}PON}$

This managed entity contains the last completed 15-minute interval performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring. All of the attribute counters, e.g. the CRC violations, are only updated at the end of each period.

Instances of this managed entity are created automatically by the OLT whenever an instance of the Interworking VCC Termination Point managed entity is created that represents the AAL 5 functions. Instances of this managed entity are deleted by the OLT.

Relationships

One instance of this managed entity can exist for each instance of the Interworking VCC Termination Point managed entity that represents AAL 5 functions.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the Managed Entity id of the corresponding Interworking VCC Termination Point. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

Sum of invalid CS field errors: This attribute provides a sum-of-errors count for invalid Convergence Sublayer (CS) field errors. For AAL Type 5, this attribute provides a single count of the number of CS PDUs discarded due to one of the following error conditions: Invalid Common Part Indicator (CPI), oversized received SDU, or length violation. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

CRC violations: This attribute represents a count of CRC violations that were detected for the incoming SAR PDUs. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Reassembly timer expirations: This attribute provides a count of reassembly timer expirations. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory if reassembly timer is implemented) (4 bytes).

BufferOverflows: This attribute indicates the number of times that there was not enough buffer space for a re-assembled packet. Default value is 0x00. (R) (mandatory) (4 bytes).

EncapProtocolErrors: This attribute indicates the number of times that the RFC-1483 encapsulation protocol detects a bad header. Default value is 0x00. (R) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the actual counters are reset to 0x00. The alarm list for this entity is given in Table 13a.

Table 13a/G.983.2 – Alarm list for AAL 5 protocol monitoring history data$_{B\text{-}PON}$

Number	Event	Description
	Threshold Crossing Alert	
0	Invalid Fields	Exceeds threshold
1	CRC Violation	Exceeds threshold
2	Reassembly Timer Expirations	Exceeds threshold
3	Buffer Overflows	Exceeds threshold
4	Encap Protocol Errors	Exceeds threshold
5-255	Reserved	

7.3.12 CES service profile$_{B\text{-}PON}$

An instance of this managed entity is used to organize data that describe the CES Service functions of the ONT. An instance of this managed entity shall be created and deleted by the OLT.

Relationships

Zero or more instances of this managed entity shall be contained in the ONT$_{B\text{-}PON}$ managed entity. One instance of this managed entity may be associated with zero or more instances of the Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for the instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

CES buffered CDV tolerance: This attribute represents the duration of user data that must be buffered by the CES interworking entity to offset the Cell Delay Variation. This timing will be in 10 μs increment. The default value for DS1 CES is 750 μs and 1000 μs for DS3 CES. (R, W, Set-by-create) (mandatory) (2 bytes).

Channel associated signalling: This attribute selects which AAL 1 format should be used. It applies to structured interfaces only. For unstructured interfaces, this value, if present, must be set to the default of 0x00. The valid values are basic (0x00), e1Cas (0x01), SfCas (0x02), ds1EsfCas (0x03), and j2Cas (0x04). (R, W, Set-by-create) (optional) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.13 This clause intentionally left blank.

7.3.14 Ethernet performance monitoring history data

This managed entity contains the last completed 15-minute interval collected statistic data for an Ethernet interface. The statistic data value is only updated at the end of each period.

Instances of this managed entity are created/deleted by the OLT after an instance of Physical Path Termination Point Ethernet UNI managed entity is created/deleted.

Relationships

One instance of this Ethernet Performance Monitoring History Data managed entity can exist for each instance of the Physical Path Termination Point Ethernet UNI.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the id of the Physical Path Termination Point Ethernet UNI. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the statistic data values are updated. The value of this attribute is 0x00 during

the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The statistic data value is updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

FCSErrors: This attribute provides a count of frames received on a particular interface that are an integral number of octets in length but do not pass the Frame Check Sequence (FCS) check. The count represented by an instance of this object is incremented when the MAC service returns the frameCheckError status to the Link Layer Control (LLC) or other MAC user. Received frames for which multiple error conditions are obtained are counted exclusively according to the error status presented to the LLC. Default value is 0x00. (R) (mandatory) (4 bytes).

Excessive collision counter: This attribute provides a count of frames for which transmission on a particular interface fails due to excessive collisions. Default value is 0x00. (R) (mandatory) (4 bytes).

Late collision counter: This attribute indicates the number of times that a collision is detected on a particular interface later than 512 bit-times into the transmission of a packet. Default value is 0x00. (R) (mandatory) (4 bytes).

FrameTooLongs: This attribute provides a count of frames received on a particular interface that exceed the maximum permitted frame size. The count is incremented when the MAC service returns the frameTooLong status to the LLC. Default value is 0x00. (R) (mandatory) (4 bytes).

BufferOverflows on receive: This attribute provides a count of the number of times that the buffer overflows on receive. Default value is 0x00. (R) (mandatory) (4 bytes).

BufferOverflows on transmit: This attribute provides a count of the number of times that the buffer overflows on transmit. Default value is 0x00. (R) (mandatory) (4 bytes).

Single collision frame counter: This attribute provides a count of successfully transmitted frames on a particular interface for which transmission is inhibited by exactly one collision. Default value is 0x00. (R) (mandatory) (4 bytes).

Multiple collisions frame counter: This attribute provides a count of successfully transmitted frames on a particular interface for which transmission is inhibited by more than one collision. Default value is 0x00. (R) (mandatory) (4 bytes).

SQECounter: This attribute provides a count of times that the SQE TEST ERROR message is generated by the PLS sublayer for a particular interface. Default value is 0x00. (R) (mandatory) (4 bytes).

Deferred transmission counter: This attribute provides a count of frames for which the first transmission attempt on a particular interface is delayed because the medium is busy. The count represented by an instance of this object does not include frames involved in collisions. Default value is 0x00. (R) (mandatory) (4 bytes).

InternalMACTransmit ErrorCounter: This attribute provides a count of frames for which transmission on a particular interface fails due to an internal MAC sublayer transmit error. Default value is 0x00. (R) (mandatory) (4 bytes).

CarrierSenseError counter: This attribute indicates the number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame on a particular interface. Default value is 0x00. (R) (mandatory) (4 bytes).

AlignmentError counter: This attribute provides a count of frames received on a particular interface that are not an integral number of octets in length and do not pass the FCS check. Default value is 0x00. (R) (mandatory) (4 bytes).

InternalMACReceive ErrorCounter: This attribute provides a count of frames for which reception on a particular interface fails due to an internal MAC sublayer receive error. Default value is 0x00. (R) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the actual counters are reset to 0x00. The event list for this entity is given in Table 13b.

Table 13b/G.983.2 – Alarm list for Ethernet performance monitoring history data

Number	Event	Description
	Threshold Crossing Alert	
0	FCS Errors	Exceeds threshold
1	Excessive Collision Counter	Exceeds threshold
2	Late Collision Counter	Exceeds threshold
3	FrameTooLongs	Exceeds threshold
4	Buffer Overflows on Receive	Exceeds threshold
5	Buffer Overflows on Transmit	Exceeds threshold
6	Single Collision Frame Counter	Exceeds threshold
7	Multiple Collisions Frame Counter	Exceeds threshold
8	SQE Counter	Exceeds threshold
9	Deferred Transmission Counter	Exceeds threshold
10	Internal MAC Transmit Error Counter	Exceeds threshold
11	Carrier Sense Error Counter	Exceeds threshold
12	Alignment Error Counter	Exceeds threshold
13	Internal MAC Receive Error Counter	Exceeds threshold
14-255	Reserved	

7.3.15 CES physical interface monitoring history data

This managed entity contains the last completed 15-minute interval collected statistic data for a physical interface (e.g. DS1/E1/J1/J2) of the CES UNI.

Instances of this managed entity are created/deleted by the OLT after an instance of the Physical Path Termination Point CES UNI managed entity is created/deleted.

The performance management of the physical interfaces used by the CES UNI shall be supported. Possible interfaces include DS1/DS3/E1/E3/J1/J2. The performance management requirements of particular interfaces are described in the corresponding ITU-T Recommendation or other standard document, (e.g. ITU-T Rec. G.784 [1]). Failure/notifications should include threshold alerts for unacceptable performance (error) rates. Performance data should include transmission counts of Errored Seconds (ES), Severely Errored Seconds (SES) and Unavailable Seconds (UAS).

Notice that, because of the various operators' requirements and cost advantages, each vendor's ONT may support different levels of performance management of the physical interfaces. It is not stated here that the errored seconds stated below have to be generated for all the possible combinations such as near-end path, far-end path, near-end line, far-end line etc. Each vendor may use vendor-specific combinations for its implemented features.

Relationships

One instance of this managed entity shall exist for each instance of the Physical Path Termination Point CES UNI.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the id 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. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. (R) (mandatory) (1 byte).

Threshold data$_{\text{B-PON}}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{\text{B-PON}}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

Error seconds: The number of Errored Seconds encountered by a physical interface in the last completed 15-minute interval. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (2 bytes).

Severely error seconds: The number of Severely Errored Seconds encountered by a physical interface in the last completed 15-minute interval. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (2 bytes).

Bursty error seconds: The number of Bursty Errored Seconds encountered by a physical interface in the last completed 15-minute interval. A BES is any second that is not a UAS that contains between 2 and 319 error events but no LOS, AIS, or OOF condition. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (Optional) (2 bytes).

Unavailable seconds: The number of Unavailable Seconds encountered by a physical interface in the last completed 15-minute interval. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (2 bytes).

Controlled slip seconds: The number of Controlled Slip Seconds encountered by a physical interface in the last completed 15-minute interval. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the actual counters are reset to 0x00. Both ONT and OLT should know the event list used by this entity. The list of TCAs for this entity is given in Table 14.

Table 14/G.983.2 – Alarm list for CES physical interface monitoring history data

Number	Event	Description
	Threshold Crossing Alert	
0	ES	Exceeds threshold
1	SES	Exceeds threshold
2	BES	Exceeds threshold
3	UAS	Exceeds threshold
4	CSS	Exceeds threshold
5-255	Reserved	

7.3.16 TC adapter protocol monitoring history data

This managed entity contains the last completed 15-minute interval collected performance monitoring as a result of performing Transmission Convergence level protocol monitoring. All the attribute counters, e.g. the discarded cells due to HEC violations, are only updated at the end of each period.

Instances of this managed entity are created/deleted by the OLT after an instance of the corresponding TC Adapter$_{B\text{-}PON}$ managed entity is created/deleted.

Relationships

One instance of this managed entity can exist for each instance of TC Adapter$_{B\text{-}PON}$ or PON TC Adapter.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the id of the corresponding TC Adapter$_{B\text{-}PON}$ or PON TC Adapter. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the

first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

Discarded cells due to HEC violations: This read-only attribute provides a raw, thresholded count of the number of ATM cells that were discarded (per interface) due to an HEC violation. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Errored cells due to HEC violations: This read-only attribute provides a raw, thresholded count of the number of ATM cells that were errored (per interface) due to an HEC violation. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the actual counters are reset to 0x00. Both ONT and OLT should know the event list, given in Table 15, used by this entity.

Table 15/G.983.2 – Alarm list for TC adapter protocol monitoring history data

Number	Event	Description
	Threshold Crossing Alert	
0	Discarded Cells due to HEC violations	Exceeds threshold
1	Errored cells due to HEC violations	Exceeds threshold
2-255	Reserved	

7.3.17 Threshold data$_{B\text{-}PON}$

An instance of this managed entity contains threshold values for the performance monitoring parameters maintained in one or more instances of other managed entities.

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

Relationships

Zero or more instances of this managed entity shall be contained in the ONT$_{B\text{-}PON}$ managed entity. This managed entity may be related to multiple instances of History Data type

managed entities, which have a Threshold $Data_{B\text{-}PON}$ id attribute that points to an instance of this managed entity.

Related Managed Entities:

- AAL 1 Protocol Monitoring History $Data_{B\text{-}PON}$;
- AAL 5 Protocol Monitoring History $Data_{B\text{-}PON}$;
- CES Physical Interface Monitoring History Data;
- Ethernet Performance Monitoring History Data;
- TC Adapter Protocol Monitoring History Data;
- UPC Disagreement Monitoring History $Data_{B\text{-}PON}$;
- AAL 2 CPS Protocol Monitoring History $Data_{B\text{-}PON}$;
- AAL 2 SSCS Protocol Monitoring History $Data_{B\text{-}PON}$;
- MAC Bridge PM History Data;
- MAC Bridge Port PM History Data;
- Voice PM History Data;
- VP PM History Data.

Attributes

Managed entity id: This attribute provides a unique number for the instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Threshold value 1: This attribute provides the associated threshold value for the 1st thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 2: This attribute provides the associated threshold value for the 2nd thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 3: This attribute provides the associated threshold value for the 3rd thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 4: This attribute provides the associated threshold value for the 4th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 5: This attribute provides the associated threshold value for the 5th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 6: This attribute provides the associated threshold value for the 6th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 7: This attribute provides the associated threshold value for the 7th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 8: This attribute provides the associated threshold value for the 8th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 9: This attribute provides the associated threshold value for the 9th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 10: This attribute provides the associated threshold value for the 10th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 11: This attribute provides the associated threshold value for the 11th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 12: This attribute provides the associated threshold value for the 12th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 13: This attribute provides the associated threshold value for the 13th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Threshold value 14: This attribute provides the associated threshold value for the 14th thresholded counter in the History Data type managed entity. (R, W, Set-by-create) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.18 AAL 2 profile$_{B\text{-}PON}$

This managed entity organizes data that describe the AAL Type 2 processing functions of the ONT. It is used with the Interworking VCC Termination Point managed entity. In an ATM environment, AAL Type 2 configuration parameters are associated with an Interworking VCC Termination Point managed entity through a pointer relationship. Each instance of the managed entity defines a combination of parameter values that may be associated with multiple Interworking VCC Termination Point instances. This managed entity is instantiated/deleted on request of the OLT. These attributes must be provisioned for both PVC and SVC VCCs.

Relationships

One instance of this managed entity shall exist for each combination of AAL 2 parameter values used within an ONT associated with a VCC that is either an SVC or a PVC. One instance of this managed entity may be associated with one or more instances of an Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

SSCSParameterProfile1Ptr: This attribute points to the SSCSParameterProfile1 instance containing the default values for the Service Specific Convergence Sublayer parameters

associated with channels carrying control and management plane traffic (e.g. CCs, ELCP, ISDN D-channels, and LES-EOC). (R, Set-by-create) (mandatory) (2 bytes).

SSCSParameterProfile2Ptr: This attribute points to the SSCSParameterProfile2 instance containing the default values for the Service Specific Convergence Sublayer parameters associated with channels carrying media streams (e.g. POTS or ISDN B-channels). (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.19 AAL 2 PVC profile$_{B\text{-}PON}$

This managed entity organizes data that describe the AAL Type 2 processing functions of the ONT. It is used with the Interworking VCC Termination Point managed entity. In an ATM environment, AAL Type 2 configuration parameters are associated with an Interworking VCC Termination Point managed entity through a pointer relationship. Each instance of the managed entity defines a combination of parameter values that may be associated with multiple Interworking VCC Termination Point instances. This managed entity is instantiated/deleted on request of the OLT. These attributes must be provisioned for PVCs (including soft-PVCs).

Relationships

One instance of this managed entity shall exist for each combination of AAL 2 parameter values used within an ONT associated with a VCC that is a PVC. One instance of this managed entity may be associated with one or more instances of an Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the AAL 2 Profile$_{B\text{-}PON}$ with which this AAL 2 PVC Profile$_{B\text{-}PON}$ is associated. (R, Set-by-create) (mandatory) (2 bytes).

AppId: This attribute specifies the protocol combinations used between the Interworking Functions found in the Voice Gateway and the ONT. Valid values include those provided in Section 4.1.1 of ATM Forum Well-Known Addresses and Assigned Codes. (R, Set-by-create) (mandatory) (1 byte).

MaximumNumChan: This attribute provides the maximum number of AAL 2 channels that can be carried by the VC Trail associated with the Interworking VCCTP. It ranges from 0x01 to 0xFF (1 to 255). (R, Set-by-create) (mandatory) (1 byte).

MinimumChanIdVal: This attribute provides the minimum value for the Channel Id allowed for any AAL 2 channel within the connection. (R, Set-by-create) (mandatory) (1 byte).

NOTE 1 – Values from 0 to 15 are reserved.

MaximumChanIdVal: This attribute provides the maximum value for the Channel Id allowed for the AAL 2 channel within the connection (R, Set-by-create) (mandatory) (1 byte).

NOTE 2 – Values from 224 to 255 are reserved.

MaxCPS_SDULen: This attribute provides the maximum allowed length of the Common Part Sublayer Service Data Unit (or CPS SDU) that will be allowed over the connection in either the upstream or downstream direction of transmission. The value is 0x2d or 0x40 (45 or 64 octets). (R, Set-by-create) (mandatory) (1 byte).

TimerCULen: This attribute provides the value (in 10ths of a millisecond) for the "combined use" timer Timer_CU on the I.363.2. (R, Set-by-create) (mandatory) (2 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.20 AAL 2 CPS protocol monitoring history data$_{B\text{-}PON}$

This managed entity contains the last completed 15-minute interval performance monitoring data collected as a result of AAL 2 protocol conversion monitoring. All the attribute counters, e.g. the CPSInPkts, are only updated at the end of each period. Instances of this managed entity are created automatically by the OLT whenever an instance of the Interworking VCC Termination Point managed entity is created that represents the AAL 2 functions. Instances of this managed entity are deleted by the OLT.

Relationships

One instance of this managed entity can exist for each instance of the Interworking VCC Termination Point managed entity that represents AAL 2 functions.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the Managed Entity id of the corresponding Interworking VCC Termination Point. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

CPSInPkts: This attribute records the number of CPS packets received by the port group associated with the Interworking VCC Termination Point. (R) (mandatory) (4 bytes).

CPSOutPkts: This attribute records the number of CPS packets transmitted by the port group associated with the Interworking VCC Termination Point. (R) (mandatory) (4 bytes).

ParityErrors: This attribute records the number of CPS PDUs discarded because of incorrect parity value in the STF field. (See errnum 0 in Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

SeqNumErrors: This attribute records the number of CPS PDUs received with incorrect sequence number in the STF. (See errnum 1 in Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

CPS_OSFMismatchErrors: This attribute records the number of CPS PDUs received for which the number of octets expected for a CPS Packet that overlaps into the next CPS PDU does not match the information contained in the STF field. (See errnum 2 in Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

CPS_OSFErrors: This attribute records the number of CPS PDUs discarded because of an incorrect Offset Field (OSF) value in the STF field. (See errnum 3 in Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

CPS_HECErrors: This attribute records the number of CPS packets having a header value indicating transmission errors in the header. (See errnum 4 on the Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

OversizedSDUErrors: This attribute records the number of times the received CPS packet payload exceeds the maximum length indicated in MaxCPS_SDULen attribute. (See errnum 5 on the Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

ReassemblyErrors: This attribute records the number of times that partial CPS packets are discarded because errors were detected before reassembly could be completed. (See errnum 6 on the Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

HECOverlapErrors: This attribute records the number of times that a CPS packet is received with a HEC that overlaps a CPS PDU boundary. (See errnum 7 in Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

UUIErrors: This attribute records the number of times that a UUI is received with a value that is reserved for future use. (See errnum 8 in Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

CIDErrors: This attribute records the number of times that a CPS PDU is received with an incorrect CID value. (See errnum 9 in Table 6/I.363.2 [15].) If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change

notification "off" will be sent at the end of the 15-minute period since then the actual counters are reset to 0x00. The event list for this entity is given in Table 15a.

Table 15a/G.983.2 – Alarm list for AAL 2 CPS protocol monitoring history data$_{B\text{-}PON}$

Number	Event	Description
	Threshold Crossing Alert	
0	Reserved	
1	Reserved	
2	ParityErrors	Exceeds threshold
3	SeqNumErrors	Exceeds threshold
4	CPS_OSFMismatchErrors	Exceeds threshold
5	CPS_OSFErrors	Exceeds threshold
6	CPS_HECErrors	Exceeds threshold
7	OversizedSDUErrors	Exceeds threshold
8	ReassemblyErrors	Exceeds threshold
9	HECOverlapErrors	Exceeds threshold
10	UUIErrors	Exceeds threshold
11	CIDErrors	Exceeds threshold
12-255	Reserved	

7.3.21 AAL 2 SSCS protocol monitoring history data$_{B\text{-}PON}$

This managed entity contains the last completed 15-minute interval performance monitoring data collected as a result of AAL 2 protocol conversion monitoring. All of the attribute counters are updated only at the end of each period. Instances of this managed entity are created automatically by the OLT whenever an instance of the Interworking VCC Termination Point managed entity is created that represents AAL 2 functions. Instances of this managed entity are deleted by the OLT.

Relationships

One instance of this managed entity can exist for each instance of the Interworking VCC Termination Point managed entity that represents AAL 2 functions.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the Managed Entity id of the corresponding Interworking VCC Termination Point. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

OversizedSSSARSDUErrors: This attribute records the number of times that an SSSAR SDU exceeds the maximum length allowed for an SSSAR-SDU of the Segmentation and Reassembly Service Specific Convergence sublayer. See "MaxSSSARSDULen" attribute of AAL 2 SSCS Parameter Profile1 managed entity. (See errnum 10 in Table 3/I.366.1 [16].) If the actual counter saturates, it remains on its maximum value. (R) (optional – used when LES EOC is carried all the way to the ONT) (4 bytes).

RASTimerExpiryErrors: This attribute records the number of times that the reassembly timer has expired. See "RASTimer" attribute of AAL 2 SSCS Parameter Profile1 managed entity. (See errnum 11 in Table 3/I.366.1 [16].) If the actual counter saturates, it remains on its maximum value. (R) (optional – used when LES EOC is carried all the way to the ONT) (4 bytes).

UndersizedSSTEDPDUErrors: This attribute records the number of times that an SSTED-PDU of length 8 or less has been received. (See errnum 20 in Table 5/I.366.1 [16].) If the actual counter saturates, it remains on its maximum value. (R) (optional – used when LES EOC is carried all the way to the ONT) (4 bytes).

PDULengthMismatchErrors: This attribute records the number of times that the value of the Length field in the SSTED-PDU does not match the length of the received SSTED-PDU. (See errnum 21 in Table 5/I.366.1 [16].) If the actual counter saturates, it remains on its maximum value. (R) (optional – used when LES EOC is carried all the way to the ONT) (4 bytes).

CRCMismatchErrors: This attribute records the number of times that the value of the CRC field is not equal to the CRC calculated over the received information. If the actual counter saturates, it remains on its maximum value. (R) (optional – used when LES EOC is carried all the way to the ONT) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change notification "off" will be sent at the end of the 15-minute period since then the actual counters are reset to 0x00. The event list for this entity is given in Table 15b.

Table 15b/G.983.2 – Alarm list for AAL 2 SSCS protocol monitoring history data$_{B\text{-}PON}$

Number	Event	Description
	Threshold Crossing Alert	
0	OversizedSSSARSDUErrors	Exceeds threshold
1	RASTimerExpiryErrors	Exceeds threshold
2	UndersizedSSTEDPDUErrors	Exceeds threshold
3	PDULengthMismatchErrors	Exceeds threshold
4	CRCMismatchErrors	Exceeds threshold
5-255	Reserved	

7.3.22 AAL 2 SSCS parameter profile1

This managed entity groups default values for Service Specific Convergence Sublayer parameters for channels carried in an AAL 2 VCC that provide control and management plane traffic. These parameters are defined in ITU-T Rec. I.366.1 [16]. Instances of this managed entity are created and deleted by request of the OLT.

Relationships

Zero or more instances of this managed entity shall exist for each instance of the AAL 2 Profile$_{B\text{-}PON}$ used within an ONT. One instance of this managed entity may be associated with one or more instances of an Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

SegmentLength: This attribute provides the segment length for the Segmentation and Reassembly Service Specific Convergence sublayer. It ranges from 0 to the maximum value provided by MaxCPS_SDULen attribute. (R, Set-by-create) (mandatory) (1 byte).

RASTimer: This attribute provides the reassembly time (in seconds) of the Segmentation and Reassembly Service Specific Convergence sublayer for I.366.1 [16]. (R, Set-by-create) (mandatory) (1 byte).

MaxSSSARSDULen: This attribute provides the maximum length allowed for an SSSAR-SDU of the Segmentation and Reassembly Service Specific Convergence sublayer. It ranges from 0x01 to 0x010020(1 to 65 568). (R, Set-by-create) (mandatory) (3 bytes).

SSTEDInd: This Boolean attribute indicates whether or not the transmission error detection mechanisms have been selected, with value TRUE indicating selection. (R, Set-by-create) (mandatory) (1 byte).

SSADTInd: This Boolean attribute indicates whether or not the assured data transfer mechanism has been selected, with value TRUE indicating selection. (R, Set-by-create) (mandatory) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.23 AAL 2 SSCS parameter profile2

This managed entity groups default values for Service Specific Convergence Sublayer parameters for channels carried in an AAL 2 VCC that provide media streams. These parameters are defined in ITU-T Rec. I.366.2 [17]. Instances of this managed entity are created and deleted by request of the OLT.

Relationships

Zero or more instances of this managed entity shall exist for each instance of the AAL 2 $Profile_{B\text{-}PON}$ used within an ONT. One instance of this managed entity may be associated with one or more instances of an Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

ServiceCatType: This attribute indicates the type of service category provided by AAL 2. Valid values include but are not limited to "Audio" (value is 0x01) and "Multirate" (value is 0x02). (R, Set-by-create) (mandatory) (1 byte).

EncSrcType: This attribute indicates the source for the encoding profile format. Valid values include but are not limited to "ITU-T" predefined (value 0x01) and "ATM Forum" predefined (value 0x02). (R, Set-by-create) (mandatory) (1 byte).

EncProfileIndex: This attribute indicates the specific predefined encoding profile used. Table 15c provides a list of possible values. (R, Set-by-create) (mandatory) (1 byte).

AudioServInd: This Boolean attribute indicates whether or not audio service is transported, where the value TRUE implies the presence of this service. (R, Set-by-create) (mandatory) (1 byte).

PCMEncType: This attribute indicates the type of PCM coding. Valid values include but are not limited to "mu-law PCM coding" (value 0x01) and "alpha-law PCM coding" (value 0x02). (R, Set-by-create) (mandatory) (1 byte).

CMDataInd: This Boolean attribute indicates whether or not Circuit Mode Data is carried on this connection, where the value TRUE implies its presence. (R, Set-by-create) (mandatory) (1 byte).

CMMultiplierNum: This attribute provides the N value in $N \times 64$ kbit/s circuit mode data. (R, Set-by-create) (mandatory) (1 byte).

FMDataInd: This Boolean attribute indicates whether or not Frame Mode Data is carried on this connection, where the value TRUE implies its presence. (R, Set-by-create) (mandatory) (1 byte).

FMMaxFrameLen: This attribute indicates the maximum length of a frame mode data unit. It ranges from 0x01 to 0xFFFF (1 to 65 535). (R, Set-by-create) (mandatory) (2 bytes).

CASInd: This Boolean attribute indicates whether or not Channel Associated Signalling is enabled on the connection, where the value TRUE implies it is enabled. (R, Set-by-create) (mandatory) (1 byte).

DTMFInd: This Boolean attribute indicates whether or not Dual Tone Multi-Frequency dialed digits are transported on the connection, where the value TRUE implies their presence. (R, Set-by-create) (mandatory) (1 byte).

MFR1Ind: This Boolean attribute indicates whether or not Multi-Frequency R1 dialed digits are transported on the connection, where the value TRUE implies their presence. (R, Set-by-create) (mandatory) (1 byte).

MFR2Ind: This Boolean attribute indicates whether or not Multi-Frequency R2 dialed digits are transported on the connection, where the value TRUE implies their presence. (R, Set-by-create) (mandatory) (1 byte).

RateControlInd: This Boolean attribute indicates whether or not rate control is transported on the connection, where the value TRUE implies its presence. (R, Set-by-create) (mandatory) (1 byte).

SynchChangeInd: This Boolean attribute indicates whether or not synchronization of change in SSCS operation is transported on the connection, where the value TRUE implies its presence. (R, Set-by-create) (mandatory) (1 byte).

FaxDemodulationInd: This Boolean attribute indicates whether fax demodulation is enabled or disabled on the connection, where the value TRUE implies it is enabled. (R, Set-by-create) (mandatory) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

Table 15c/G.983.2 – Coding of the EncProfileIndex attribute

EncSrcType	EncProfileIndex		
1: ITU-T predefined	0:	Not used.	
	1:	PCM-64	ITU-T Rec. I.366.2
	2:	PCM-64 and silence	ITU-T Rec. I.366.2
	3:	ADPCM and silence	ITU-T Rec. I.366.2
	4:	G.728 with higher efficiency	ITU-T Rec. I.366.2
	5:	G.728 with lower delay	ITU-T Rec. I.366.2
	6:	G.729 with higher efficiency and G.726 for voiceband data	ITU-T Rec. I.366.2
	7:	G.729 with lower delay	ITU-T Rec. I.366.2
	8:	G.729 with lower delay and G.726-32 for voiceband data at lower rates.	ITU-T Rec. I.366.2
	9:	G.729 with lower delay and G.726-40 for voiceband data at higher rates.	ITU-T Rec. I.366.2
	10:	G.729 with full variable bit rates	ITU-T Rec. I.366.2
	11:	AMR	ITU-T Rec. I.366.2
	12:	G.723	ITU-T Rec. I.366.2
	13:	PCM 64 kbits/s and ADPCM 32 kbits/s	ITU-T Rec. I.366.2
	14-255:	Reserved for future ITU-T assignment	

Table 15c/G.983.2 – Coding of the EncProfileIndex attribute

EncSrcType	EncProfileIndex		
2: ATM Forum predefined	0:	Not used.	
	1:	LPC-10 (High efficiency)	af-vtoa-0113.000
	2:	LPC-10 (Low delay)	af-vtoa-0113.000
	3:	CVSD-32	af-vtoa-0113.000
	4:	CVSD-16	af-vtoa-0113.000
	5:	CVSD-12	af-vtoa-0113.000
	6:	G.723.1	af-vtoa-0113.000
	7:	PCM-64, ADPCM-32, 44 octet packets, and silence.	af-vmoa-0145.000
	8:	PCM-64, 44 octet packets, and silence.	af-vmoa-0145.000
	9:	PCM-64, 44 octet packets, without silence.	af-vmoa-0145.000
	10:	PCM-64 and ADPCM-32, 44 octet packets, without silence.	af-vmoa-0145.000
	11:	PCM-64, ADPCM-32, 40 octet packets, without silence.	af-vmoa-0145.000
	12:	PCM-64, ADPCM-32, 40 octet packets, with silence.	af-vmoa-0145.000
	13-255:	Reserved for future ATM Forum assignment.	af-vmoa-0145.000

7.3.24 Voice service profile AAL

This managed entity is used to organize data that describes the Voice Service functions of the ONT if supported by AAL 2 or AAL 1. Instances of this managed entity are created and deleted by request of the OLT.

Relationships

Zero or more instances of this managed entity shall be contained in the $ONT_{B\text{-}PON}$ managed entity. One instance of this managed entity may be associated with zero or more instances of the Interworking VCC Termination Point carrying voice services.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the id of the Physical Path Termination Point POTS UNI. (R, Set-by-create) (mandatory) (2 bytes).

AnnouncementType: This attribute provides the announcement to the customer going off-hook when no call has been attempted. Valid values include but are not limited to "silence" (0x01), "reorderTone" (0x02), "fastBusy" (0x03), "voiceAnnouncement" (0x04), and "N/A" (0xFF). (R, Set-by-create) (mandatory) (1 byte).

JitterTarget: This attribute provides the target value of the jitter buffer. The system will try to maintain the jitter buffer at the target value. Units are in milliseconds. (R, W, Set-by-create) (mandatory for AAL 2) (2 bytes).

JitterBufferMax: This attribute provides the maximum depth of the jitter buffer associated with this service. Units are in milliseconds. (R, W, Set-by-create) (mandatory for AAL 2) (2 bytes).

EchoCancelInd: This Boolean attribute indicates whether echo cancellation is on or off, where the value TRUE implies that it is on. (R, Set-by-create) (mandatory) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.25 LES service profile

This managed entity is used to organize data that describes voice grade Loop Emulation Service functions of the ONT associated with AAL 2 interworking. Instances of this managed entity shall be created and deleted by the OLT.

Relationships

Zero or more instances of this managed entity shall be contained in the $ONT_{B\text{-}PON}$ managed entity. One instance of this managed entity may be associated with zero or more instances of the Interworking VCC Termination Point.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the Voice Service Profile AAL with which this LES Service Profile is associated. (R, Set-by-create) (mandatory) (2 bytes).

ELCPInd: This Boolean attribute indicates whether or not Emulated Loop Control Protocol is in use. The value TRUE means enabled. (R, Set-by-create) (mandatory) (1 byte).

POTSSignalling: This attribute selects which signalling format should be used for POTS service. Valid values include but are not limited to CCS (value 0x01), CAS (value 0x02), and other (0xFF). (R, Set-by-create) (mandatory) (1 byte).

BRISignalling: This attribute selects which signalling format should be used for Basic Rate ISDN. Valid values include but are not limited to DSS1 (0x01), and other (0xFF). The default value is 0x01. (R, W) (mandatory) (1 byte).

MaxNumCIDs: This attribute specifies the maximum number of channels within the VCC that can be active. (R, Set-by-create) (mandatory) (1 byte).

MaxPacketLength: This attribute specifies the maximum packet length (in bytes). (R, Set-by-create) (mandatory) (1 byte).

Channel&SSCSParameterPointerList: This attribute correlates channel ids with SSCS parameter values.

NOTE – SSCS parameter sets yet to be defined.

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.26 Physical path termination point POTS UNI

This managed entity represents the point at the POTS UNI in the ONT where physical paths terminate and physical path level functions (e.g. analog telephony, facsimile function) are performed. An instance of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a Subscriber Line Card with POTS type.

Relationships

One or more instances of this managed entity shall be contained in an instance of the $ONT_{B\text{-}PON}$ or a Subscriber Line Card managed entity classified as POTS type.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the physical position of the UNI. The first byte is the slot id (defined in 7.1.3). If the UNI is integrated, this value is 0x00. The second byte is the port id with value range from 0x01 to 0xFF (1 to 255), 0x01 is used for the leftmost/lowest port on a Subscriber Line Card, 0x02 is used for the next right/upper port, and so forth. (R) (mandatory) (2 bytes).

Administrative state: This attribute is used to activate (unlock: value 0x00) and deactivate (lock: value 0x01) the functions performed by instances of this managed entity. Selection of a default value for this attribute is outside the scope of this Recommendation as it is normally handled through supplier-operator negotiations. (R, W) (mandatory) (1 byte).

Interworking VCC pointer: This attribute provides a pointer to the instance of the Interworking VCC managed entity to which this instance is connected. (R, W) (optional) (2 bytes).

ARC: This attribute is used to control alarm reporting from this managed entity. Valid values are "off" (alarm reporting allowed immediately, value 0x00) and "on" (alarm reporting inhibited, value 0x01). Upon initial installation and provisioning of the ONT, this attribute may be set to "on" or "off" for the time interval specified by "ARCInterval." Similarly, this attribute may be set to "off". If the attribute is set to "on", then alarm reporting is inhibited until this managed entity detects a valid signal for the time interval specified by "ARCInterval." (R, W) (optional) (1 byte).

ARCInterval: This attribute provides a provisionable length of time. Units are given in minutes (R, W) (optional) (1 byte).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Test: Request that the ONT perform one or more MLT tests. See "Test" and "Test result" message layouts in II.2.27 and II.2.45.

Notifications

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. Both ONT and OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 15d. See also Appendix III.

Table 15d/G.983.2 – Alarm list for physical path termination point POTS UNI

Number	Alarm	Description
0	AIS	alarm indication signal
1	RDI	remote defect indication
2-255	Reserved	

7.3.27 Voice CTP

This managed entity is used to represent the point in the ONT where the voice channel is terminated/originated. Instances of this managed entity are created and deleted by request of the OLT.

Relationships

Zero or more instances of this managed entity shall be contained in an instance of the $ONT_{B\text{-}PON}$ or Subscriber Line Card managed entity classified as a POTS type

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

InterworkingVCCTPPtr: This attribute points to the instance of the Interworking VCC Termination Point carrying this voice channel. (R, Set-by-create) (mandatory) (2 bytes).

InterworkingPPTPPtr: This attribute provides a pointer to the associated instance of the Termination Point managed entity for the case of POTS or ISDN services. When this Voice CTP is associated with a Subscriber Line Card managed entity classified as a POTS type, this attribute points to the instance of the Physical Path Termination Point POTS UNI. (R, Set-by-create) (mandatory) (2 bytes).

ChannelId: This attribute identifies the logical Channel Id for this service if AAL 2 is employed. This attribute is null if another type of adaptation is employed. (R, Set-by-create) (mandatory) (1 byte).

SignallingCode: This attribute specifies whether "loop start" (0x01), "ground start" (0x02), "loop reverse battery" (0x03), "coin first" (0x04), "dial tone first" (0x05), or "multi-party" (0x06) signalling is employed. (R, Set-by-create) (mandatory) (1 byte).

RobbedBitSignalling: This attribute describes the robbed bit signalling in use on the telephony port. Valid values include "a" (value 0x01), "ab" (value 0x02), "abcd" (value 0x03), "transparent" (value 0x04), and "other" (value 0xFF). (R, Set-by-create) (mandatory) (1 byte).

SilenceSuppressionInd: This Boolean attribute indicates whether silence suppression is on or off. The value TRUE means on. (R, Set-by-create) (mandatory) (1 byte).

VoiceCompressionType: This attribute identifies the voice compression applied to the voice channel. Valid values include but are not limited to the following: PCM-64 (value 0x01), ADPCM-32 (value 0x02), LD-CELP16 (value 0x03), CS-ACELP8 (value 0x04), and unknown (value 0xFF). (R, Set-by-create) (mandatory) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Notifications

None.

7.3.28 Voice PM history data

This managed entity contains the last completed 15-minute interval performance monitoring data collected as a result of monitoring a voice port on an ONT. The statistic data value is only updated at the end of each period. Instances of this managed entity are created/deleted by the OLT after an instance of a Physical Path Termination Point POTS UNI managed entity is created/deleted.

Relationships

One instance of this managed entity can exist for each instance of a Physical Path Termination Point POTS UNI.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the id of a Physical Path Termination Point POTS UNI. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{\text{B-PON}}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{\text{B-PON}}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

VoicePortBufferOverflows: This attribute provides the total number of payload octets dropped due to buffer overflow at this port.

NOTE – This number does not include octets that are dropped because they arrived late and which had already been substituted by a filler octet). If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

VoicePortBufferUnderflows: This attribute provides the total number of filler octets injected into the active media stream on this port due to playout buffer underflow. If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

ActiveSeconds: This attribute provides the total length of time, in seconds, that the AAL 2 channel associated with this port has been active. If the counter saturates, it remains on its maximum value. (R) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold by the actual counter; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the actual counters are reset to 0x00. The event list for this entity is given in Table 15e.

Table 15e/G.983.2 – Alarm list for Voice PM History Data

Number	Event	Description
	Threshold Crossing Alert	
0	Reserved	
1	Reserved	
2	VoicePortBufferOverflows	Exceeds threshold
3	VoicePortBufferUnderflows	Exceeds threshold
4-255	Reserved	

7.3.29 MAC bridge service profile

This managed entity is used to organize data that affects all ports on a MAC Bridge at a bridged LAN Ethernet UNI interface on the ONT. Instances of this managed entity are created and deleted by request of the OLT.

Relationships

Zero or more instances of this managed entity shall be referred to by the Physical Path Termination Point Ethernet UNI managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The first byte is the slot id (defined in 7.1.3). If the UNI is integrated, this value is 0x00. The second byte is the bridge group id. (R) (mandatory) (2 bytes).

SpanningTreeInd: This Boolean attribute indicates whether or not a spanning tree algorithm is enabled. The value TRUE means enabled. (R, W, Set-by-create) (mandatory) (1 byte).

LearningInd: This Boolean attribute indicates whether or not the learning functions of the bridge are enabled. The value TRUE means enabled. (R, W, Set-by-create) (mandatory) (1 byte).

ATMPortBridgingInd: This Boolean attribute indicates whether or not bridging between ATM ports is enabled. The value TRUE means enabled. (R, W, Set-by-create) (mandatory) (1 byte).

Priority: This attribute indicates the bridge priority set on the LAN card. The range is 0x00 to 0xFFFF (0 to 65 535). The value of this attribute is reflected to the BridgePriority attribute of the MAC Bridge Configuration Data managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

MaxAge: This attribute indicates the maximum age (in 256ths of a second) for an entry in the spanning tree listing. It indicates the maximum age in 256ths of a second for received protocol information before it is discarded. The range is 0x0600 to 0x2800 (6 s to 40 s) in accordance with IEEE 802.1D [14]. (R, W, Set-by-create) (mandatory) (2 bytes).

HelloTime: This attribute provides the time interval (in 256ths of a second) between hello packets. It is the time interval, in 256ths of a second, that a bridge advertises its presence while as a root or attempting to become a root. The range is 0x0100 to 0x0a00 (1 s to 10 s) in accordance with IEEE 802.1D [14]. (R, W, Set-by-create) (mandatory) (2 bytes).

ForwardDelay: This attribute gives the time (in 256ths of a second) that the bridge on the Ethernet card in the ONT retains a packet before forwarding it. (It indicates the value in 256ths of a second that the bridge uses for Forward Delay when the bridge acts as the root.) The range is 0x0400 to 0x1e00 (4 s to 30 s) in accordance with IEEE 802.1D [14]. (R, W, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.30 MAC bridge configuration data

This managed entity is used to organize and record data that is associated with bridged LAN configurations. Some of the data is volatile. Instances of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a MACBridgeServiceProfile.

Relationships

This managed entity is associated with one instance of a MACBridgeServiceProfile.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the MACBridgeServiceProfile with which this MACBridgeConfigurationData is associated. (R) (mandatory) (2 bytes).

BridgeMACAddress: This attribute indicates the MAC address used by the bridge. Upon autonomous instantiation, this attribute consists of all 0x00. (R) (mandatory) (6 bytes).

BridgePriority: This attribute denotes the priority of the bridge and is positive integer-valued. Upon autonomous instantiation, the value 0x8000 is used. (R) (mandatory) (2 bytes).

DesignatedRoot: This attribute provides the bridge identifier for the root of the spanning tree. This attribute consists of Bridge Priority (2 bytes) and MAC address (6 bytes). (R) (mandatory) (8 bytes).

RootPathCost: This attribute provides the cost of the best path to the root as seen from the bridge. Upon autonomous instantiation, the value 0x00 is used. (R) (mandatory) (4 bytes).

BridgePortCount: This attribute provides the number of existing ports controlled by this bridge. (R) (mandatory) (1 byte).

RootPortNum: This attribute provides the port number that has the lowest cost from the bridge to the root bridge. The value 0x00 means that the port itself is the root. Upon autonomous instantiation, the value 0x00 is used. (R) (mandatory) (2 bytes).

HelloTime: This attribute provides the time interval (in 256ths of a second) between hello packets. It is the "HelloTime" received from the designated root. The range is 0x0100 to 0x0a00 (1 s to 10 s) in accordance with IEEE 802.1D [14]. (R) (optional) (2 bytes).

ForwardDelay: This attribute gives the time (in 256ths of a second) that the bridge on the Ethernet card in the ONT retains a packet before forwarding it. It is the "ForwardDelay" time received from the designated root. The range is 0x0400 to 0x1e00 (4 s to 30 s) in accordance with IEEE 802.1D [14]. (R) (optional) (2 bytes).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.31 MAC bridge port configuration data

This managed entity is used to organize and record data that is associated with a bridge port. Some of the data is volatile. Instances of this managed entity are created and deleted by request of the OLT.

Relationships

Zero or more instances of this managed entity shall be contained in an instance of the MACBridgeServiceProfile.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

BridgeIdPointer: This attribute identifies the MAC bridge controlling the port. This attribute points to the instance of the MACBridgeServiceProfile. (R, Set-by-create) (mandatory) (2 bytes).

PortNum: This attribute provides the port number. (R, Set-by-create) (mandatory) (1 byte).

TPType: This attribute identifies the type of the termination point associated with this MAC bridge port. The value is set to 0x01 if this bridge port is associated with the LAN side's termination point. The value is set to 0x02 if this bridge port is associated with the ATM side's termination point. (R, Set-by-create) (mandatory) (1 byte).

TPPointer: This attribute points to the termination point associated with this MAC bridge port. The value of this attribute is the same as the id of the Physical Path Termination Point Ethernet UNI associated with this MAC bridge port. (R, Set-by-create) (mandatory) (2 bytes).

PortPriority: This attribute denotes the priority of the port. The range is 0x00 to 0x00FF (0 to 255). (R, W, Set-by-create) (mandatory) (2 bytes).

PortPathCost: This attribute provides the cost contribution of the port to the path cost towards the spanning tree root bridge. The range is 0x0001 to 0xFFFF (1 to 65 535). (R, W, Set-by-create) (mandatory) (2 bytes).

PortSpanningTreeInd: This Boolean attribute indicates whether or not STP is enabled at this port. The value TRUE means enabled. (R, W, Set-by-create) (mandatory) (1 byte).

EncapsulationMethod: This attribute identifies the frame encapsulation method that is used. Value 0x00: identification by ATM VC; value 0x01: LLC encapsulation. Upon autonomous instantiation, the value 0x00 is used. (R,W) (mandatory) (1 byte).

LANFCSInd: This attribute indicates whether LAN FCS (Frame Check Sequence) bytes are forwarded (value 0x00) or discarded (value 0x01) towards the OLT. Upon autonomous instantiation, the value 0x00 is used. (R, W) (1 byte) (optional).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.32 MAC bridge port designation data

This managed entity is used to organize and record data that is associated with a bridge port. Some of the data is volatile. Instances of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a MACBridgePortConfigurationData.

Relationships

This managed entity is associated with one instance of a MACBridgePortConfigurationData.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the MACBridgePortConfigurationData with which this MACBridgePortDesignationData is associated. (R) (mandatory) (2 bytes).

DesignatedBridgeRootCostPort: This attribute provides the Designated Root, Designated Cost, Designated Bridge, and Designated Port outputs of the "Read port parameters" operation defined in 14.8.2.1 of IEEE 802.1D [14], i.e.:

– bridge identifier of the designated bridge for the port's segment (8 bytes);

– bridge identifier of the root transmitted by the designated bridge for the segment (8 bytes);

– port number of the designated port on the designated bridge considered to be part of this port's segment (4 bytes);

– path cost contribution of the designated port to this port's segment (4 bytes).

Upon autonomous instantiation, this attribute consists of all 0x00. (R) (mandatory) (24 bytes).

PortState: This attribute provides status information on the port. Valid values include "disabled" (value 0x00), "listening" (value 0x01), "learning" (value 0x02), "forwarding" (0x03), "blocking" (value 0x04), "linkdown" (value 0x05), and "stp_off" (value 0x06) in accordance with IEEE 802.1D [14].

NOTE – The value "linkdown" is introduced to denote the port status where the Ethernet link state is down. This value is necessary to distinguish the case where Ethernet is physically down and the case where Ethernet is administratively down, which can be denoted by "disabled." The value "stp_off" is

introduced to denote the port status where Spanning Tree Protocol is disabled, by setting "PortSpanningTreeInd" of "MAC Bridge Port Configuration Data" to FALSE, and Ethernet link state is up. This value is used to distinguish whether or not a bridge port forwarding frames is under control of STP.

Upon autonomous instantiation, the value 0x00 is used. (R) (mandatory) (1 byte).

Actions

Get: Get one or more attributes.

Notifications

None.

7.3.33 MAC bridge port filter table data

This managed entity is used to organize and record data that is associated with a bridge port. Some of the data is volatile. Instances of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a MACBridgePortConfigurationData managed entity.

NOTE – Alternative schemes for this managed entity may be included in future Recommendations.

Relationships

This managed entity is associated with one instance of a MACBridgePortConfigurationData managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the MACBridgePortConfigurationData with which this MACBridgePortFilterTableData is associated. (R) (mandatory) (2 bytes).

MACFilterTable: This attribute lists destination MAC Addresses associated with the bridge port and an allow/disallow forwarding indicator for each of inbound traffic (towards the LAN physical port) and outbound (towards the ATM side) traffic. One entry provides the Entry number (1 byte) which is an index in this attribute list, Filter byte (1 byte), and MAC address (6 bytes). Moreover, the bits of the Filter byte are assigned as described in Table 15f. Upon autonomous instantiation, this attribute is a null list. An OMCI message can carry a maximum of 3 entries at the same time because this attribute list is larger than an OMCI message size. (R, W) (mandatory) ($N \times 8$ bytes, N is the number of entries in the list.)

Table 15f/G.983.2 – Coding of filter byte in the MACFilterTable attribute

Bit	Name	Setting
8	Add/remove	0: remove this entry 1: add this entry
7-2	Reserved	(0)
1	Filter/forward	0: forward 1: filter

Actions

Get: Get one or more attributes. Latch a snapshot (i.e. copy) of the current MACFilterTable and respond with the size of data (4 bytes), which should be obtained using the "Get next" command.

Get next: Get the latched attribute values of the managed entity within the current snapshot.

Set: Set one or more attributes.

Notifications

None.

7.3.34 MAC bridge port bridge table data

This managed entity is used to organize and record data that is associated with a bridge port. Some of the data is volatile. Instances of this managed entity shall be automatically created/deleted by the ONT upon the creation/deletion of a MACBridgePortConfigurationData.

Relationships

This managed entity is associated with one instance of a MACBridgePortConfigurationData.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the MACBridgePortConfigurationData with which this MACBridgePortBridgeTableData is associated. (R) (mandatory) (2 bytes).

BridgeTable: This attribute lists the destination MAC Addresses, whether they are learned or statically assigned, whether packets having them as destination addresses are filtered or forwarded, and their ages. One entry provides Information (2 bytes) and MAC address (6 bytes). Moreover, the Information bits are assigned as described in Table 15g. Upon autonomous instantiation, this attribute is a null list. An OMCI message can carry a maximum of 3 entries at the same time because this attribute list is larger than an OMCI message size. (R) (mandatory) (M × 8 bytes, M is the number of entries in the list.).

Table 15g/G.983.2 – Coding of information in the BridgeTable attribute

Bit	Name	Setting
16-5	Age	Age in seconds (1 s to 4095 s)
4	Reserved	(0)
3	Dynamic/static	0: this entry is statically assigned. 1: this entry is dynamically learned.
2	Reserved	(0)
1	Filter/forward	0: forward 1: filter

Actions

Get: Get one or more attributes. Latch a snapshot (i.e. copy) of the current BridgeTable and respond with the size of the data (4 bytes) that should be obtained using the "Get next" command.

Get next: Get the latched attribute values of the managed entity within the current snapshot.

Notifications

None.

7.3.35 MAC bridge PM history data

This managed entity contains the past performance monitoring data collected at a MAC bridging function supporting Ethernet interfaces on the ONT. Instances of this managed entity are created/deleted by the OLT after/before an instance of the MACBridgeServiceProfile managed entity is created/deleted.

Relationships

This managed entity is associated with one instance of a MACBridgeServiceProfile.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the MACBridgeServiceProfile with which this MACBridgePMHistoryData is associated. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

BridgeLearningEntryDiscardCount: This attribute records the number of forwarding database entries that have been or would have been learned but were discarded or replaced due to lack of space in the database table. (R) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.36 MAC bridge port PM history data

This is a managed entity that contains the past performance monitoring data collected at the port bridging function for Ethernet interfaces on the ONT. Instances of this managed entity are created/deleted by the OLT after an instance of the MACBridgePortConfigurationData managed entity is created/deleted.

Relationships

This managed entity is associated with one instance of a MACBridgePortConfigurationData.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the id of the MACBridgePortConfigurationData with which this MACBridgePortPMHistoryData is associated. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the attribute counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. The attribute counters are updated at the end of the interval. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

ForwardedFrameCounter: This attribute provides a count of successfully transmitted frames on this port. (R) (mandatory) (4 bytes).

DelayExceededDiscardCounter: This attribute provides a count of frames discarded on this port because transmission is delayed. (R) (mandatory) (4 bytes).

MTUExceededDiscardCounter: This attribute provides a count of frames discarded on this port because MTU is exceeded. (R) (mandatory) (4 bytes).

ReceivedFrameCounter: This attribute provides a count of frames received on this port. (R) (mandatory) (4 bytes).

ReceivedAndDiscardedCounter: This attribute provides a count of frames received on this port that have been discarded due to errors. (R) (mandatory) (4 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

None.

7.3.37 VP PM history data

This managed entity is used to collect and report performance monitoring data associated with a VPC for the last completed 15-minute interval. The instances of this managed entity are created and deleted on request of the OLT.

Relationships

Zero or more instances of this managed entity may exist for each instance of the VP Network CTP$_{B\text{-}PON}$ managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the Managed Entity id of the corresponding VP Network $CTP_{B\text{-}PON}$. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recently finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the actual counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute is set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. (R) (mandatory) (1 byte).

Threshold $data_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold $Data_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

Lost C=0+1 cells: This attribute measures background cell loss. It cannot distinguish between cells lost because of header bit errors, ATM-level header errors, cell policing, or buffer overflows. It records only loss of information independent of the priority of the cell. If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (2 bytes).

Lost C=0 cells: This attribute measures background cell loss. It cannot distinguish between cells lost because of header bit errors, ATM-level header errors, cell policing, or buffer overflows. It records only loss of high priority cells. If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (2 bytes).

Misinserted cells: This attribute is used to measure occurrences of when a cell is misrouted to an active VP that is being monitored. If the actual counter saturates, it remains on its maximum value. (R) (mandatory) (2 bytes).

Transmitted C=0+1 cells: This attribute provides a count of all cells that are originated at a monitored connection by the transmitting end point (i.e. backward reporting is assumed). (R) (mandatory) (5 bytes).

Transmitted C=0 cells: This attribute provides a count of all high priority cells that are originated at a monitored connection by the transmitting end point (i.e. backward reporting is assumed). (R) (mandatory) (5 bytes).

Impaired block: This severely errored cell block counter will be incremented whenever one of the following events takes place: the number of misinserted cells exceeds $M_{misinserted}$, the number of bipolar violations exceeds $M_{errored}$, or the number of lost cells exceeds M_{lost}. The values for $M_{misinserted}$, $M_{errored}$, and M_{lost} are set based on vendor-operator negotiation. (R) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the counters are reset to 0x00. Both ONT and OLT should know the event list used by this entity, given in Table 15h.

Table 15h/G.983.2 – Alarm list for VP PM history data

Number	Event	Description
	Threshold Crossing Alert	
0	Lost CLP=0+ 1 Cells	Exceeds threshold
1	Lost CLP=0 Cells	Exceeds threshold
2	Misinserted Cells	Exceeds threshold
3	Impaired Blocks	Exceeds threshold
4-255	Reserved	

7.4 VP MUX management

7.4.1 VP network $CTP_{B\text{-}PON}$

This managed entity is used to represent the termination of VP links on an ONT. An instance of the ATM VP Cross-Connection (i.e. VP MUX in ONT) managed entity may be used to relate two instances of the VP Network $CTP_{B\text{-}PON}$ managed entity for point-to-point cross-connection (multipoint cross-connection is for further study).

Instances of the VP Network $CTP_{B\text{-}PON}$ managed entity will be created on demand of the OLT:

- as a consequence of action "create" on the VP Network $CTP_{B\text{-}PON}$ managed entity, or
- as a consequence of action "create complete connection" on the ATM VP Cross-Connection managed entity.

Instances of the VP Network $CTP_{B\text{-}PON}$ managed entity will be deleted on demand of the OLT:

- as a consequence of action "delete" on the VP Network $CTP_{B\text{-}PON}$ managed entity, or
- as a consequence of action "delete complete connection" on the ATM VP Cross-Connection managed entity.

Notice that a VP Network $CTP_{B\text{-}PON}$ can be deleted only when no ATM VP Cross-Connection or Interworking VCC Termination Point is associated with it. It is the responsibility of the OLT to make sure that the VP Network $CTP_{B\text{-}PON}$ meets this condition at the time when the OLT requests to delete it.

Note that this managed entity aggregates connectivity functionality from the network view and alarms from the network element view as well as artefacts from trails.

Relationships

Zero or more instances of the VP Network $CTP_{B\text{-}PON}$ managed entity shall exist for each instance of the TC $Adapter_{B\text{-}PON}$, PON TC Adapter or Interworking VCC Termination Point managed entity.

Relationship to Priority $Queue_{B\text{-}PON}$ /Traffic Descriptor Profile Pointer: see attribute definition.

Relationship to UPC Disagreement Monitoring History Data$_{B\text{-}PON}$: one or zero implied in the managed entity id of UPC Disagreement Monitoring History Data$_{B\text{-}PON}$.

This managed entity is related to the ATM VP Cross-Connection managed entity through the Termination Point ANI/UNI side attributes of the ATM VP Cross-Connection managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

VPI value: This attribute identifies the VPI value associated with the VP link being terminated. (R, Set-by-create) (mandatory) (2 bytes).

UNI/ANI pointer: This attribute associates the VP Network CTP$_{B\text{-}PON}$ with the ANI (i.e. PON interface) or a UNI. It points to the connected ANI/UNI instance id.

NOTE – For the case using the multiplexing function of AAL 2 (i.e. multiple instances of UNI are associated with a VP Network CTP$_{B\text{-}PON}$ instance), this attribute is assigned a special value:

– 0x00XX will be used for pseudo slotIDs,

– 0xXX00 will be used for pseudo portIDs.

Therefore, 0x0000 will be used only for integrated interfaces (integrated type of ONT) that support multiple AAL 2 functions. (R, Set-by-create) (mandatory) (2 bytes).

Direction: This attribute specifies whether the VP link is used for UNI-to-ANI (value 0x01), ANI-to-UNI (value 0x02), or bi-directional (value 0x03) connection. (R, W, Set-by-create) (mandatory) (1 byte).

Priority queue pointer for downstream: This attribute points to the instance of the Priority Queue$_{B\text{-}PON}$ used for this VP Network CTP$_{B\text{-}PON}$ in the downstream direction. Note that the value of this pointer is null when the VP Network CTP$_{B\text{-}PON}$ is at the ANI side. (R, Set-by-create) (mandatory) (2 bytes).

Priority queue pointer for upstream: This attribute points to the instance of the Priority Queue$_{B\text{-}PON}$ used for this VP Network CTP$_{B\text{-}PON}$ in the upstream direction. It is used when the UNI/ANI pointer indicates an ANI instance id and the **Traffic Management Option** attribute in ONT$_{B\text{-}PON}$ is 0x00; this pointer is null otherwise. (R, Set-by-create) (mandatory) (2 bytes).

Traffic descriptor profile pointer: This attribute serves as a pointer to the instance of the Traffic Descriptor Profile managed entity that contains the traffic parameters used for this VP Network CTP$_{B\text{-}PON}$. This attribute is used when the **Traffic Management Option** attribute in ONT$_{B\text{-}PON}$ is 0x01. It applies to the UNI side VP Network CTP$_{B\text{-}PON}$ if UPC is used. In this case, this pointer points to a Traffic Descriptor managed entity.

When traffic shaping is used, it applies to the ANI side VP Network CTP$_{B\text{-}PON}$. In this case, this pointer points to a Traffic Descriptor Profile managed entity and the **Priority Queue Pointer for the upstream** attribute is null. (R, Set-by-create) (optional) (2 bytes). See also Appendix IV.

UNI counter: This attribute represents the number of instances of UNI$_{B\text{-}PON}$ managed entities associated with an instance of the VP Network CTP$_{B\text{-}PON}$ managed entity. If only one instance of a UNI$_{B\text{-}PON}$ managed entity is associated with an instance of the VP Network CTP$_{B\text{-}PON}$ managed entity, this attribute is set to 0x01. If multiple instances of UNI$_{B\text{-}PON}$ managed entities are associated with an instance of the VP Network CTP$_{B\text{-}PON}$ managed entity (i.e. in case of AAL 2 multiplexing), this attribute is set to 0xZZ, where ZZ represents the number of associated UNI$_{B\text{-}PON}$ instances. (R) (optional) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Set: Set one or more attributes of this managed entity.

Notifications

Alarm: This notification is used to notify the management system for the ATM Layer Management Indication (LMI) when an alarm has been detected or cleared. The OLT should know the alarm list used by this entity. The alarm list for this entity is given in Table 16. See also Appendix III.

Table 16/G.983.2 – Alarm list for VP network $CTP_{B\text{-}PON}$

Number	Alarm	Description
0	VP-AIS-LMIR	VP-AIS receiving indication (optional)
1	VP-RDI-LMIR	VP-RDI receiving indication (optional)
2	VP-AIS-LMIG	VP-AIS generation indication (optional)
3	VP-RDI-LMIG	VP-RDI generation indication (optional)
4	Segment Loss of Continuity	Loss of continuity is detected when the VP Network $CTP_{B\text{-}PON}$ is a segment end point (optional)
5	End-to-End Loss of Continuity	Loss of continuity is detected when the VP Network $CTP_{B\text{-}PON}$ supports an Interworking VCC Termination Point (optional)
6-255	Reserved	

7.4.2 ATM VP cross-connection

For point-to-point ATM VP Cross-Connections, this managed entity is used to represent the Cross-Connect relationship between two VP Network $CTPs_{B\text{-}PON}$. For multipoint ATM VP Cross-Connections, which are optional, the use of this managed entity is for further study.

Instances of this managed entity shall be created and deleted by the OLT based on ATM connection set up.

Relationships

Zero or more instances of the ATM VP Cross-Connection managed entity shall exist for each instance of the $ONT_{B\text{-}PON}$ managed entity.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. This 2-byte number is directly associated with the instance identifier of the VP Network $CTP_{B\text{-}PON}$ at the ANI side of this ATM VP cross-connect. (R, Set-by-create) (mandatory) (2 bytes).

Termination point ANI side: This attribute identifies the instance of the VP Network $CTP_{B\text{-}PON}$ managed entity that represents the cross-connected VP Network $CTP_{B\text{-}PON}$s on the ANI side. (R, Set-by-create) (mandatory) (2 bytes).

Termination point UNI side: This attribute identifies the instance of the VP Network $CTP_{B\text{-}PON}$ managed entity that represents the cross-connected VP Network $CTP_{B\text{-}PON}$s on the UNI side. (R, Set-by-create) (mandatory) (2 bytes).

Operational state: This attribute indicates whether or not this managed entity is capable of performing its task. The operational state reflects the perceived ability to receive or to generate a valid signal. Valid values are enabled (0x00) and disabled (0x01). (R) (optional) (1 byte).

Administrative state: This attribute is used to "unlock" (value 0x00) and "lock" (value 0x01) the functions performed by instances of this managed entity. (R, W, Set-by-create) (mandatory) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Create complete connection: Create two instances of the VP Network $CTP_{B\text{-}PON}$ managed entity (ANI-side and UNI-side) and one instance of the ATM VP Cross-Connection managed entity.

Delete complete connection: Delete two instances of the VP Network $CTP_{B\text{-}PON}$ managed entity (ANI-side and UNI-side) and one instance of the ATM VP Cross-Connection managed entity.

Get: Get attributes of this managed entity.

Get complete connection: Get all attributes of a connection; this holds the attributes of two instances of the VP Network $CTP_{B\text{-}PON}$ managed entity (ANI-side and UNI-side) and the attributes of the corresponding ATM VP Cross-Connection managed entity.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes of attributes of this managed entity. The notification shall identify its new value. The list of AVCs for this managed entity is given in Table 16a.

Table 16a/G.983.2 –AVC list for ATM VP cross-connection

Number	AVC	Description
1	N/A	
2	N/A	
3	OpState	Operational state
4	N/A	
5-16	Reserved	

7.5 Traffic management

7.5.1 Priority queue$_{B\text{-}PON}$

This managed entity specifies the priority queue in the ONT that is used for the VP Network $CTP_{B\text{-}PON}$.

All the Priority Queues used for the upstream traffic are created by the ONT after initialization. All the Priority Queues used for the downstream traffic are created/deleted by the ONT after the

creation/deletion of the Subscriber Line Card.

The following assumption is made in order to simplify the queue management: the maximum number of priority queues supported by an ONT, Subscriber Line Card or PON IF Line Card is 32. If *N* priority queues reside in the ONT, the Subscriber Line Card or PON IF Line Card, *N* Priority $Queue_{B\text{-}PON}$ managed entities will be automatically created by the ONT following the creation of the related equipment. Note that the OLT will find all the queues by reading the Priority $Queue_{B\text{-}PON}$ managed entity instances. If the OLT tries to retrieve a non-existing Priority $Queue_{B\text{-}PON}$, this will be indicated in the response from the ONT to the OLT.

See also Appendix IV.

Relationships

One or more instances of this managed entity shall be contained in the $ONT_{B\text{-}PON}$ managed entity to model the upstream direction if the **Traffic Management Option** attribute in ONT is 0x00. One or more instances of this managed entity shall be associated with the Subscriber Line Card managed entity as downstream Priority $Queue_{B\text{-}PON}$.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The first byte is the slot id of the Subscriber Line Card or PON IF card with which this queue is associated. The second byte is the priority of this queue (0x00 indicates the highest priority, and 0x1F (31) the lowest). (R) (mandatory) (2 bytes).

Queue configuration option: This attribute identifies the buffer-partitioning policy. The value of 0x01 means that all the queues share one buffer size of Maximum Queue Size and the value 0x00 means that each queue uses its individual buffer size of Maximum Queue Size. (R) (mandatory) (1 byte).

Maximum queue size: This attribute specifies the maximum size of the queue. (R) (mandatory) (2 bytes).

Allocated queue size: This attribute identifies the allocated size of this queue. (R, W) (mandatory) (2 bytes).

Discard-cell-counter reset interval: This attribute represents the interval in milliseconds at which the counter resets itself. (R, W) (optional) (2 bytes).

Threshold value for discarded cells due to buffer overflow: The threshold for the number of cells discarded on this queue due to buffer overflow. (R, W) (optional) (2 bytes).

Actions

Get: Get one or more attributes.

Set: Set one or more attributes.

Notifications

Attribute value change: This notification is used to report autonomous changes to the attributes of this managed entity. The notification shall identify the attribute that changed and its new value.

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) has been detected or cleared. Both ONT and OLT should know the event coding used by this entity. The event list for this entity is given in Table 17.

Table 17/G.983.2 – Alarm list for Priority Queue$_{B\text{-}PON}$

Number	Alarm	Description
	Threshold Crossing Alert	
0	Cell loss	Exceeds threshold
1-255	Reserved	

7.5.2 Traffic descriptors

ATM transfer capabilities (ATCs) are defined in ITU-T Rec. I.371 [7]. These are Deterministic Bit Rate (DBR), Statistical Bit Rate (SBR), ATM Block Transfer with Delayed Transmission (ABT/DT), ATM Block Transfer with Immediate Transmission (ABT/IT), Available Bit Rate (ABR), and Guaranteed Frame Rate (GFR).

[App.V-9] has defined analogous Service Categories. These are Constant Bit Rate (CBR), Real-time Variable Bit Rate (rt-VBR), Non-Real-Time VBR (nrt-VBR), Unspecified Bit Rate (UBR), Available Bit Rate (ABR), and Guaranteed Frame Rate (GFR).

Both the ITU-T SBR ATC and the ATM Forum VBR service categories may be further subdivided into 3 categories. These are taken to be separate ATCs or Service Categories and are designated by adding the numeral 1, 2, or 3 to the VBR or SBR acronym. For VBR1 and SBR1, the cell loss ratio (CLR) performance objective is applied to the aggregate traffic in the connection. For VBR2 and SBR2, the CLR objectives are applied only to cells with the cell loss priority (CLP) bit set to 0x00, and there is no tagging of cells. For VBR3 and SBR3, the CLR objective is applied only to cells with the cell loss priority (CLP) bit set to 0x00, and there is tagging of cells.

The plausible approximate correspondence among ITU-T ATC and the service categories in [App.V-9] is shown in Table 18.

Table 18/G.983.2 – Traffic descriptors

ITU	[App.V-9]	Traffic descriptor in G.983.2
DBR [1]	CBR	CBR/DBR Traffic Descriptor
DBR [U]	UBR	UBR Traffic Descriptor
SBR1 [2]	VBR1	SBR1/VBR1 Traffic Descriptor
SBR2 [1]/[3]	VBR2	SBR2/VBR2 Traffic Descriptor
SBR3 [3]	VBR3	SBR3/VBR3 Traffic Descriptor
ABR	ABR	ABR Traffic Descriptor
GFR	GFR	GFR Traffic Descriptor
ABT/DT ABT/IT		ABT/DT/IT Traffic Descriptor

The attribute value units used in the Traffic Descriptors in the following clauses are identical to the ones defined in ITU-T Rec. I.751 [9]. See also References [12] and [13] for a full discussion of traffic attributes.

7.5.2.1 DBR/CBR traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream DBR/CBR virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x00 is used for DBR/CBR. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-Create) (mandatory) (2 bytes).

CLR: Maximum permissible Cell Loss Ratio for the CLP = 0 + 1 traffic flow. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.2.2 UBR traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream UBR virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x01 is used for UBR/DBR[U]. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one of more attributes of this managed entity.

Notifications

None.

7.5.2.3 SBR1/VBR1 traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream SBR1/VBR1 virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x02 is used for SBR1, value 0x03 is used for Real-time VBR1, and value 0x04 is used for Non Real-time VBR1. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Sustainable cell rate: Sustainable Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Maximum burst size: Maximum Burst Size for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the SCR: Cell Delay Variation Tolerance in relation to the SCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

CLR: Maximum permissible Cell Loss Ratio for the CLP = 0 + 1 traffic flow. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.2.4 SBR2/VBR2 traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream SBR2/VBR2 virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x05 is used for SBR2, value 0x06 is used for real-time VBR2, and value 0x07 is used for non-real-time VBR2. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Sustainable cell rate: Sustainable Cell Rate for the CLP = 0 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Maximum burst size: Maximum Burst Size for the CLP = 0 traffic flow. Unit is an integer number of cells. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the SCR: Cell Delay Variation Tolerance in relation to the SCR for the CLP = 0 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

CLR: Maximum permissible Cell Loss Ratio for the CLP = 0 traffic flow. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.2.5 SBR3/VBR3 traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream SBR3/VBR3 virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x08 is used for SBR3, value 0x09 is used for real-time VBR3, and value 0x0A is used –or non-real-time VBR3. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Sustainable cell rate: Sustainable Cell Rate for the CLP = 0 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Maximum burst size: Maximum Burst Size for the CLP = 0 traffic flow. Unit is an integer number of cells. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the SCR: Cell Delay Variation Tolerance in relation to the SCR for the CLP = 0 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

CLR: Maximum permissible Cell Loss Ratio for the CLP = 0 traffic flow. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.2.6 ABR traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream ABR virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ managed entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x0B is used for ABR. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Minimum cell rate: Minimum Cell Rate for the CLP = 0 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Initial cell rate: Rate at which a source should send initially and after an idle period. The unit is an integer number of cells/second. The value must not exceed PCR and is usually lower. (R, Set-by-create) (optional) (2 bytes).

Transient buffer exposure: These parameters are required for ABR traffic. (R, Set-by-create) (optional) (2 bytes).

Rate decrease factor: Controls the rate decrease that occurs when backward RM cells with CI = 1 are received. Allowed values are $1/2^k$, with k between 0 and 15. The coding of the attribute is according to the value of k. (R, Set-by-create) (optional) (1 byte).

Rate increase factor: Controls the rate increase that occurs when a backward RM cell is received with CI = 0 and NI = 0. Allowed values are $1/2^k$, with k between 0 and 15. The coding of the attribute is according to the value of k. (R, Set-by-create) (optional) (1 byte).

Fixed round trip time: The sum of the fixed and propagation delays (in ms) from the source to the destination and back. (R, Set-by-create) (optional) (2 bytes).

Number RM: The maximum number of data cells a source may send for each forward RM cell. Allowed values are 2^k, where k is used as the code and is between 1 and 8. (R, Set-by-create) (optional) (1 byte).

Time RM: Upper bound on the time (in ms) between forward RM cells for an active source. Allowed values are computed as $100/2^k$, where k is used as the code and is between 0 and 7. The default is k = 0. (R, Set-by-create) (optional) (1 byte).

Cut-off decrease factor: Controls the rate decreases associated with lost or delayed backward RM cells. Allowed values are: $1/2^6$ (value 0x07), $1/2^5$ (value 0x06), $1/2^4$ (value 0x05), $1/2^3$ (value 0x04), $1/2^2$ (value 0x03), 1/2 (value 0x02), 0x01 (value 0x01) and 0x00 (value 0). (R, Set-by-create) (optional) (1 byte).

ACR decrease time factor: Time permitted between sending RM cells before the rate decreases to ICR. The range is from 10 ms to 10.23 s in increments of milliseconds. (R, Set-by-create) (optional) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.2.7 ABT/DT/IT traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream ABT/DT/IT virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ managed entities through its pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x0C is used for ABT/DT; value 0x0D is used for ABT/IT. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Sustainable cell rate: Sustainable Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (optional) (2 bytes).

Maximum burst size: Maximum Burst Size for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells. (R, Set-by-create) (optional) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the SCR: Cell Delay Variation Tolerance in relation to the SCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (optional) (2 bytes).

Number RM: The maximum number of data cells a source may send for each forward RM cell. Allowed values are 2^k, where k is used as the code and is between 0x01 and 0x08. (R, Set-by-create) (optional) (1 byte).

Time RM: Upper bound on the time between forward RM cells for an active source. Allowed values are computed as $100/2^k$, where k is used as the code and is between 0x00 and 0x07. The default is k = 0. (R, Set-by-create) (optional) (1 byte).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.2.8 GFR traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream GFR virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ managed entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x0E is used for GFR. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Sustainable cell rate: Sustainable Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (optional) (2 bytes).

Maximum burst size: Maximum Burst Size for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells. (R, Set-by-create) (optional) (2 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Cell delay variation tolerance in relation to the SCR: Cell Delay Variation Tolerance in relation to the SCR for the CLP = 0 traffic flow. Unit is in microseconds. (R, Set-by-create) (optional) (2 bytes).

Maximum frame size: Maximum Frame size for GFR traffic. Unit is an integer number of cells. (R, Set-by-create) (optional).

Minimum cell rate: Minimum Cell Rate for the CLP = 0 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.2.9 UBR+ traffic descriptor

This managed entity specifies traffic and QoS parameters for upstream UBR+ virtual path connections.

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

Relationships

Zero or more instances of this managed entity may be contained in an instance of an $ONT_{B\text{-}PON}$ managed entity.

Each instance of this entity may be related to zero or more instances of VP Network $CTP_{B\text{-}PON}$ managed entities through their pointer attribute: Traffic Descriptor Profile Pointer.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. (R, Set-by-create) (mandatory) (2 bytes).

Service category/ATC: Value 0x01 is used for UBR/DBR[U]. (R, Set-by-create) (mandatory) (1 byte).

Peak cell rate: Peak Cell Rate for the CLP = 0 + 1 traffic flow. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (4 bytes).

Minimum cell rate: Minimum guaranteed cell rate. Unit is an integer number of cells/second. (R, Set-by-create) (mandatory) (4 bytes).

Cell delay variation tolerance in relation to the PCR: Cell Delay Variation Tolerance in relation to the PCR for the CLP = 0 + 1 traffic flow. Unit is in microseconds. (R, Set-by-create) (mandatory) (2 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Notifications

None.

7.5.3 This clause intentionally left blank.

7.5.4 UPC disagreement monitoring history data$_{B\text{-}PON}$

An instance of this managed entity is used to collect and report the last completed 15-minute interval data associated with UPC Disagreement Monitoring functions performed by the ONT on individual VP Network $CTP_{B\text{-}PON}$ managed entities in $ONT_{B\text{-}PON}$. The instances of this managed entity are created and deleted by the OLT.

Relationships

One instance of this managed entity may exist for each instance of a VP Network $CTP_{B\text{-}PON}$ managed entity instantiated at the UNI side.

Attributes

Managed entity id: This attribute provides a unique number for each instance of this managed entity. The assigned number is the same as the Managed Entity id of the corresponding VP Network $CTP_{B\text{-}PON}$. (R, Set-by-create) (mandatory) (2 bytes).

Interval end time: This attribute identifies the most recent finished 15-minute interval. It is a cyclic counter (modulo 0xFF (256)) that is incremented each time a new interval is finished and the actual counters are updated. The value of this attribute is 0x00 during the first 15-minute interval that starts with the reception of the "synchronize time" action. The value is 0x01 during the first period after this, and so on. If this managed entity is created after the reception of the "synchronize time" action, the value of this attribute set equal to the number of the last completed interval. The actual counters of this managed entity start counting directly. (R) (mandatory) (1 byte).

Threshold data$_{B\text{-}PON}$ id: This attribute provides a pointer to an instance of the Threshold Data$_{B\text{-}PON}$ managed entity that contains the threshold values for the performance monitoring data collected by this managed entity. (R, W, Set-by-create) (mandatory) (2 bytes).

Discarded cells due to UPC: This attribute provides a raw, thresholded count of the number of discarded cells due to combined CLP = 0 and CLP = 1 UPC policing. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (2 bytes).

Discarded CLP = 0 cells due to UPC: This attribute provides a raw, thresholded count of the number of discarded CLP = 0 cells due to CLP = 0 only UPC policing. This counter is only present if CLP = 0 traffic is separately policed. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (2 bytes).

Tagged CLP = 0 cells: This attribute provides a raw, unthresholded count of the number of cells that have been tagged. If the actual counter saturates, it remains on its maximum value. Default value is 0x00. (R) (mandatory) (2 bytes).

Successfully passed cells: This attribute provides a raw, unthresholded count of the number of cells that have been passed by the combined CLP = 0 + 1 UPC policing. (R) (mandatory) (5 bytes).

Successfully passed CLP = 0 cells: This attribute provides a raw, unthresholded count of the number of high priority cells that have been passed by the CLP = 0 UPC policing. (R) (mandatory) (5 bytes).

Actions

Create: Create an instance of this managed entity.

Delete: Delete an instance of this managed entity.

Get: Get one or more attributes of this managed entity.

Set: Set one or more attributes of this managed entity.

Notifications

Threshold crossing alert: This notification is used to notify the management system when a threshold crossing alert (TCA) is detected or cleared. The TCA change notification "on" will be sent at the crossing of the threshold; the TCA change notification "off" will be sent at the end of the 15-minute period since that is when the counters are reset to 0x00. Both ONT and OLT should know the alarm list used by this entity, given in Table 19.

Table 19/G.983.2 – Alarm list for UPC disagreement monitoring history data$_{B\text{-}PON}$

Number	Alarm	Description
	Threshold Crossing Alert	
0	Discarded Cells due to UPC	Exceeds threshold
1	Discarded CLP = 0 Cells due to UPC	Exceeds threshold
2-255	Reserved	

8 ONT Management and Control Channel (OMCC)

An ATM connection shall be provisioned for the OMCC. ITU-T Rec. G.983.1 [3] specifies a PLOAM message that activates a VPI/VCI pair between the OLT and ONT processors. The VPI/VCI value for the management channel of each is programmed by the OLT using this message. The OMCCs of different ONTs should be assigned different VPIs. A grant flow must be allocated by the MAC layer of the OLT for upstream OMCC traffic of each ONT.

The following performance requirements related to the OMCC should be studied further with input from operators:

a) The cells carrying ONT management messages should be sent with cell loss priority CLP = 0.

b) The upstream traffic on each OMCC should not exceed x bandwidth, where x is based on the operator's requirement.

c) An upstream OMCC cell should always be put in the high priority queue or be modelled with the CBR service category; the constraints on the downstream OMCC cells are out of the scope of the Recommendation as this is completely under control of the OLT.

d) Message Response Time: The system should support response times that do not exceed 1 s for the high priority protocol handling messages and 3 s for the low priority protocol handling messages.

9 ONT management and control protocol

9.1 ONT management and control protocol cell format

9.1.1 Introduction

Each ONT Management and Control Protocol packet is encapsulated directly in a single 53-byte ATM cell. The cell format is shown in Figure 12. The following clauses discuss the details.

ATM Header (5 bytes)	Transaction Correlation Identifier (2 bytes)	Message Type (1 byte)	Device Identifier (1 byte)	Message Identifier (3 bytes)	Message Contents (33 bytes)	AAL 5 Trailer (8 bytes)

Figure 12/G.983.2 – ONT management and control protocol cell format

9.1.2 ATM header

The header contains the VPI/VCI value of the OMCC for the addressed ONT (see clause 8).

9.1.3 Transaction correlation identifier

The Transaction Correlation Identifier is used to associate a request message with its response message. For request messages, the OLT selects any transaction identifier. A response message carries the transaction identifier of the message to which it is responding. The transaction identifier

of event messages is 0x0000.

As explained in 9.2 Message Flow Control and Error Recovery, the most significant bit of the Transaction Correlation Identifier is used to indicate the priority of the message. The following coding will be used: 0 = low priority, 1 = high priority. The OLT decides whether a command should be executed with low or high priority.

The mechanism that the OLT uses to assign the rest of the bits of the Transaction Correlation Identifier in an acknowledged command is not standardized and is left to the implementers.

However, since the Transaction Correlation Identifier is used to match a command from the OLT to the ONT with a response from the ONT to the OLT, some care is required in the choice of the Transaction Correlation Identifier. The OLT must assign the Transaction Correlation Identifier in such a way that, whenever it sends a command with a Transaction Correlation Identifier that has been used before in another command to the same ONT, it is guaranteed with sufficiently high probability that no response for the first command will be received.

9.1.4 Message type

The Message Type field is subdivided into four parts. These are given in Figure 13.

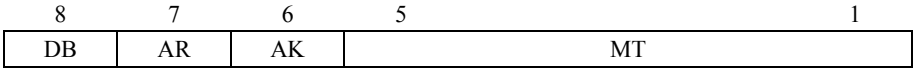


Figure 13/G.983.2 – Message type field subdivision

The most significant bit, bit 8, is reserved for the destination bit (DB). In the OMCI this bit is always 0.

Bit 7, Acknowledge Request (AR), is used to indicate whether or not the message requires an acknowledgement. If an acknowledgement is expected, this bit is set to "1". If no acknowledgement is expected, the coding of this bit is "0". Note that "acknowledge" means a response to an action request, not an acknowledgement at the link layer.

Bit 6, Acknowledgement (AK), is used to indicate whether or not this message is an acknowledgement to an action request. If a message is an acknowledgement, this bit is set to "1". If the message is not a response, this bit is set to "0".

Bit 5 to bit 1, Message Type (MT), are used to indicate the message type. Codes 0 to 3 are reserved for future use. Codes 4 to 31 are used by this specification. Table 20 lists the message types that are defined.

Table 20/G.983.2 – OMCI message types

MT	Type	Purpose	AK	Inc MIB data sync.
4	Create	Create a managed entity instance with its attributes	yes	yes
5	Create complete connection	Create an ATM VP Cross-Connection and two associated VP Network $CTP_{B\text{-}PON}$s	yes	yes
6	Delete	Delete a managed entity instance	yes	yes
7	Delete complete connection	Delete an ATM VP Cross-Connection and two associated VP Network $CTP_{B\text{-}PON}$s	yes	yes
8	Set	Set one or more attributes of a managed entity	yes	yes
9	Get	Get one or more attributes of a managed entity	yes	no
10	Get complete connection	Get all attributes of an ATM VP Cross-Connection and the attributes of the associated VP Network $CTP_{B\text{-}PON}$s	yes	no
11	Get all alarms	Latch the alarm statuses of all managed entities and reset the alarm message counter	yes	no
12	Get all alarms next	Get the alarm status of the next managed entity	yes	no
13	MIB upload	Latch the MIB	yes	no
14	MIB upload next	Get latched attributes of a managed entity instance	yes	no
15	MIB reset	Clear the MIB and reinitialize it to its default and reset the MIB data sync counter to 0	yes	no
16	Alarm	Notification of an alarm	no	no
17	Attribute value change	Notification of an autonomous attribute value change	no	no
18	Test	Request a test on a specific managed entity	yes	no
19	Start software download	Start a software download action	yes	yes
20	Download section	Download a section of a software image	yes/no	no
21	End software download	End of a software download action	yes	yes
22	Activate software	Activate the downloaded software image	yes	yes
23	Commit software	Commit the downloaded software image	yes	yes
24	Synchronize Time	Synchronize the time between OLT and ONT	yes	no
25	Reboot	Reboot ONT, Subscriber Line Card or PON IF Line Card	yes	no
26	Get next	Get the latched attribute values of the managed entity within the current snapshot	yes	no
27	Test result	Notification of test result that is initiated by "Test"	no	no
NOTE – The "Download section" action is only acknowledged for the last section within a window. See I.2.15.				

9.1.5 Device identifier

For systems based on ITU-T Rec. G.983.1 [3], this field is defined as 0x0A.

9.1.6 Message identifier

The message identifier consists of three bytes. The first, most significant, byte of the message identifier field is used to indicate which managed entity is the target of the action specified in the message type. The maximum number of possible managed entities is thus 256. The least significant two bytes of this message identifier field are used to identify the managed entity instance. The maximum number of instances per managed entity is thus 65 536.

Table 21 gives the managed entities and their class values in the OMCI. Depending on the managed entity, there will be only one (e.g. $ONT_{B\text{-}PON}$) or several (e.g. VP Network $CTP_{B\text{-}PON}$) instances.

Table 21/G.983.2 – Managed entity identifiers

Managed entity class value	Managed entity
1	$ONT_{B\text{-}PON}$
2	ONT Data
3	PON IF Line Cardholder
4	PON IF Line Card
5	Subscriber Line Cardholder
6	Subscriber Line Card
7	Software Image
8	$UNI_{B\text{-}PON}$
9	TC $Adapter_{B\text{-}PON}$
10	Physical Path Termination Point ATM UNI
11	Physical Path Termination Point Ethernet UNI
12	Physical Path Termination Point CES UNI
13	Logical N × 64 kbit/s Subport Connection Termination Point
14	Interworking VCC Termination Point
15	AAL 1 $Profile_{B\text{-}PON}$
16	AAL 5 $Profile_{B\text{-}PON}$
17	AAL 1 Protocol Monitoring History $Data_{B\text{-}PON}$
18	AAL 5 Protocol Monitoring History $Data_{B\text{-}PON}$
19	AAL 2 $Profile_{B\text{-}PON}$
20	(intentionally left blank)
21	CES Service $Profile_{B\text{-}PON}$
22	(intentionally left blank)
23	CES Physical Interface Monitoring History Data
24	Ethernet Performance Monitoring History Data
25	VP Network $CTP_{B\text{-}PON}$
26	ATM VP Cross-Connection
27	Priority $Queue_{B\text{-}PON}$
28	DBR/CBR Traffic Descriptor
29	UBR Traffic Descriptor
30	SBR1/VBR1 Traffic Descriptor
31	SBR2/VBR2 Traffic Descriptor

Table 21/G.983.2 – Managed entity identifiers

Managed entity class value	Managed entity
32	SBR3/VBR3 Traffic Descriptor
33	ABR Traffic Descriptor
34	GFR Traffic Descriptor
35	ABT/DT/IT Traffic Descriptor
36	UPC Disagreement Monitoring History Data$_{B\text{-}PON}$
37	(intentionally left blank)
38	ANI
39	PON TC Adapter
40	PON Physical Path Termination Point
41	TC Adapter Protocol Monitoring History Data
42	Threshold Data$_{B\text{-}PON}$
43	Operator Specific
44	Vendor Specific
45	MAC Bridge Service Profile
46	MAC Bridge Configuration Data
47	MAC Bridge Port Configuration Data
48	MAC Bridge Designation Data
49	MAC Bridge Port Filter Table Data
50	MAC Bridge Port Bridge Table Data
51	MAC Bridge PM History Data
52	MAC Bridge Port PM History Data
53	Physical Path Termination Point POTS UNI
54	Voice CTP
55	Voice PM History Data
56	AAL 2 PVC Profile$_{B\text{-}PON}$
57	AAL 2 CPS Protocol Monitoring History Data$_{B\text{-}PON}$
58	Voice Service Profile AAL
59	LES Service Profile
60	AAL 2 SSCS Parameter Profile 1
61	AAL 2 SSCS Parameter Profile 2
62	VP PM History Data
63-64	(Reserved for OMCI support of Dynamic Bandwidth Assignment)
65	UBR+ Traffic Descriptor
66	AAL 2 SSCS Protocol Monitoring History Data$_{B\text{-}PON}$
67... 255	Reserved

9.1.7 Message contents

The layout of the message contents field is message specific. The detailed layout of all messages is given in Appendix II.

9.1.8 AAL 5-trailer

The eight bytes of this field are used as follows:

a) The CPCS-User-to-User-Indication (CPCS-UU) field is set to 0x00 at the transmitter and ignored at the receiver.

b) The CPCS Common Part Indication (CPCS-CPI) field is set to 0x00 at the transmitter and ignored at the receiver.

c) The length of the CPCS-SDU field is set to 0x0028.

d) The 32-bit CRC is as specified in ITU-T Rec. I.363.5 [6].

9.2 Message flow control and error recovery

The flow control/error recovery procedures for message exchange over the OMCC are based upon a simplex acknowledged transaction stop-and-wait mechanism that can easily be extended to support concurrent execution of multiple transaction requests of different priority levels. These flow-control procedures ensure that a low level acknowledged transaction request transmitted from the OLT has been properly received and processed to completion by the ONT before the next message of the same priority level is sent by the OLT. The stop-and-wait protocol uses the transaction correlation identifier field, retry counter(s), and applicable transaction request timer(s) to control the message flow rate while relying upon a CRC calculation to verify the data integrity of all received messages.

A Transaction Request Timer T_i with expiration time $Tmax_i$ is started when a transaction request message of priority level "i" is sent to an ONT and is stopped upon receipt of an error-free acknowledgement message containing the same transaction correlation id value. If a valid acknowledgement message is not received by the OLT after timer T_i expires, the OLT re-sends the original transaction request message.

A retransmitted acknowledged transaction request message carries the same correlation ID as the original message. Each time an acknowledged transaction request message is retransmitted by the OLT, the transmitter increments the Retry Counter R_i (the counter associated with priority level "i" acknowledged transaction requests). When a retry counter R_i (initialized to 0x00 upon start-up) reaches the maximum retry value, $Rmax_i$, the transmitter stops re-transmitting the message and declares an OMCC link state error.

Note that these timers (T_i) and retry counters (R_i) are only maintained within the OLT controller and do not exist within the ONT. Furthermore, the default threshold values for timer expiration ($Tmax_i$) and number of retries ($Rmax_i$) are not subject to standardization. It is suggested that the default threshold values of both Tmax and Rmax be independently configurable for each priority level. The default value for $Tmax_1$ (i.e. high priority threshold) should account for the typical message transmission delay plus the command message response time.

These flow control/error recovery procedures are illustrated in Figure 14 for a case where the OMCC link is not permanently broken. First the OLT sends an acknowledged transaction request (Message 1) with priority level 0. Subsequently (i.e. while Message 1 is still outstanding), the OLT issues an additional acknowledged transaction request (Message 2) with priority level 1. Both of these commands are received and executed with the associated response (acknowledgement messages) returned to the OLT by the ONT. The acknowledgement for Message 1 is received by the OLT in time, however the response to Message 2 is lost and never received. The OLT detects that something went wrong because timer T_1 expires, and the OLT therefore retransmits the original command (Message 2). Note that the ONT detects that this retransmitted command is identical to the last received command (for priority level 1) and therefore does not re-execute it. The ONT simply retransmits the original response from the previous execution of Message 2, which reaches the OLT in time. Finally, the OLT sends an acknowledged transaction request (Message 3) with priority level 0, but the message itself gets lost and is never properly received by the ONT. After the associated timer (T_0) expires, the OLT retransmits the command and now all goes well.

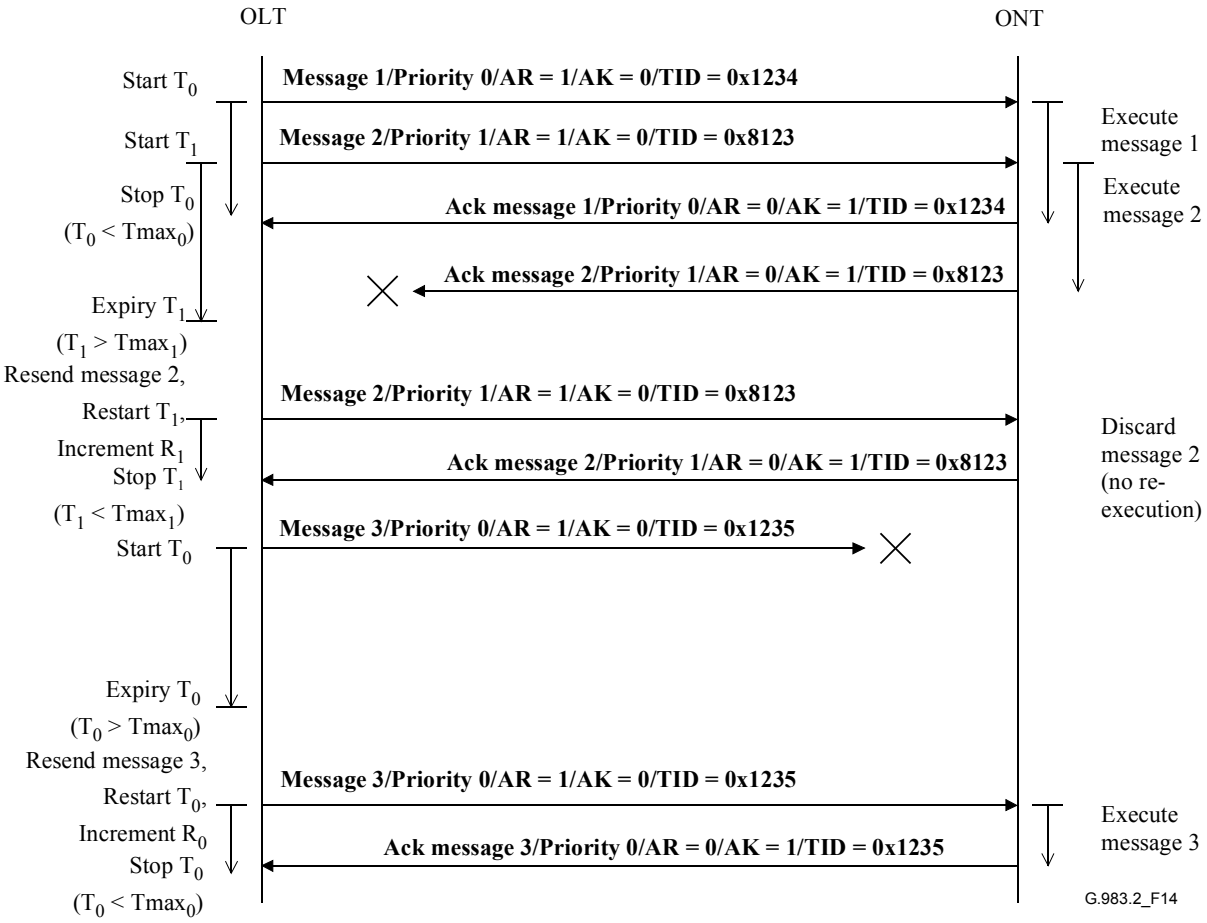


Figure 14/G.983.2 – Concurrent message exchange with error recovery

A case where the OMCC link is effectively broken (down) is shown in Figure 15.

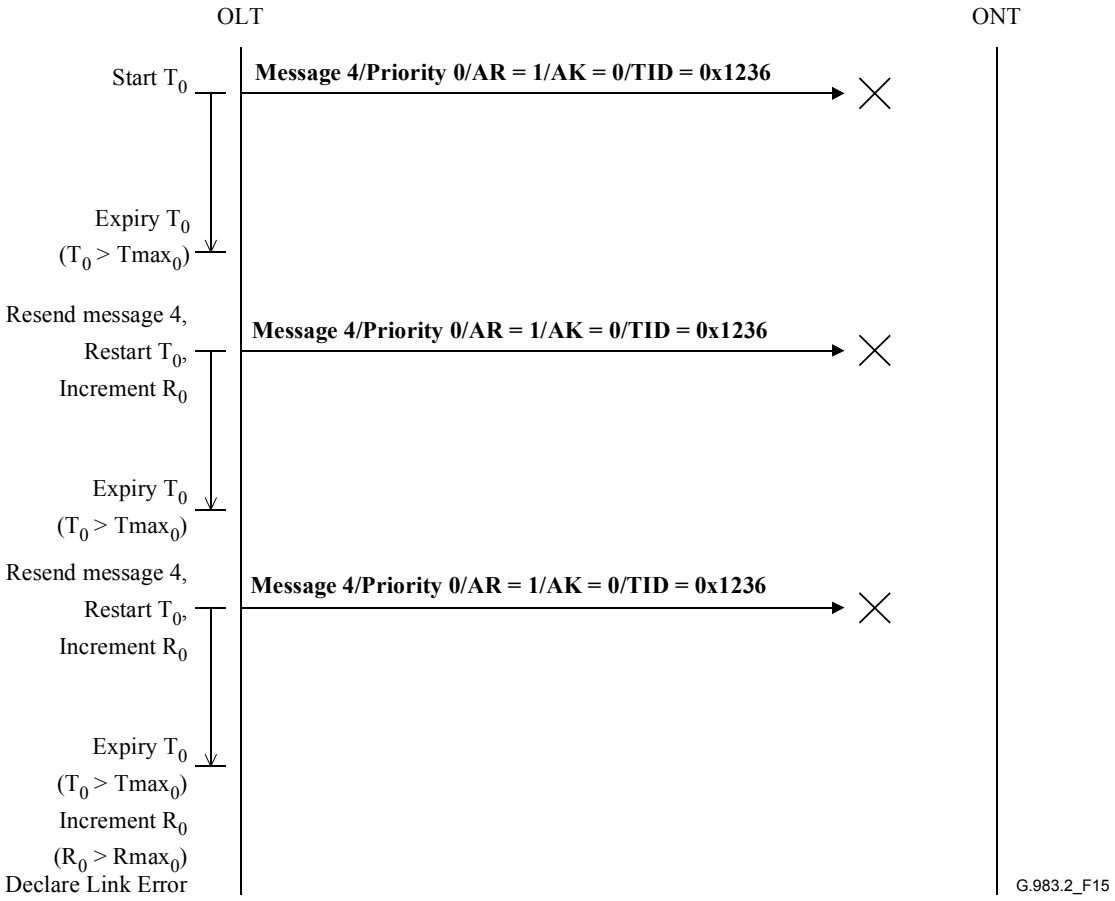


Figure 15/G.983.2 – OMCC link error detection

9.3 OMCI handling within the ONT

9.3.1 Prioritized protocol entities

This clause specifies the behaviour of the ONT more precisely than in the preceding clause with respect to the prioritized request mechanism of the OMCC.

Conceptually, the way the ONT handles the OMCC requests can be illustrated by referring to the dual priority level implementation example shown in Figure 16.

When the ONT receives an ATM cell via the VCC associated with the management channel, it shall calculate the CRC and compare it with the value found in the AAL 5 trailer. If the values do not match, the ONT shall discard the message. It is recommended that this event be logged by the ONT and possibly communicated to the OLT by some out-of-band mechanism but, as far as the protocol is concerned, the message is discarded silently.

Messages with a correct CRC are then placed into either of two distinct incoming FIFO-based message queues, according to the priority level (i.e. high or low) of the associated command. Note that the priority level of a given command is encoded using the most significant bit of the transaction correlation Identifier field. If the associated incoming message queue is already full, the ONT must simply discard the message. It is recommended that this event be logged by the ONT and possibly communicated to the OLT by some out-of-band mechanism but, as far as the protocol is concerned, the message is discarded silently.

There are two distinct incoming command processing protocol entities (one associated with each priority level) that are used to service messages sequentially from an independently associated incoming FIFO queue. Each of these protocol entities can execute concurrently. If a message is a

one-way command (i.e. an unacknowledged command), the protocol entity will simply have the command executed. If a message is an acknowledged command, the protocol entity must first look at the Transaction Correlation Identifier. If it is not equal to the Transaction Correlation Identifier of the last executed command with the same priority level, the protocol entity will have the command executed and place the response/acknowledgement (with identical Transaction Correlation Identifier) in the outgoing FIFO queue of the same priority level. If the Transaction Correlation Identifier is equal to that of the last executed command with the same priority level (i.e. the case where the controller retransmits a command due to lack of proper acknowledgement), the protocol entity will not actually have the command executed but simply will place the response from the last execution of that command in the outgoing FIFO queue (i.e. resend the previous acknowledgement response). It is assumed that in both cases the command processing protocol entity for a given priority level will block until there is room in the associated outgoing FIFO queue for the response message.

In the other direction, requests by the applications to send autonomous event notifications will simply result in the corresponding messages being directed to an event notification protocol entity for transmission to the OLT. The event notification protocol entity will forward these event notification messages to the low priority outgoing FIFO queue. In this case as well, the event notification protocol entity will block until there is room in the low priority outgoing FIFO queue to hold the notification message. The CRC generator will remove messages from the outgoing FIFO queues using a strict priority discipline (i.e. the low-priority queue will only be serviced when the high-priority queue is empty), generate a CRC, append a properly-formatted AAL 5 trailer to the cell payload, and transmit the message to the OLT.

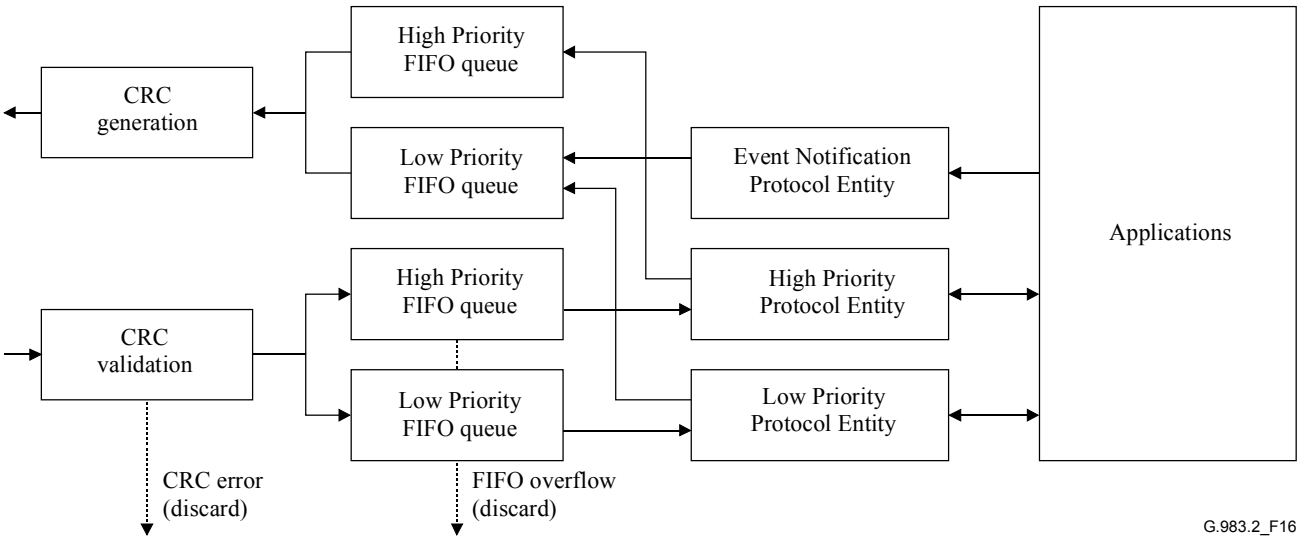


Figure 16/G.983.2 – Protocol entities within the ONT

9.3.2 Restrictions on the actions in relation to the protocol entities

To reduce the complexity and the amount of memory necessary in the ONT, the OLT is not allowed to issue a MIB Upload or a Software Download of a certain priority level while a similar action in the other priority level is in progress.

Appendix I

OMCI common mechanisms and services

This appendix describes the common mechanisms of the OMCI, e.g. the MIB resynchronization, and the OMCI services, e.g. the equipment management or connection management.

I.1 Common mechanisms

The common mechanisms consist of:

a) MIB data sync increase.

b) MIB audit and resynchronization.

c) Alarm sequence number increase.

d) Alarm audit and resynchronization.

e) Get an attribute that is larger than the OMCI message contents field.

f) Create an instance of a managed entity with an attribute that is larger than the OMCI message contents field.

g) Reporting of test result.

These common mechanisms will be explained by the use of scenario diagrams.

I.1.1 MIB data sync increase

The MIB at the OLT and the instances of the managed entities in the ONT have to be synchronized at all times. This clause describes the means for achieving this. The "tool" used for this is the MIB data sync attribute of the ONT Data managed entity.

The MIB data sync attribute is a global 8-bit *sequence number*. When auditing the MIB in the ONT, the OLT requests this sequence number. If this number coincides with the corresponding sequence number in the OLT, no further action is needed, as the two MIBs, in ONT and OLT, are thought to be identical. If there is a discrepancy, the OLT either:

1) downloads its copy (including the MIB data sync) of the MIB to the ONT; or

2) uploads the MIB of the ONT, compares it with its own MIB, sends the necessary commands to the ONT to correct the differences and downloads its sequence number.

The ONT will be audited with respect to its MIB in three cases:

a) On loss and reestablishment of the OMCC.

b) Periodically, based on the operator's requirements.

c) On demand of the OpS.

On detecting a newly installed ONT, regardless of the sequence number of its MIB, the OLT will download (configure) a MIB to that ONT.

The MIB data sync counter will be incremented for the creation and deletion of managed entity instances that are the consequence of a command by the OLT. The MIB data sync counter will also be incremented for attribute value changes which are the consequence of a command by the OLT. The MIB data sync counter will be incremented once per executed command (see Figure I.1).

In contrast, the MIB data sync counter will not be incremented for autonomous creation and deletion of managed entity instances by the ONT itself. Neither will the MIB data sync counter be incremented for autonomous changes to attributes of managed entities within the ONT (see Figure I.2).

The order in which the OLT and the ONT will update their MIBs and increment the MIB data sync is not imposed. However, both the OLT and the ONT must locally update the MIB and increment the MIB data sync as one atomic action.

When incremented, the sequence number that follows 255 is 1. 0x00 is reserved for the following cases:

a) Default MIB with which the ONT left the factory.

b) An ONT which after (re-) initialization cannot restore its MIB.

Note that no mechanisms exist to detect that an autonomous attribute value change notification has been lost. Therefore, the OLT must regularly read the values of the attributes that can change their values autonomously.

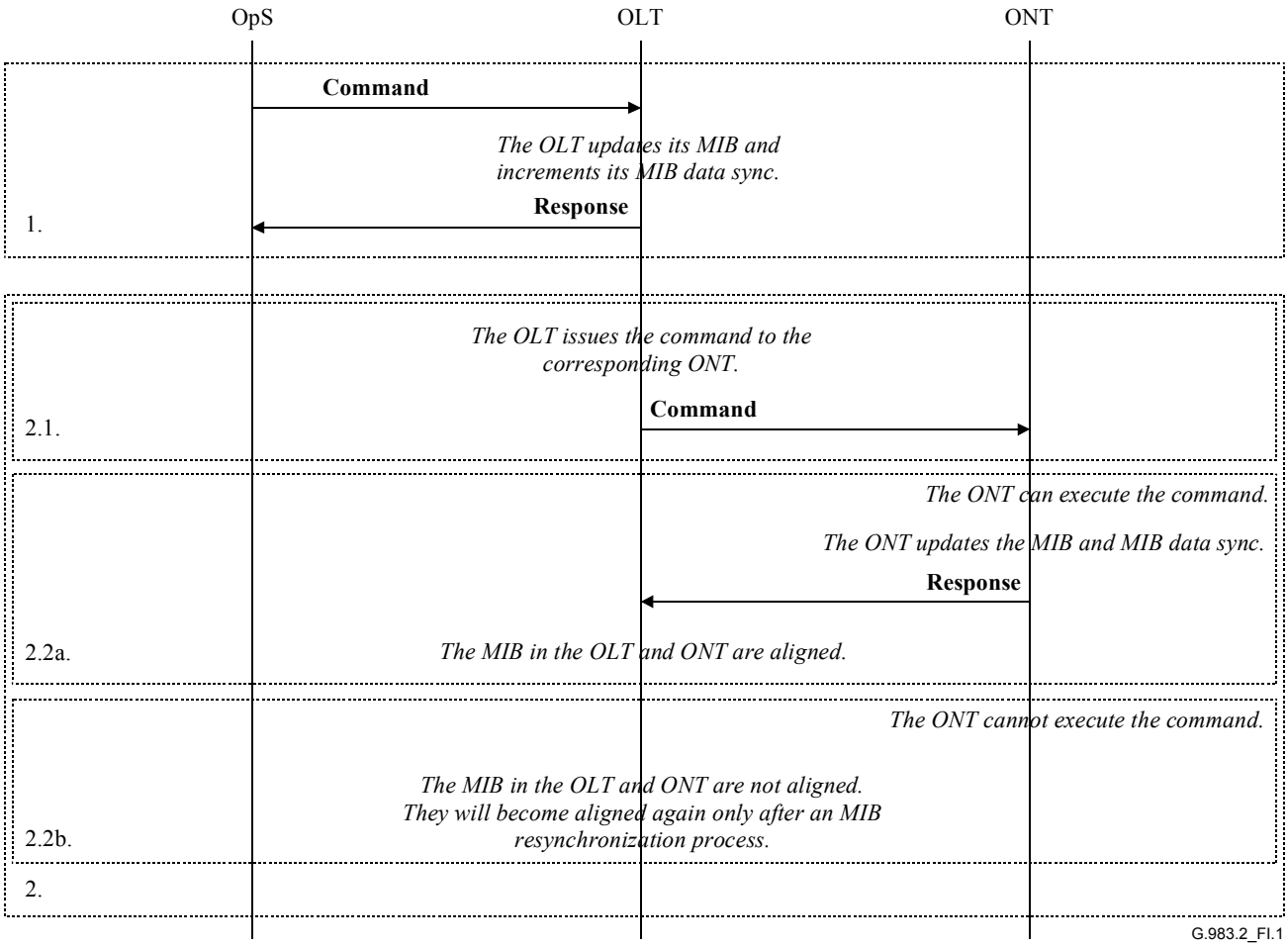


Figure I.1/G.983.2 – Increment of MIB data sync at ONT and OLT under OLT command

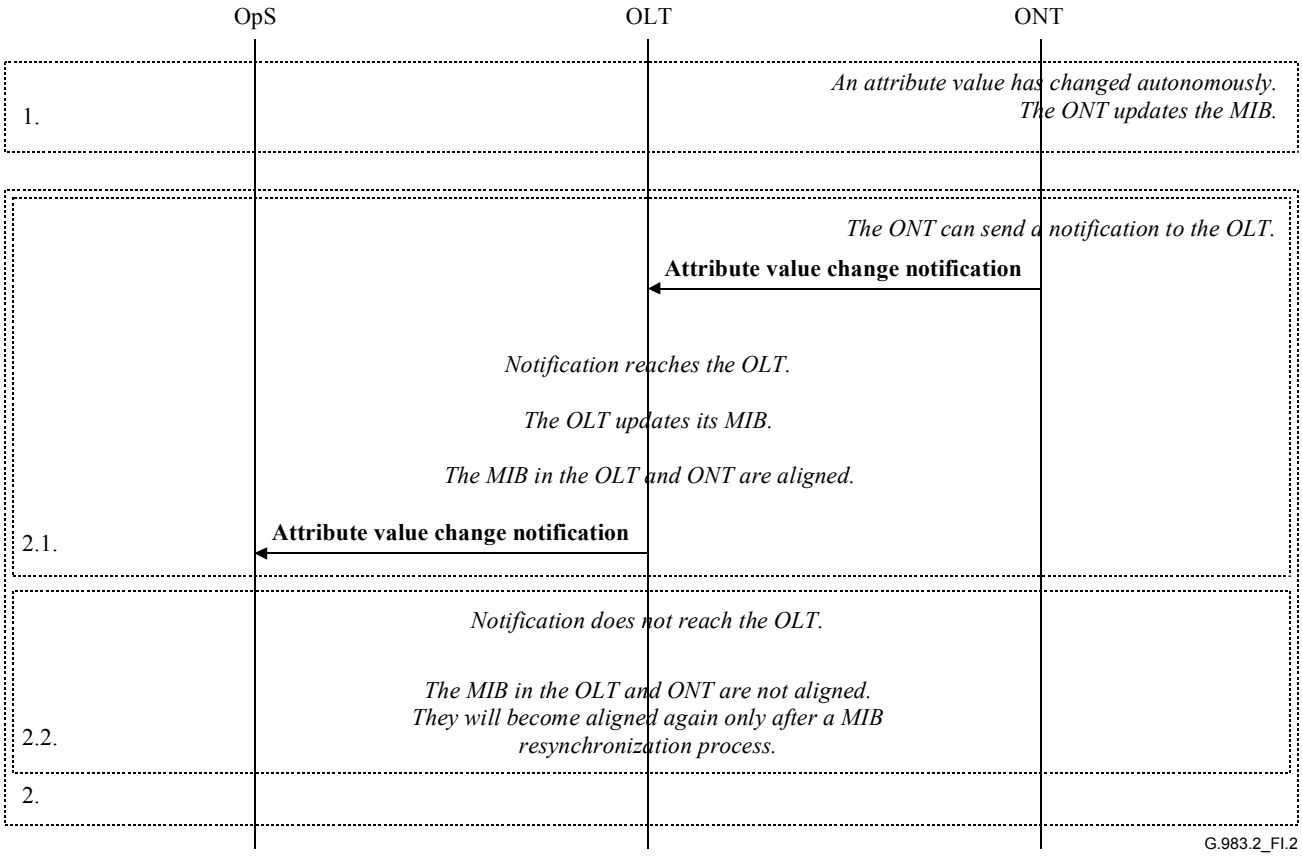


Figure I.2/G.983.2 – No increment of MIB data sync at ONT and OLT in case of autonomous attribute value changes

I.1.2 MIB audit and resynchronization

Figure I.3 shows the scenario diagram of the MIB audit and MIB resynchronization process.

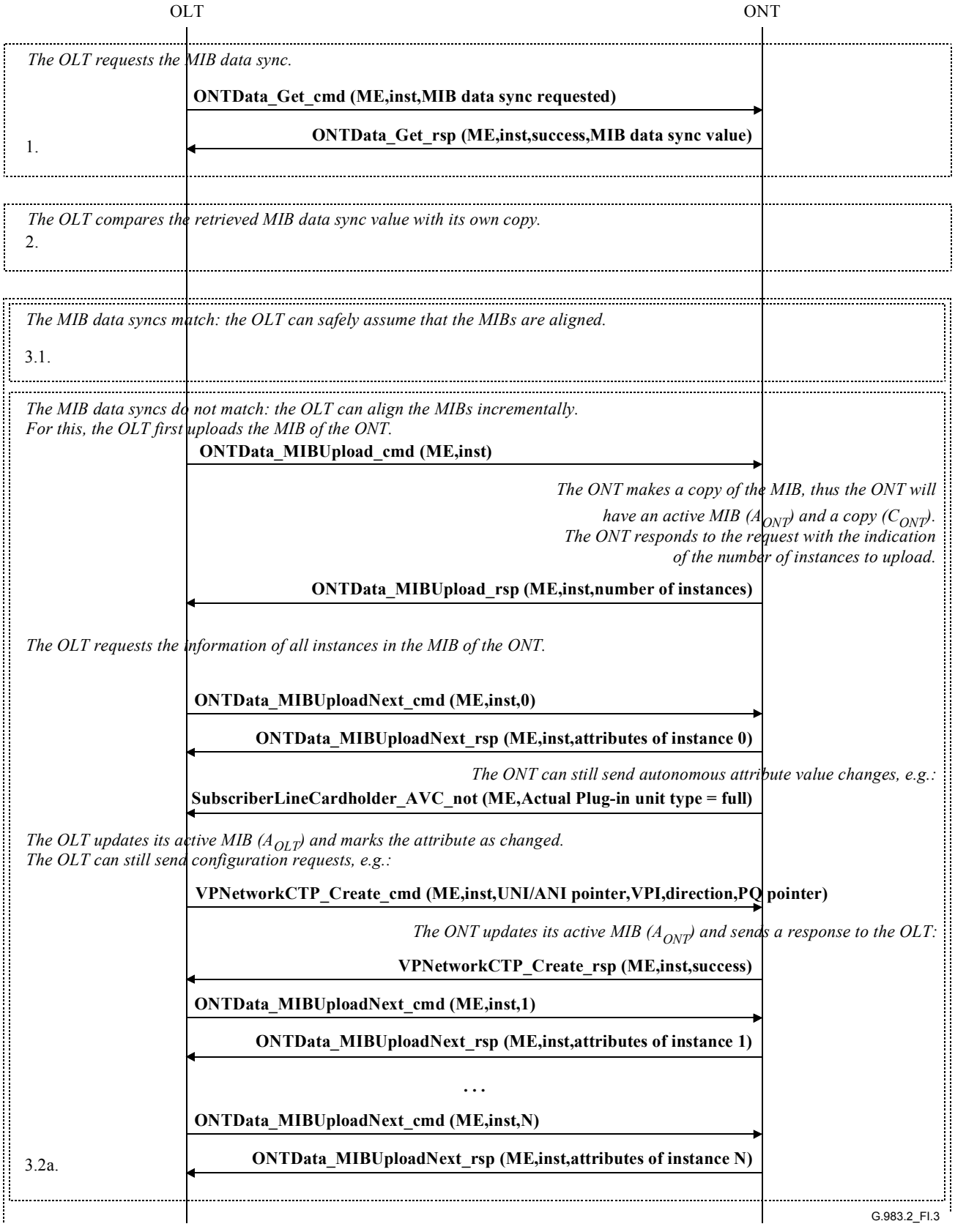


Figure I.3/G.983.2 – Audit and MIB resynchronization

The OLT must issue as many MIBUploadNext requests as the number of instances given in the MIBUpload response. The maximum time between two MIBUploadNext requests is 1 minute. If the OLT does not send a MIBUploadNext request within this time after the previous MIBUploadNext request or after the MIBUpload start request, the ONT assumes the MIB upload to be terminated. The ONT can drop the copy of the MIB.

I.1.3 Alarm sequence number increase

The ONT informs the OLT of alarm status changes by sending alarm status change notifications. Note that these notifications are sent in unacknowledged messages that carry an eight-bit alarm sequence number for the benefit of the OLT to detect loss of alarm notifications (see Figure I.4 and clause I.1.4). After a restart of the ONT, the alarm sequence number is reset so that the first alarm notification sent by the ONT will have an alarm sequence number equal to 1. The alarm message sequence number is incremented for each alarm notification and wraps around from 255 to 1. Consequently, an alarm notification with sequence number 0x00 will never be sent.

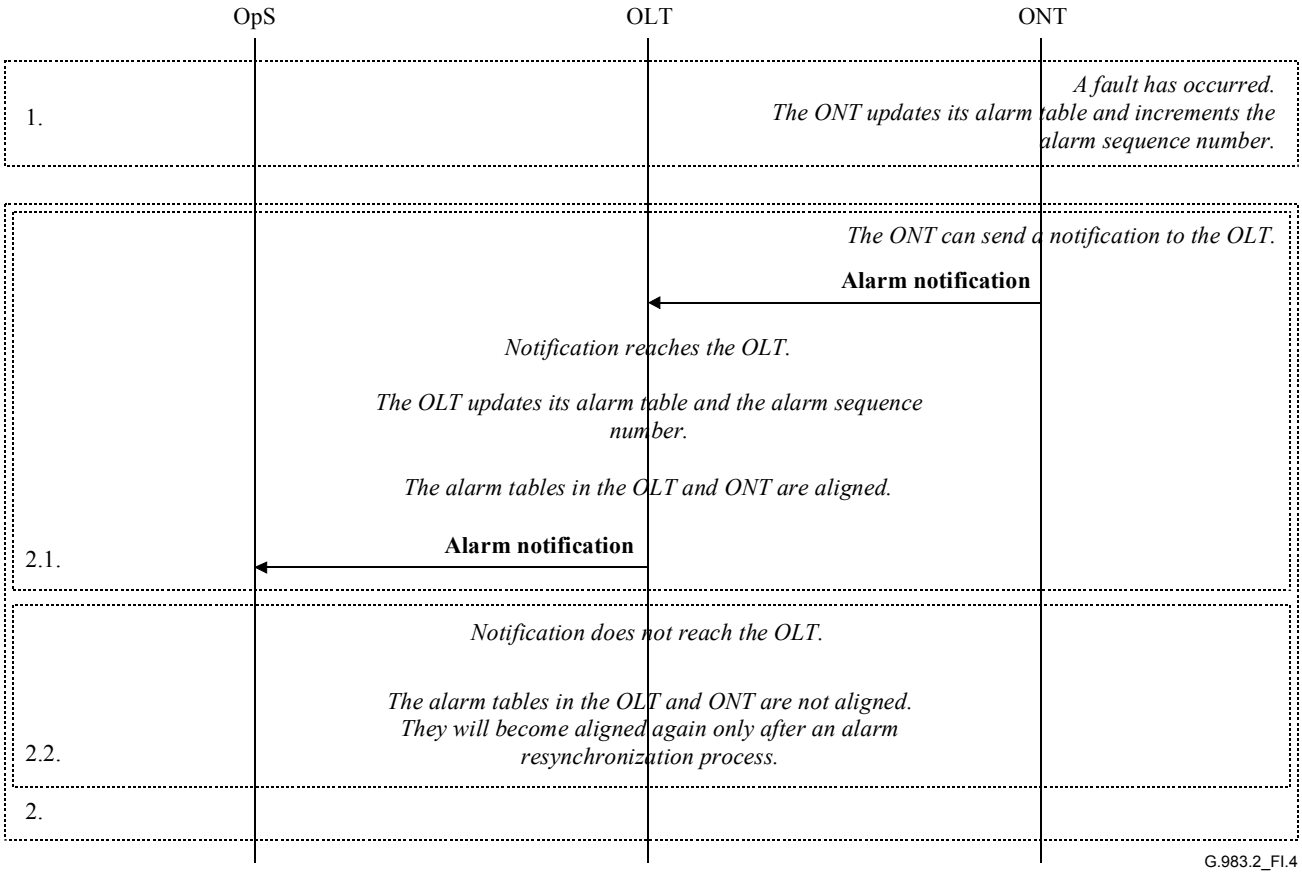


Figure I.4/G.983.2 – Increment of alarm sequence number at ONT and OLT

I.1.4 Alarm audit and resynchronization

When the OLT detects a gap in the received sequence, as shown in Figure I.5, it asks the ONT for an alarm status report by sending a "Get All Active Alarms" command. Obviously, 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 entities instances via the "Get All Alarms Next" command. The OLT will compare these alarm statuses of all these instances with its own and will notify the network manager of the changes. The alarm sequence number is reset by the ONT when it receives the "Get All Active Alarms" request.

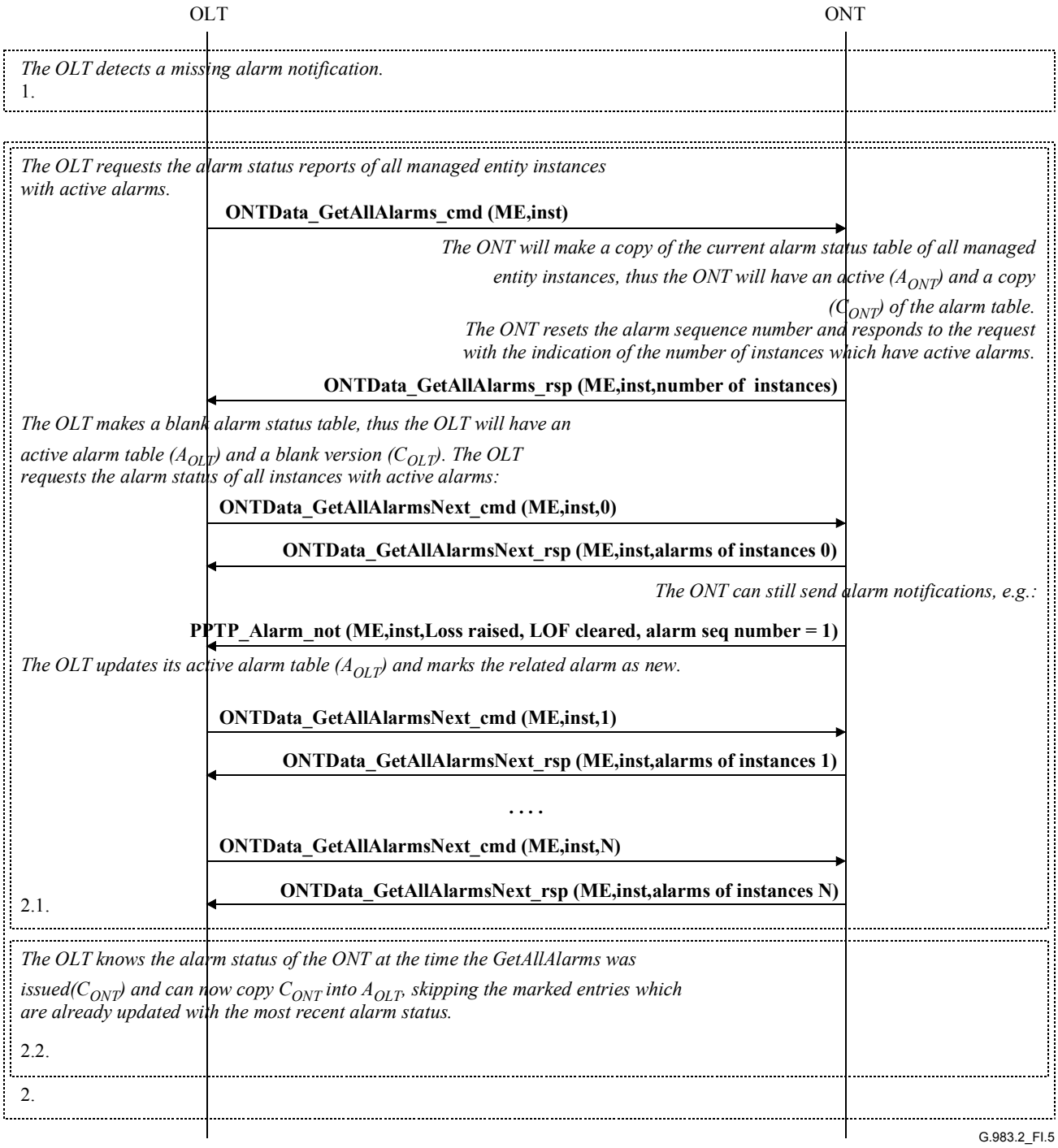


Figure I.5/G.983.2 – Audit and alarm resynchronization

The OLT must issue as many GetAllAlarmsNext requests as the number of instances given in the GetAllAlarms start response. The maximum time between two GetAllAlarmsNext requests is 1 minute. If the OLT does not send a GetAllAlarmsNext request within this time after the previous GetAllAlarmsNext request or after the GetAllAlarms start request, the ONT assumes the alarm upload to be terminated. The ONT can drop the copy of the alarm table.

I.1.5 Get an attribute that is larger than the OMCI message contents field

Figure I.5a shows the scenario diagram when the OLT gets an attribute that is larger than the OMCI message contents field (exactly 30 bytes). The OLT asks the ONT for the size of the attribute by sending a "Get" command. This command is acknowledged by a response that contains the size of the attribute. Then, the OLT will request the attribute data from the ONT via the appropriate

number of "Get next" commands. This scenario is used for the MAC Filter Table attribute of MAC Bridge Port Filter Table Data managed entity and the Bridge Table attribute of the MAC Bridge Port Bridge Table Data managed entity.

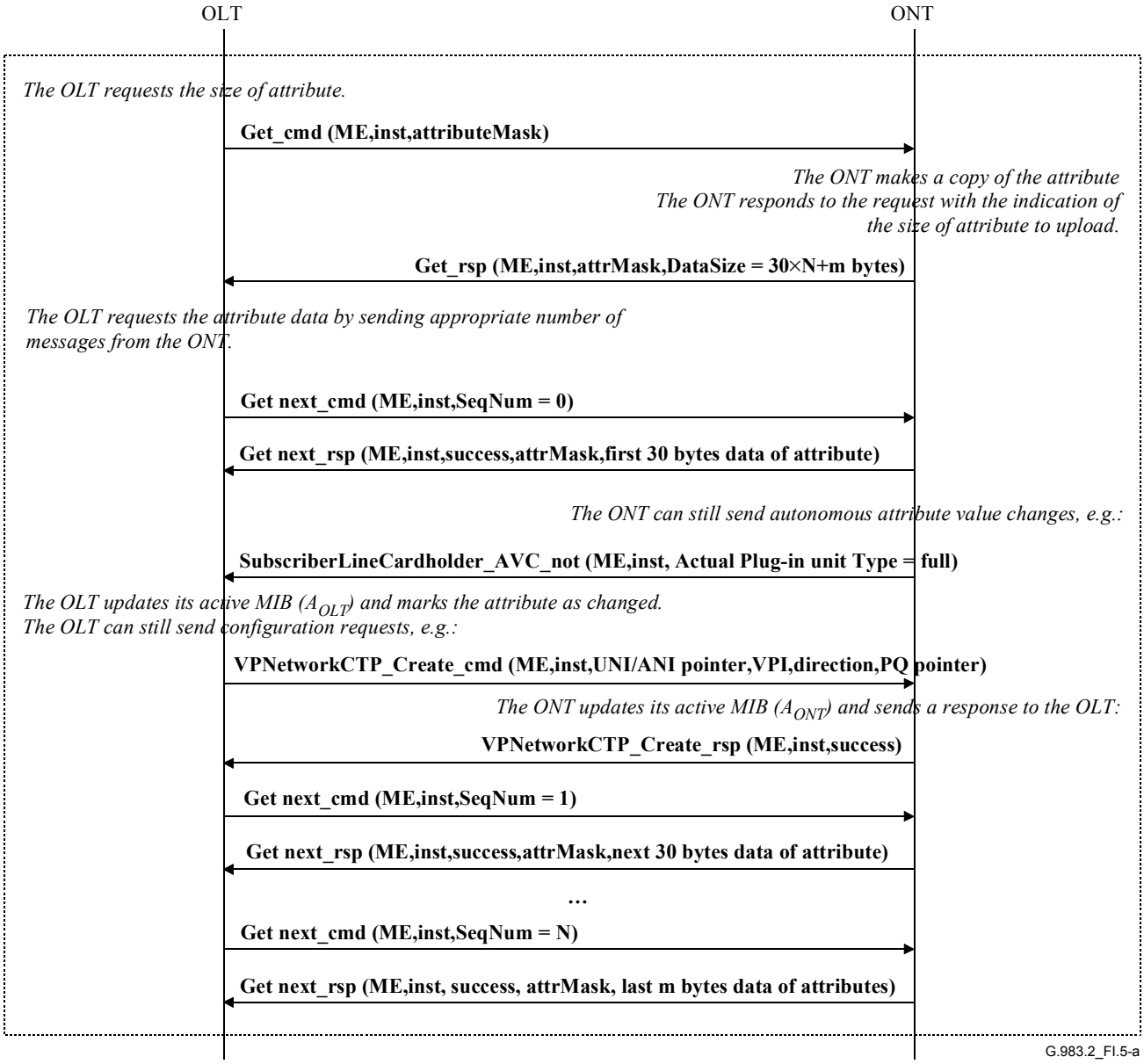


Figure I.5a/G.983.2 – Get an attribute that is larger than the OMCI message field

The OLT must issue as many "Get next" requests as the number of command sequences given in the Get response. The maximum time between two "Get next" requests is 1 minute. If the OLT does not send a "Get next" request within this time after the previous "Get next" request or after the Get start request, the ONT assumes the Get attribute command has been terminated and can drop the copy of the attribute.

I.1.6 Create an instance of a managed entity with an attribute that is larger than the OMCI message contents field

Figure I.5b shows the scenario diagram when the OLT creates an instance of a managed entity with an attribute that is larger than the OMCI message contents field (exactly 33 bytes). The OLT first creates an instance of the managed entity without attribute data by sending a "Create" command and then sets the attribute data by sending the appropriate number of "Set" commands. This scenario is useful for Threshold $Data_{B\text{-}PON}$ ME.

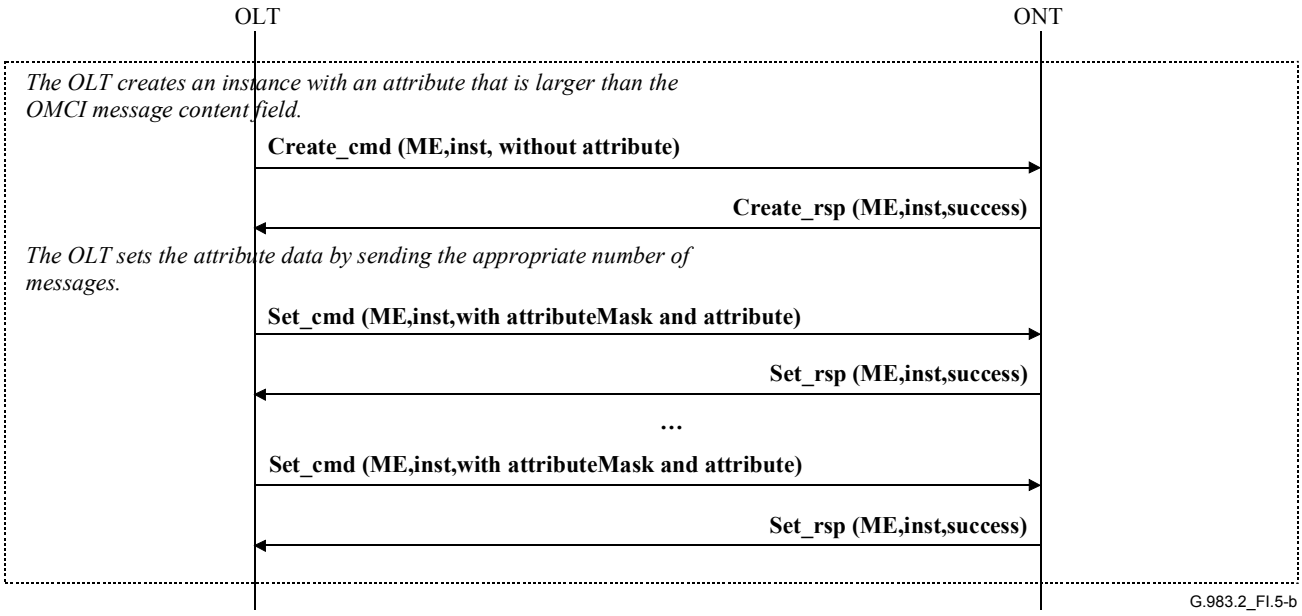


Figure I.5b/G.983.2 – Create an instance of a managed entity with an attribute that is larger than the OMCI message field

I.1.7 Report test result

Figure I.5c shows the scenario diagram for when the OLT requests that the ONT perform a test. The OLT requests that the ONT starts testing by sending a "Test" command. This command is acknowledged by a "Test" response. Then, the ONT carries out the test. After the test is complete, the ONT reports the test result via a "Test result" notification message. This scenario is used for the "SelfTest" attribute of $ONT_{B\text{-}PON}$ managed entity or Subscriber Line Card managed entity. Moreover, this scenario may be useful for MLT tests or for additional tests that may be added in the future.

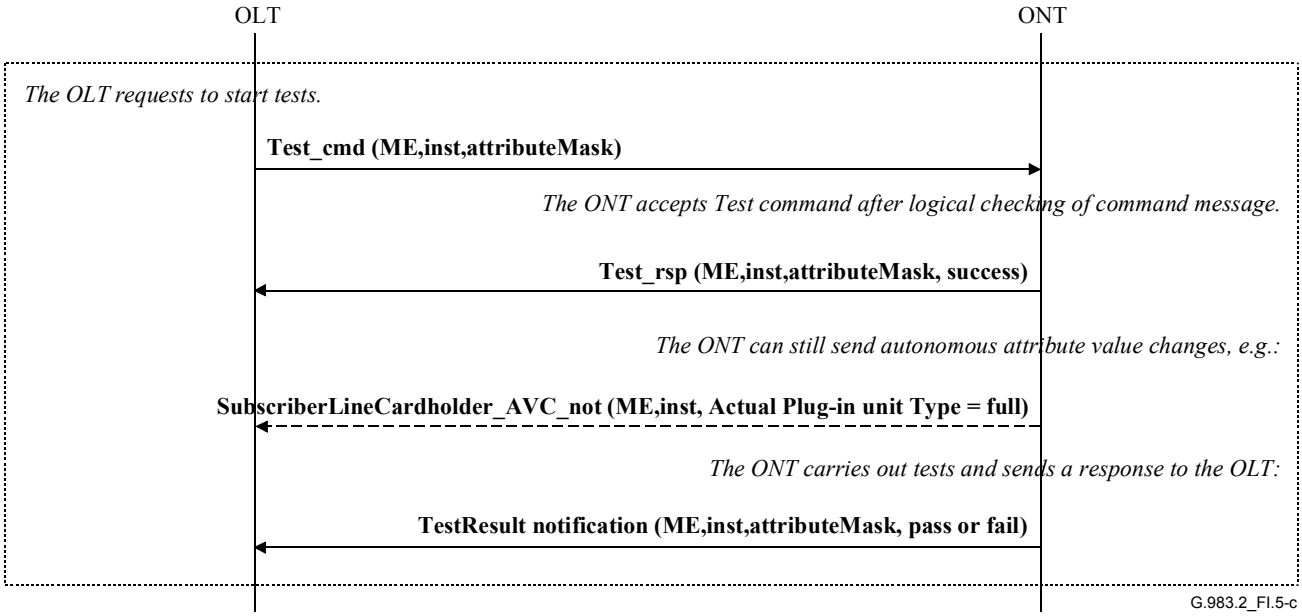


Figure I.5c/G.983.2 –Reporting of test result

I.2 Common services

The common services consist of:

a) start-up phase of ONT;

b) on demand subscriber line card provisioning;

c) on demand subscriber line card deprovisioning;

d) plug-and-play subscriber line card provisioning;

e) plug-and-play subscriber line card deprovisioning;

f) ATM VP Cross-Connection set-up;

g) ATM VP Cross-Connection breakdown;

h) software image download;

i) software image changes;

j) MAC bridge service connection set-up;

k) MAC bridge service connection tear-down;

l) Addition of entities to MAC Filter Table;

m) Removal of entities from MAC Filter Table;

n) Voice service connection set-up; and

o) Voice service connection tear-down.

All the listed services will be explained by the use of scenario diagrams.

I.2.1 Start-up phase of ONT

The start-up phase of an ONT, from the OMCI point of view, belongs to one of two cases:

a) the ONT is "new" to the OLT; or

b) the OLT already "saw" this ONT at this PON.

The details of start-up scenarios also vary for ONTs with different configuration options, e.g.

a) ONT with cardholders at both PON IF and UNI;

b) ONT with integrated interfaces at both PON IF and UNI;

c) ONT with cardholders at PON IF and integrated interfaces at UNI; and

d) ONT with integrated interfaces at PON IF and cardholders at UNI.

Here the following scenarios will only show cases a) and b), from which the scenarios for cases c) and d) can be deduced.

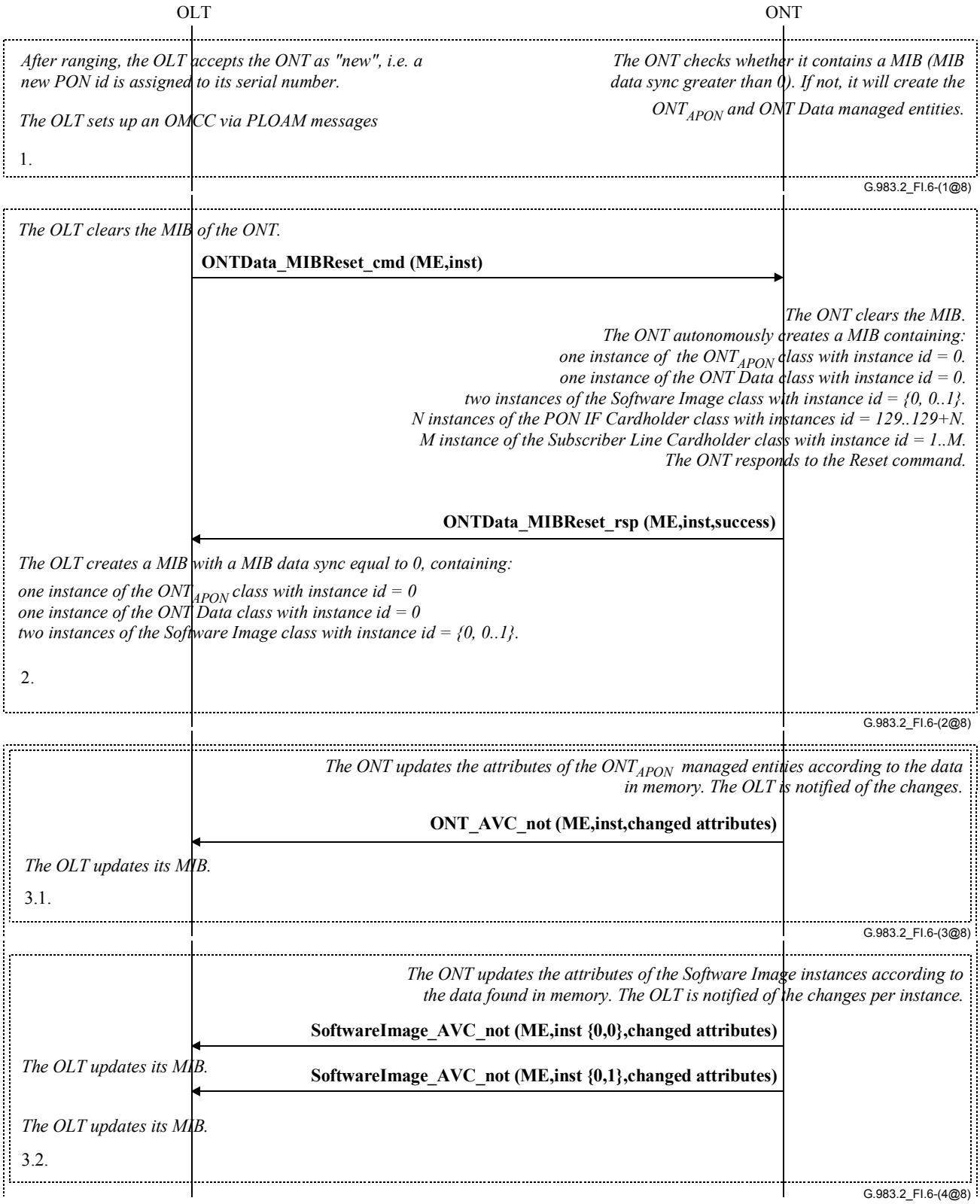
NOTE – The preferred solution is that Subscriber Line Card and Subscriber Line Cardholder managed entities should always be modelled, regardless of whether or not the ONT has integrated interfaces.

Figure I.6 shows the start-up phase of a "new" ONT with Cardholders on both sides. Figure I.7 shows the start-up phase of a "new" ONT with integrated interfaces on both sides. Figure I.8 shows the start-up phase of an "old" ONT.

The behaviour of the ONT with respect to inserted Subscriber Line Cards during the start-up phase is not shown in the following figures. This behaviour is the subject of I.2.2.

Note that if attribute value changes do not arrive at the OLT, the OLT will not know the number of cardholders or integrated ports that reside in the ONT. The OLT can request the information of the newly created managed entity instances by a sequence of "Get" requests. If a "Get" request is issued on a non-existing instance, the response message to the OLT will indicate the error – Unknown managed entity instance.

Figure I.6/G.983.2 – Start-up of a "new" ONT with Cardholders on both sides (start)



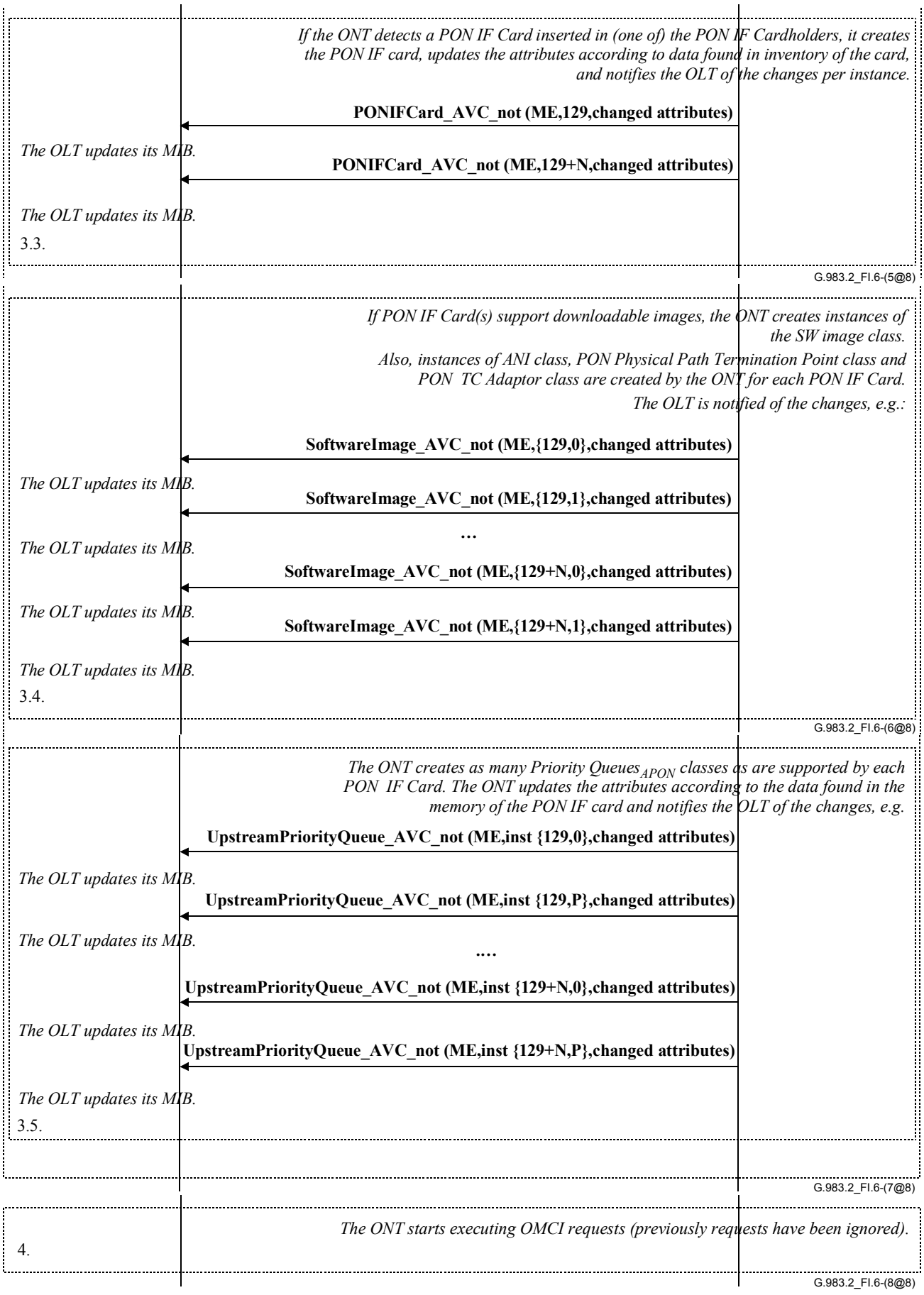


Figure I.6/G.983.2 – (end)

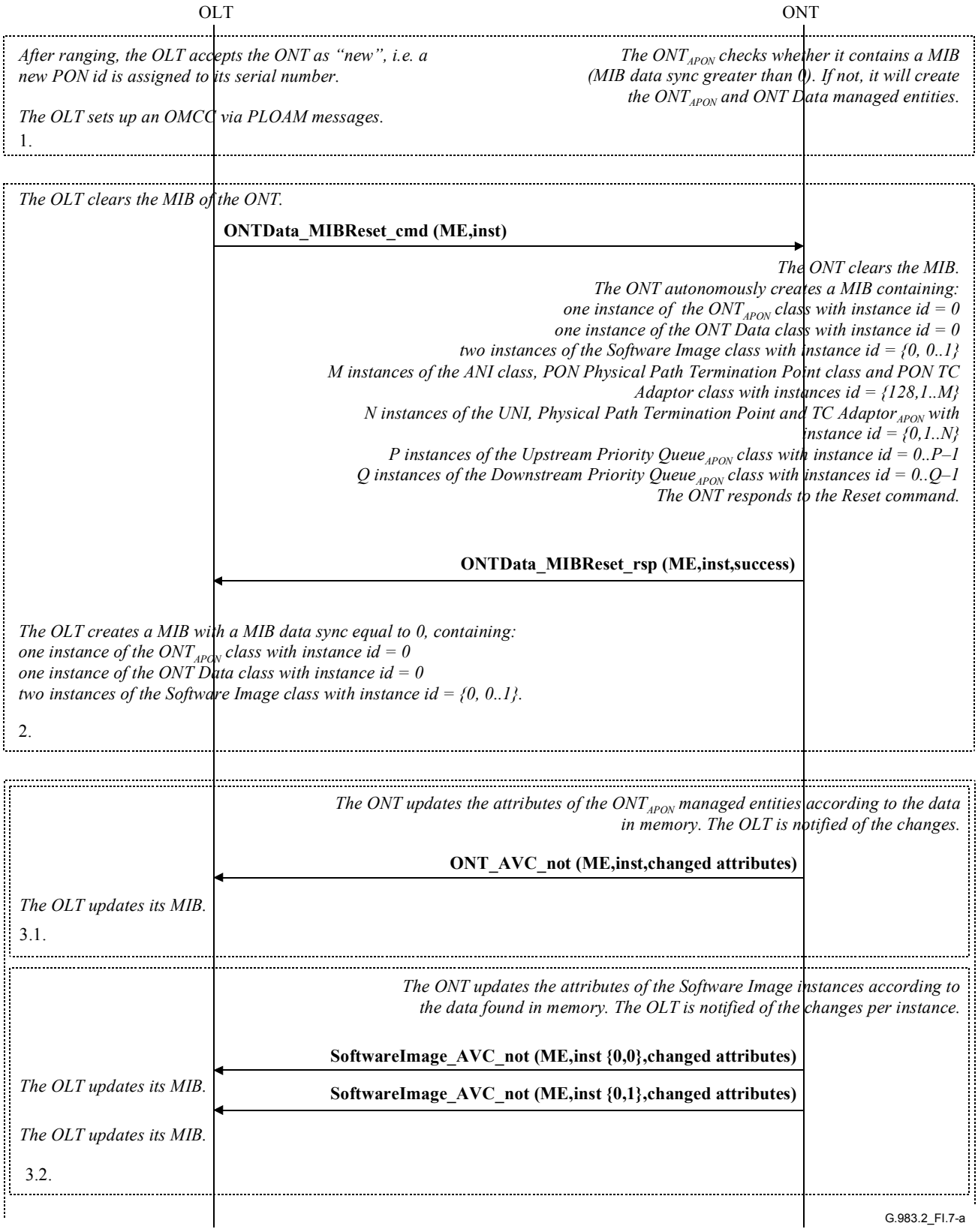


Figure I.7a/G.983.2 – Start-up phase of a "new" ONT with integrated interfaces on both sides

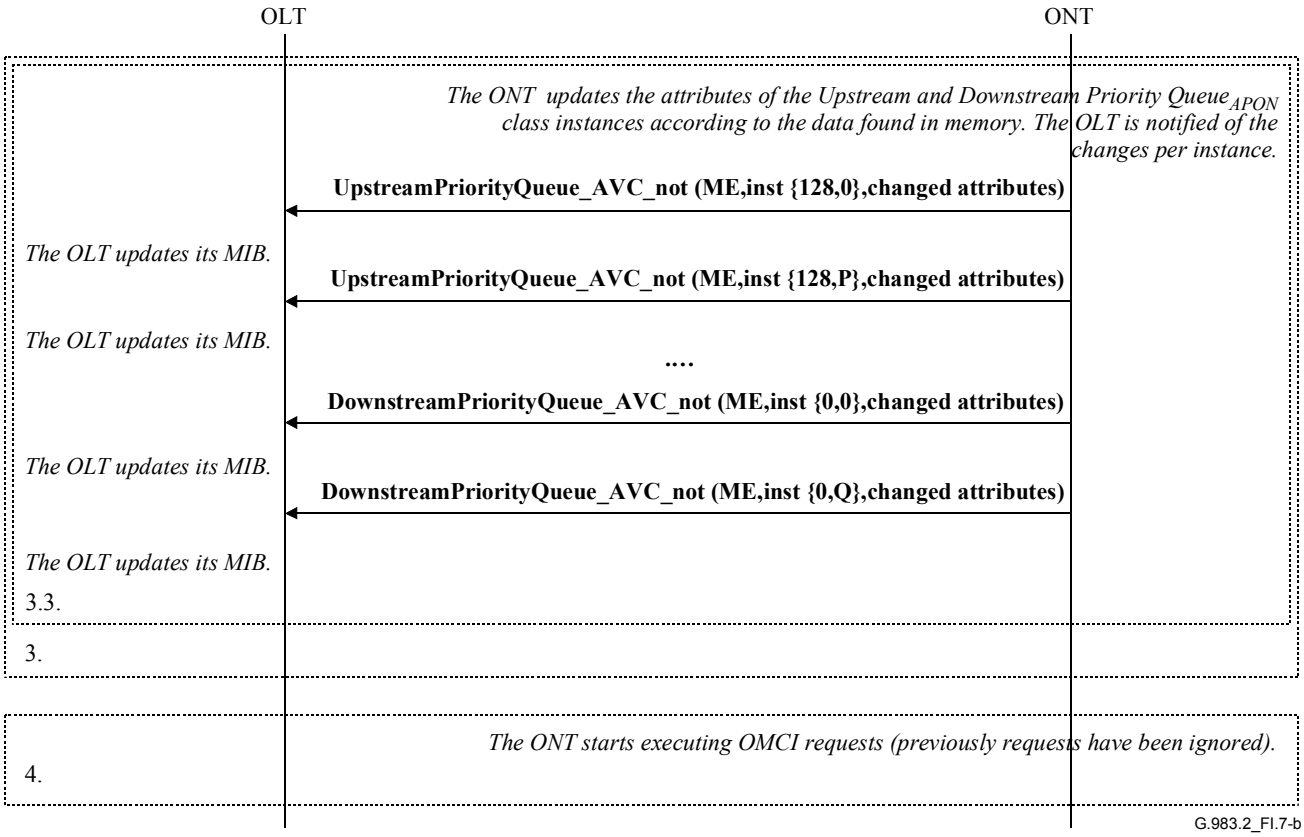


Figure I.7b/G.983.2 – Start-up phase of a "new" ONT with integrated interfaces on both sides

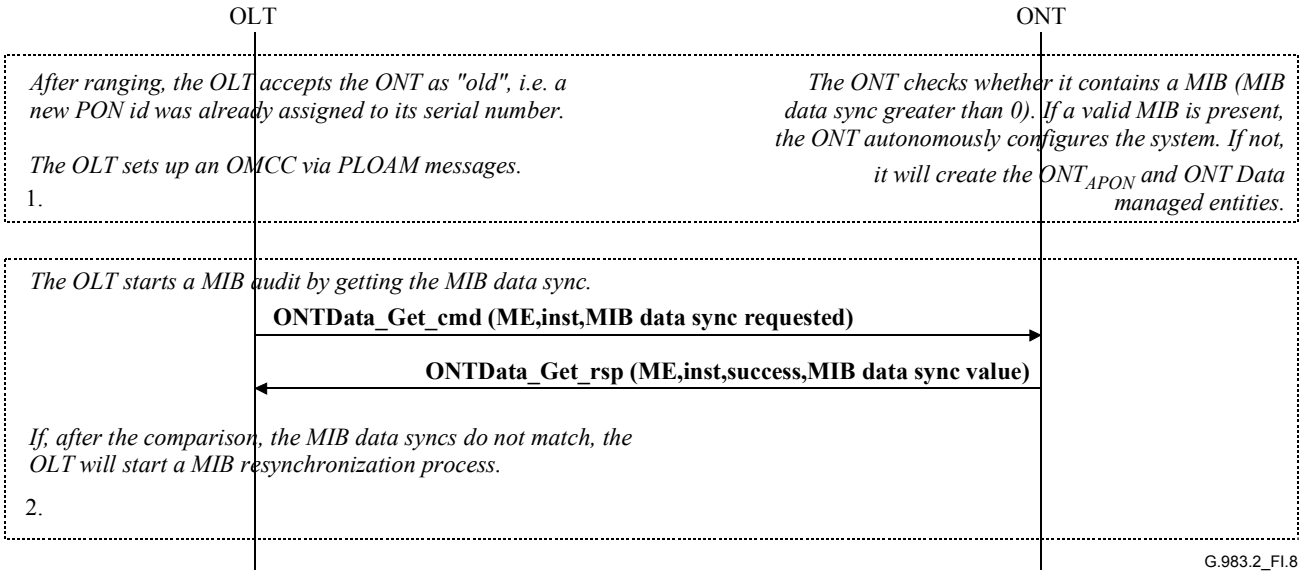


Figure I.8/G.983.2 – Start-up phase of an "old" ONT

I.2.2 Subscriber Line Card provisioning/deprovisioning

The provisioning and de-provisioning of Subscriber Line Card can be triggered in two ways:

a) On demand by the OpS;

b) Plug-and-play, triggered by the detection of the card insertion/removal.

However, this trigger of provisioning and deprovisioning is transparent to the ONT, i.e. the ONT would always be used in the provisioning mode. The difference between plug-and-play mode and on-demand mode would reside in the OLT. For the on-demand mode, the OLT will provision (deprovision) the presence of the subscriber line card in the ONT when it has been provisioned (deprovisioned) by the operator; for the plug-and-play mode, the OLT will provision the slot to "plug-and-play" and further provision (deprovision) the presence of the subscriber line card in the ONT as soon as it has received a notification from the ONT that a line card has been plugged in (out).

I.2.3 On-demand Subscriber Line Card provisioning

NOTE – It is possible to provision a subscriber line card while a subscriber line card of the same or of a different type is provisioned for the subscriber line cardholder. In case a subscriber line card of the same type is already provisioned, the provisioned command will have no effect. In case a subscriber line card of a different type is already provisioned, this subscriber line card will be automatically de-provisioned and only then the system will be configured according to the newly given plug-in unit type. Figure I.9 shows the scenario of provisioning an ATM LIM. Figure I.10 shows the scenario of provisioning a non-ATM LIM.

The cases below show the use of the attributes "Expected type" and "Sensed type" of the corresponding Physical Path Termination Point ATM/Ethernet/CES UNI.

Case 1

The subscriber line card or the ONT itself (the latter in case of integrated interfaces) only supports a specific type of interface. Notice that in the former case, the attribute "type" of the Subscriber Line Card managed entity will be equal to this type.

In this case, on creation of the Physical Path Termination Point managed entity instance, the attributes "Expected type" and "Sensed type" of the Subscriber Line Card managed entity are both set equal to the specific interface type and the ONT sends attribute value change notifications to the OLT with the values of these attributes. It will not be possible for the OLT to change the value of the attribute "Expected type" later on (i.e. any attempt by the OLT to change the value of the attribute will be refused by the ONT).

Case 2

The subscriber line card or the ONT itself (the latter in case of integrated interfaces) supports interfaces of different types.

In this case, on creation of the Physical Path Termination Point managed entity instance, the attribute "Expected type" is set to autosensing (0x00) and attribute "Sensed type" is set to:

- inapplicable or unknown if the interface does not support autosensing or if the autosensing fails (actually, the coding is 0x00 in both cases);
- the sensed type if the interface supports autosensing and the autosensing was successful.

The ONT will send an attribute value change notification with the values of these attributes.

Later on, it will be possible for the OLT to change the value of attribute "Expected type" with the "Set" action. The value of attribute "Sensed type" will be set equal to the value of attribute "Expected type". Notice however that the ONT will only execute the "Set" action if the ONT supports the configured interface type.

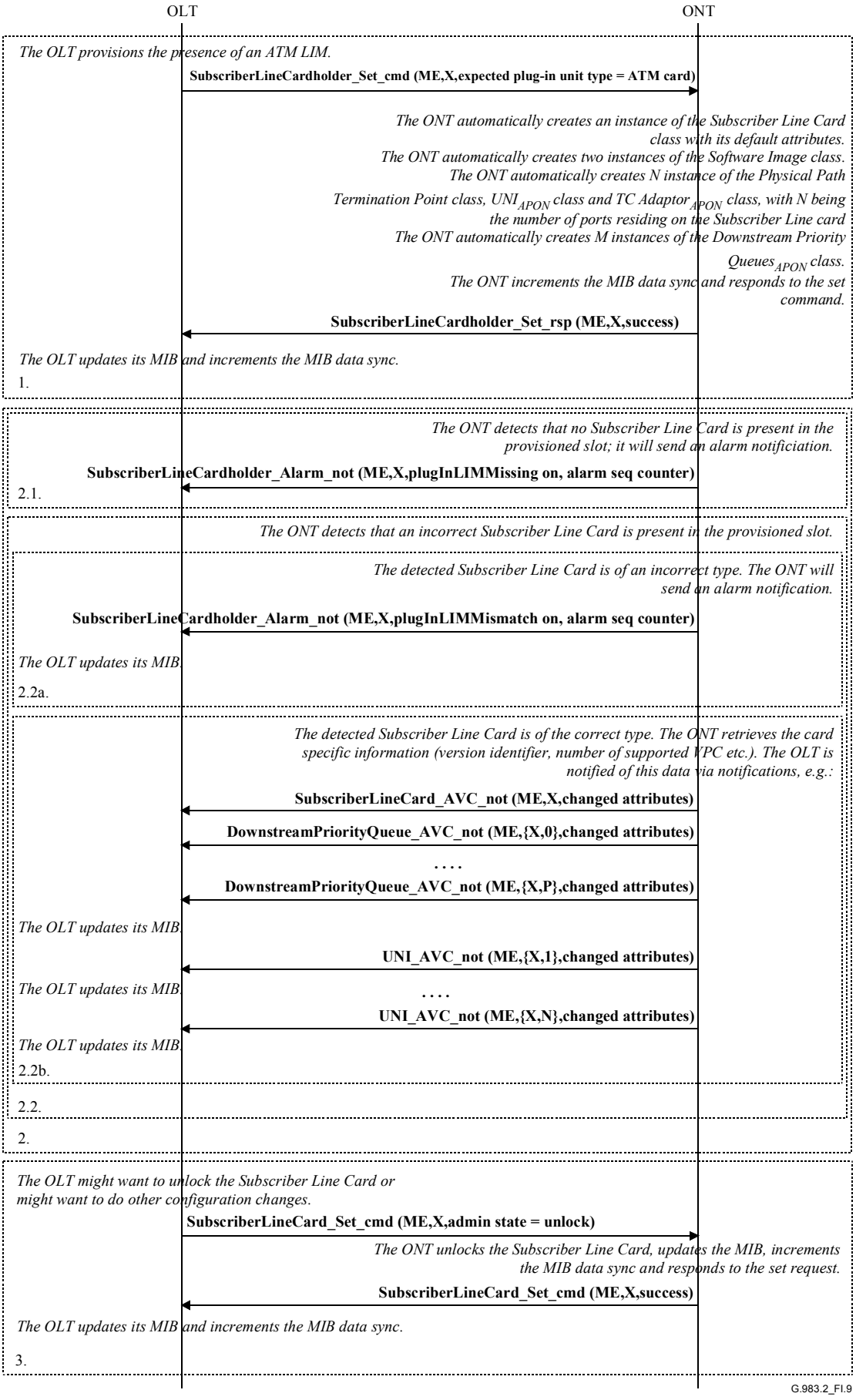


Figure I.9/G.983.2 – ATM subscriber line card provisioning

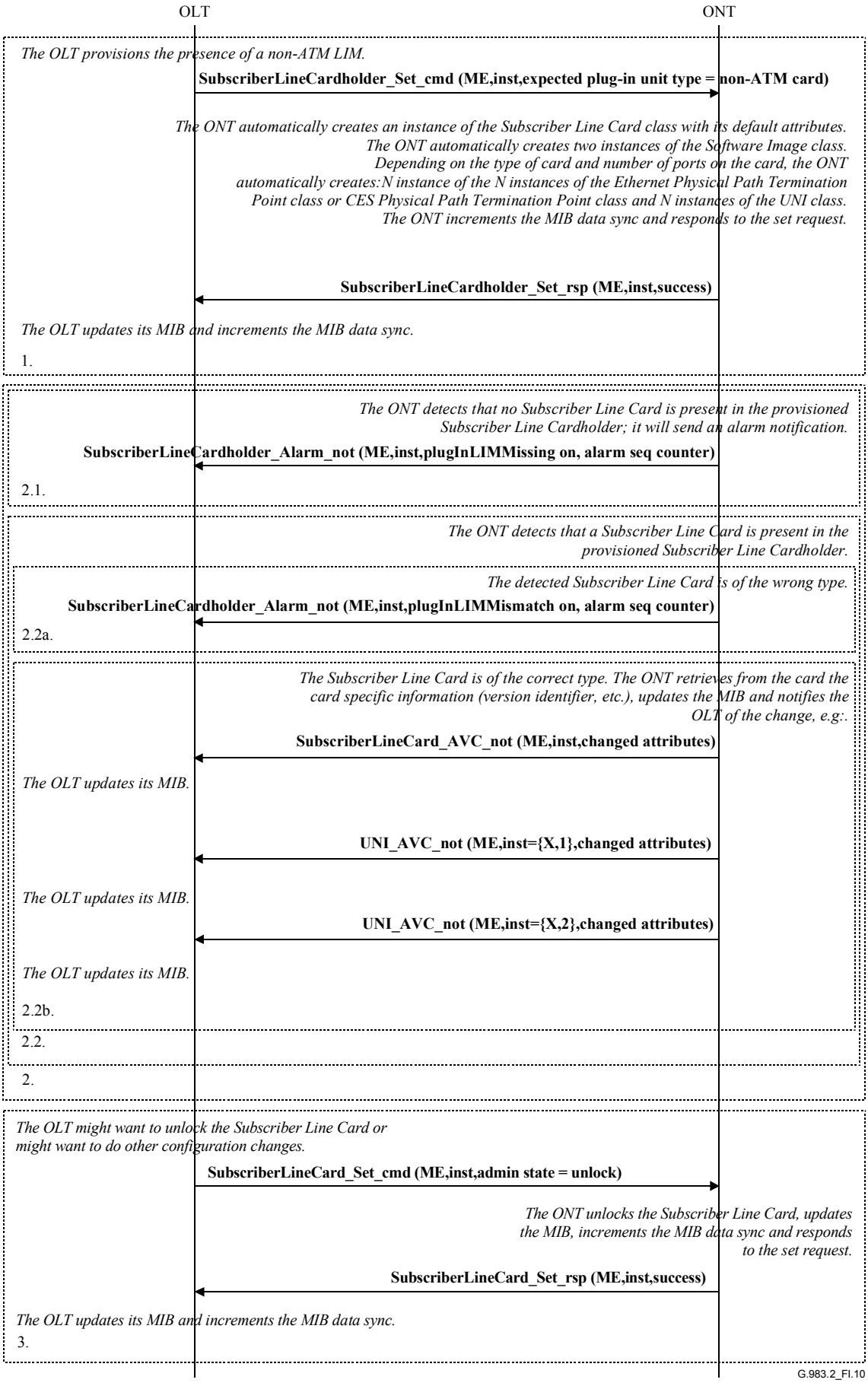


Figure I.10/G.983.2 – Non-ATM card subscriber line card provisioning

I.2.4 On-demand subscriber line card deprovisioning

The ONT will delete from the MIB all managed entities that it automatically created during the provisioning of this subscriber line card. On the other hand, the OLT will be responsible for deleting all those managed entities that are associated with this card and were created by the OLT. Figure I.11 shows the process of deprovisioning a Subscriber Line Card.

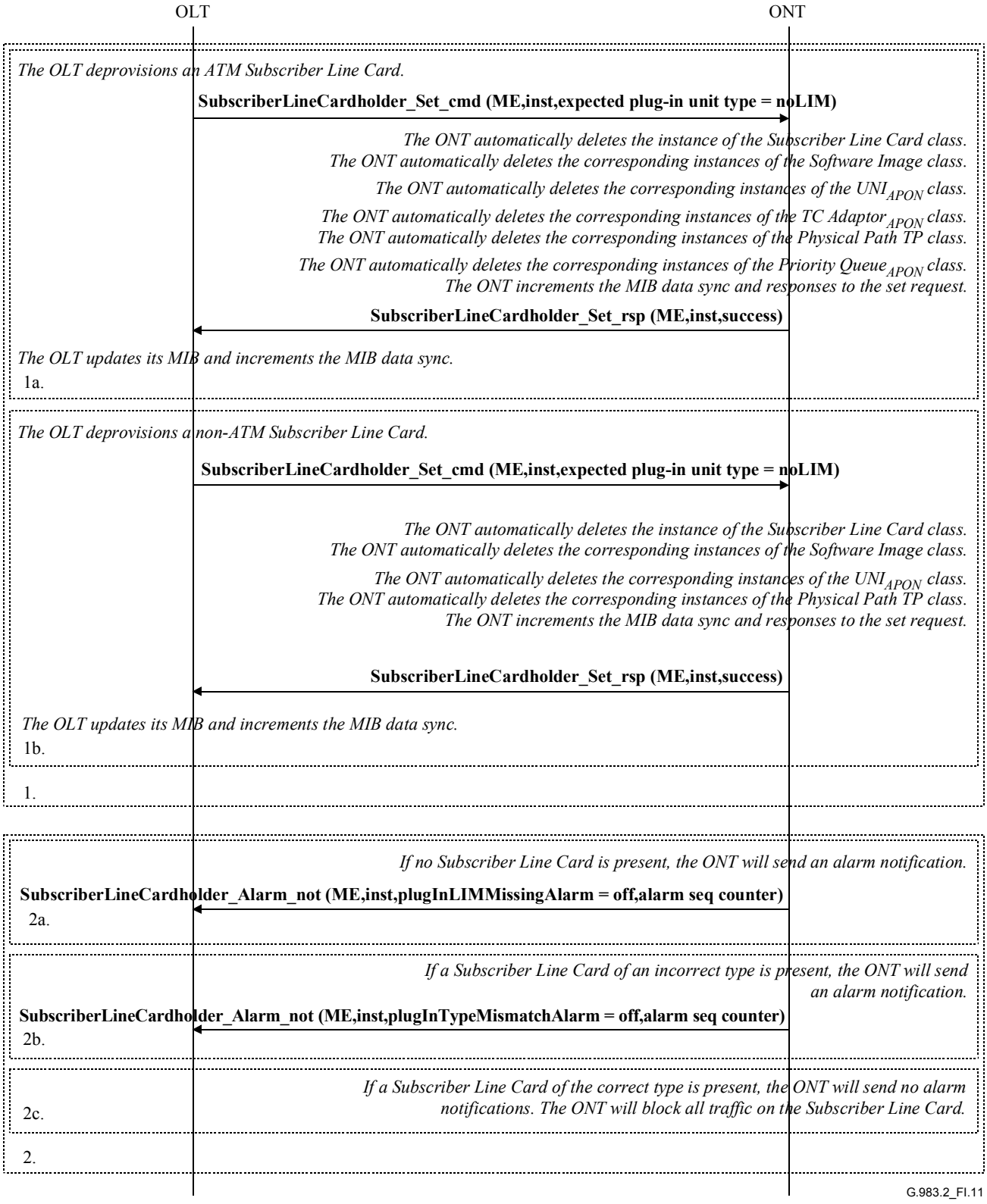


Figure I.11/G.983.2 – Subscriber line card deprovisioning

I.2.5 Plug-and-play subscriber line card provisioning

A subscriber line cardholder can be provisioned for a plug-and-play mode of operation (see also Figure 10). Figure I.12 shows the scenario for provisioning a slot for plug-and-play.

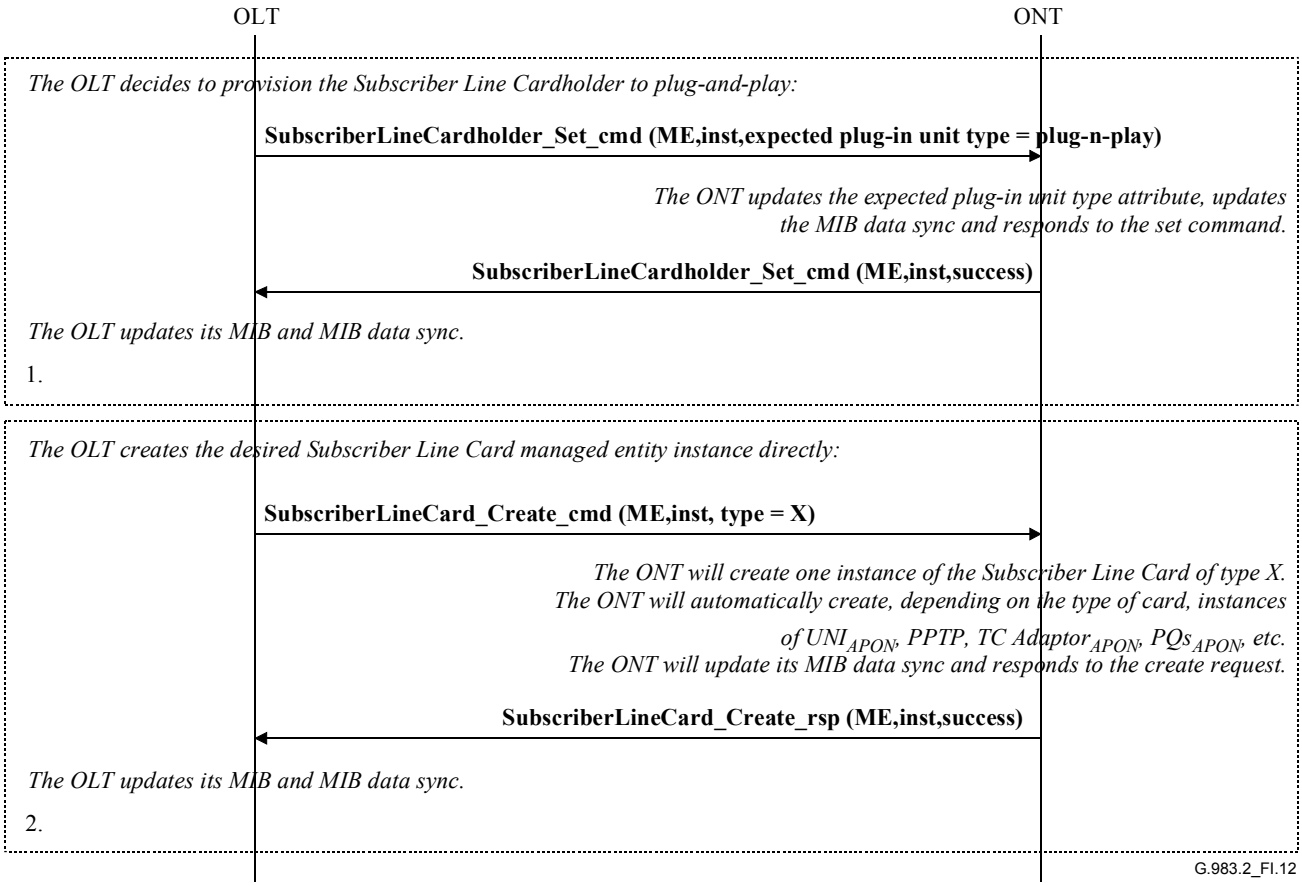


Figure I.12/G.983.2 – Plug-and-play subscriber line card provisioning

Not shown in the scenario diagram given in Figure I.12 are the notifications of the ONT due to incorrectly inserted subscriber line cards. Figure 10 is given for this purpose.

I.2.6 Plug-and-play subscriber line card deprovisioning

When a subscriber line card is removed from a subscriber line cardholder, a notification will be send to the OLT. The OLT will deprovision the subscriber line cardholder upon receiving the notification (see Figure I.13).

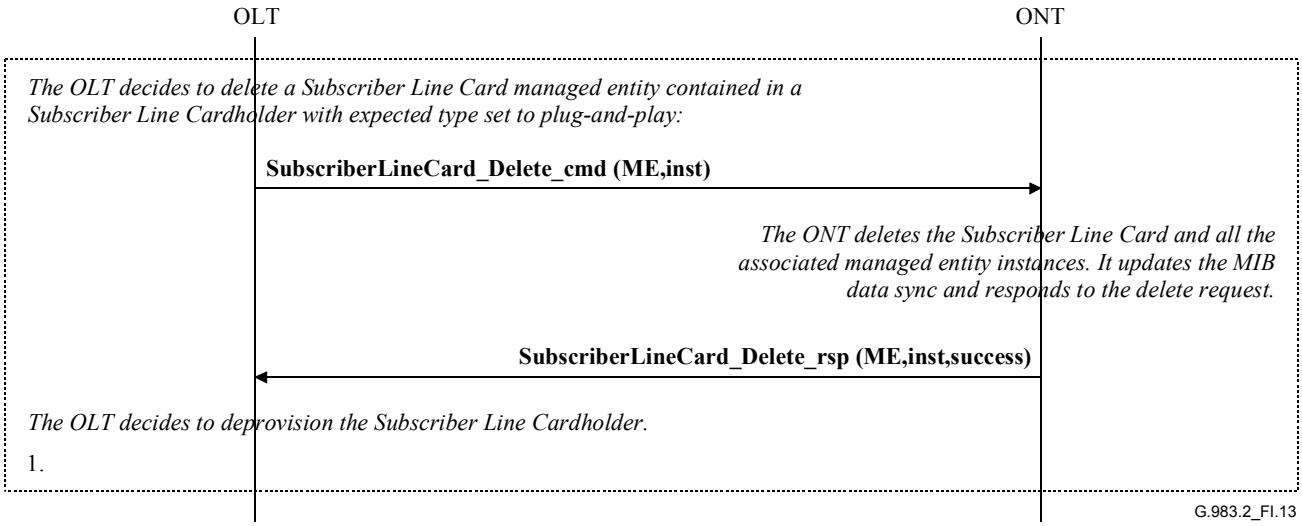


Figure I.13/G.983.2 – Plug-and-play subscriber line card deprovisioning

I.2.7 ATM service set-up

The ATM connections within the ONT can be created in two ways: one consists of consecutively requesting the creation of two VP Network $CTP_{B\text{-}PON}$s and one ATM VP Cross-Connection (Figure I.14), whereas the other uses one request which will cause the simultaneous creation of two VP Network $CTP_{B\text{-}PON}$s and one ATM VP Cross-Connection (Figure I.15).

In the given figures for ATM service set-up, the assumption is made that Priority Queues are used. If Traffic Descriptors are used, the Traffic Descriptor managed entity instance for the requested service must be created first. Also, the OLT might want to create corresponding History Data managed entities for the connection.

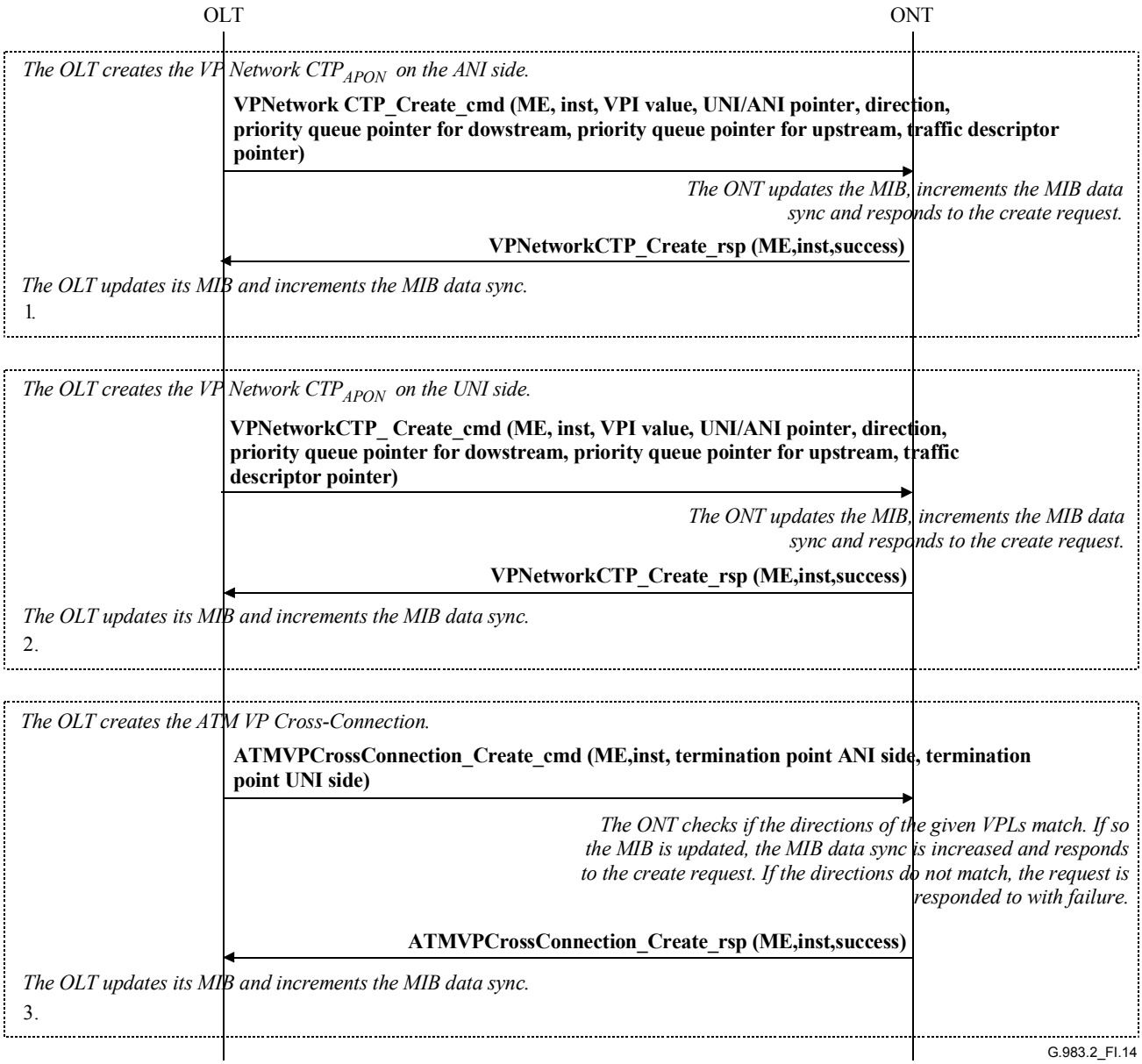


Figure I.14/G.983.2 – VP cross-connection set-up (alternative 1)

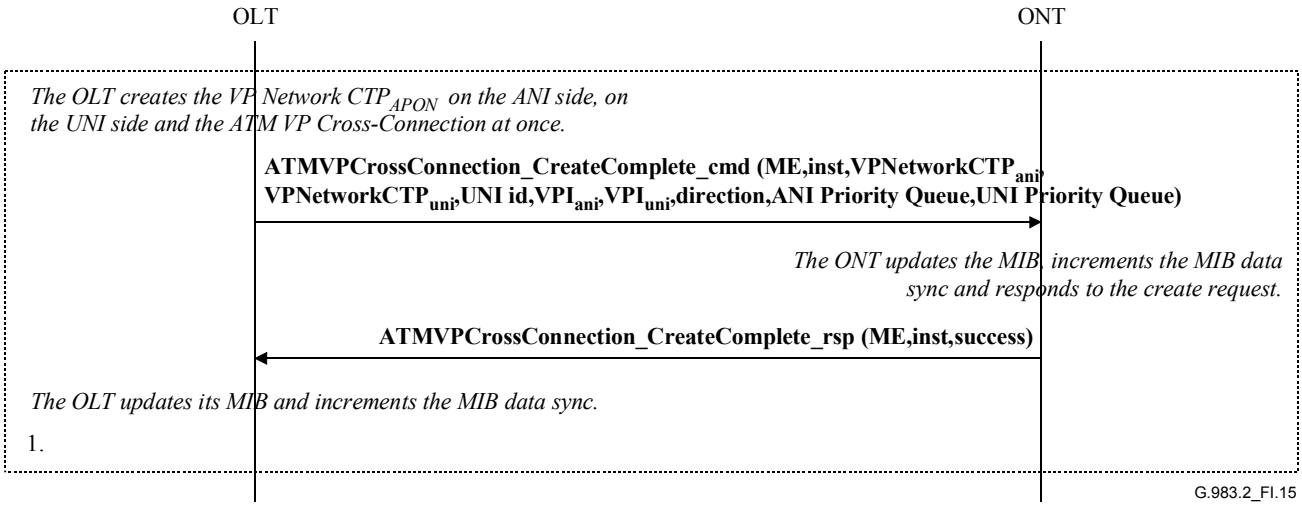


Figure I.15/G.983.2 – VP cross-connection set-up (alternative 2)

I.2.8 ATM service take-down

The connections within the ONT can be deleted in two ways: one consists of consecutive deletion of the ATM VP Cross-Connection and the two VP Network $CTP_{B\text{-}PONS}$ (Figure I.16), whereas the other uses one request to delete the ATM VP Cross-Connection and the two associated VP Network $CTP_{B\text{-}PON}$s (Figure I.17). The correct order of the deletion of the instances in the first alternative is under the control of the OLT. If applicable, the OLT must delete the corresponding History Data managed lenities as well.

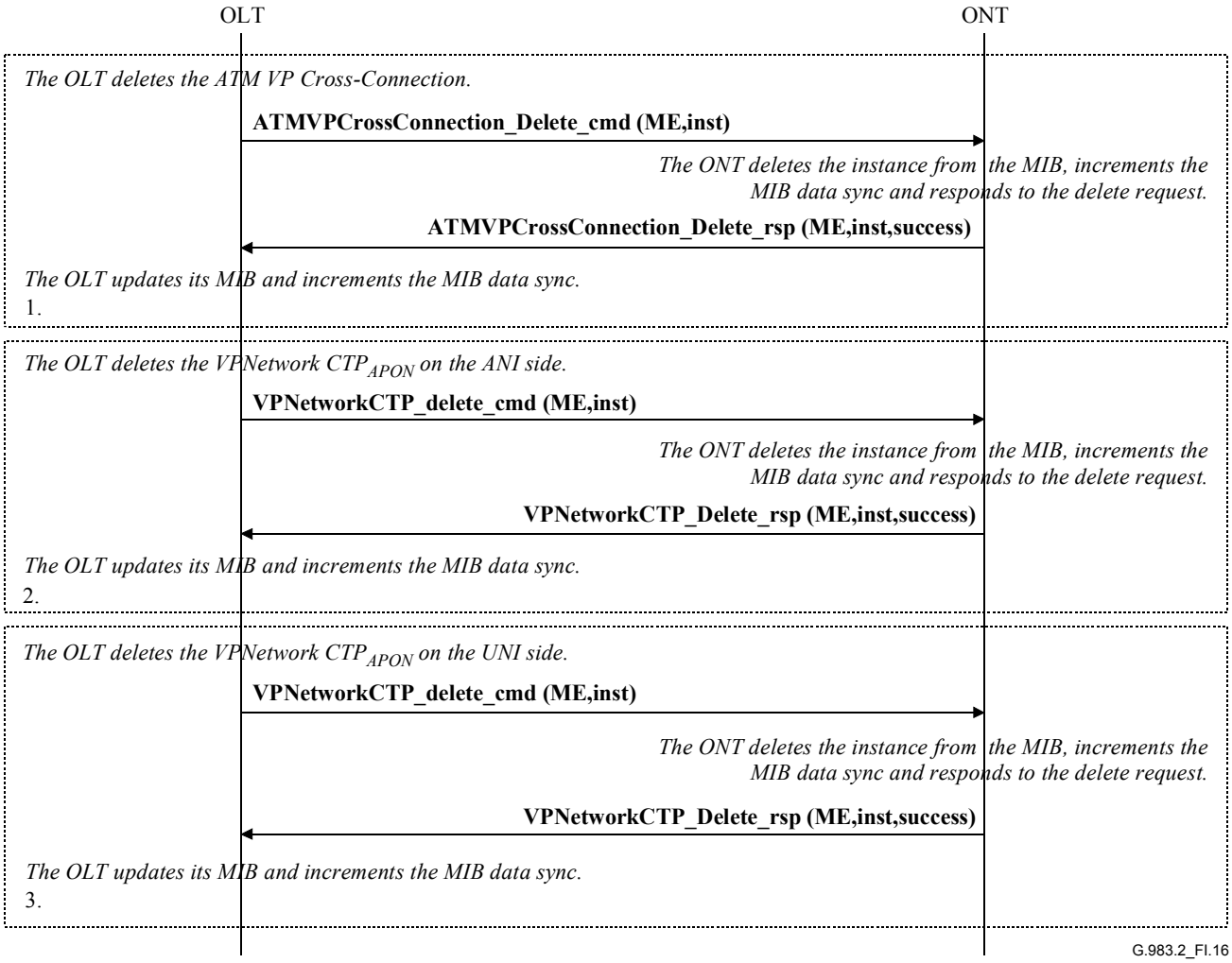


Figure I.16/G.983.2 – VP cross-connection deletion (alternative 1)

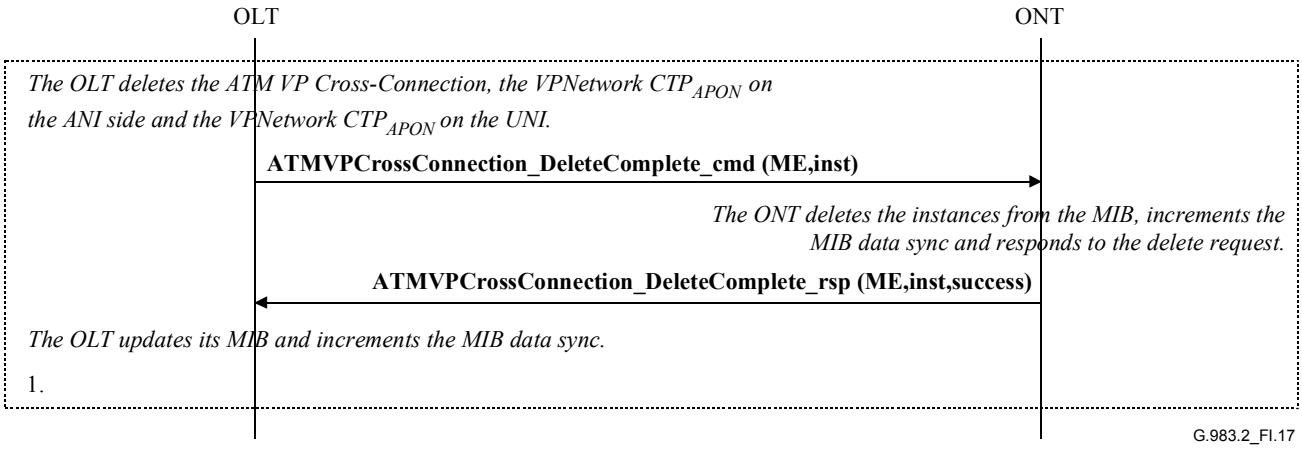


Figure I.17/G.983.2 – VP cross-connection deletion (alternative 2)

I.2.9 Structured CES service connection set-up

The following scenario of structured CES service connection set-up is given for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side.

Figure I.18 shows the set-up of the first structured CES service on a Subscriber Line Card. Additional services on the same UNI interface, with their Interworking VCC Termination Points, AAL 1 $Profile_{B\text{-}PON}$s and CES $Profile_{B\text{-}PON}$s, can also share the same VP Network $CTP_{B\text{-}PON}$.

Note that the AAL 1 and CES profiles can be shared among multiple Interworking VCC Termination Points. No creation of profiles is needed if the Interworking VCC Termination Point is pointing to an existing profile.

Also, the OLT might want to create corresponding History Data managed entities for the connection.

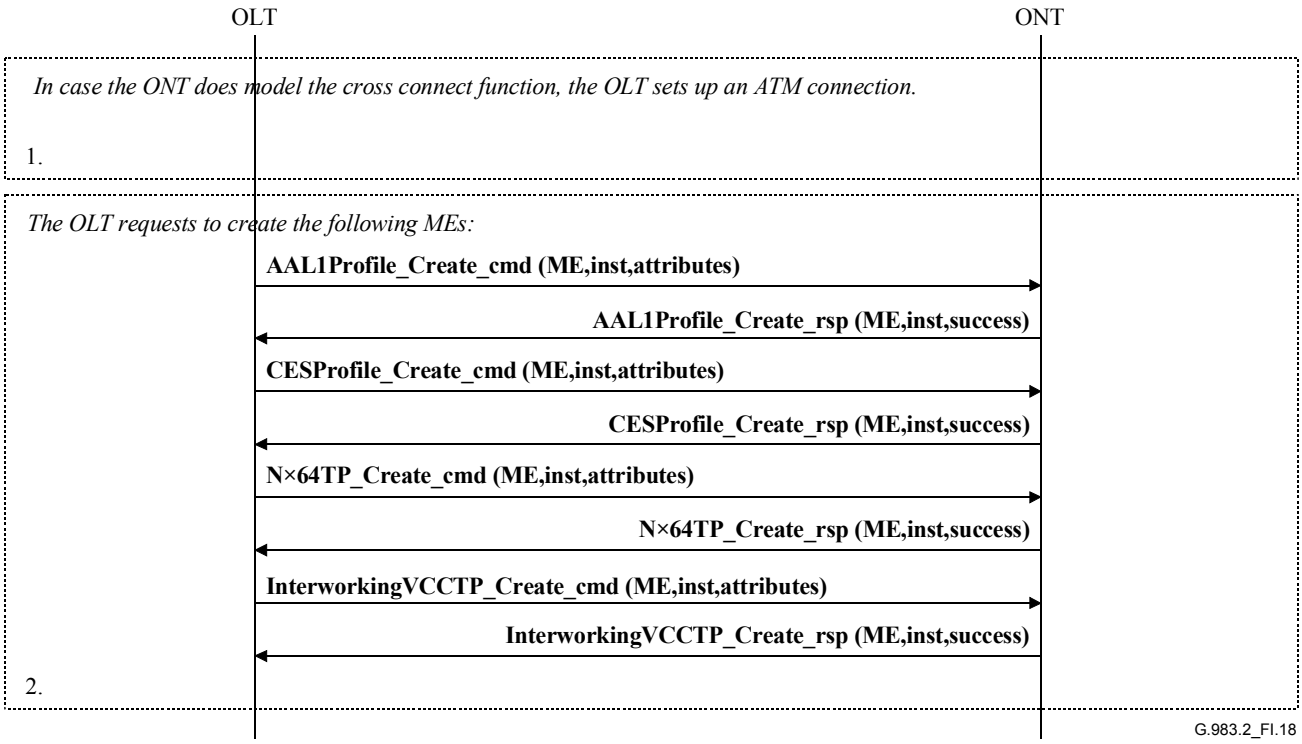


Figure I.18/G.983.2 – Connection set-up of a structured CES

I.2.10 Structured CES service connection tear-down

The following scenario, shown in Figure I.19, of structured CES service connection tear-down is given for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side.

Note that the AAL 1 and CES profiles can be shared among multiple Interworking VCC Termination Points. If there are more Interworking VCC Termination Points associated with these profile managed entities, the OLT may not request to delete them. This holds also for the ATM connection used: if more Interworking VCC Termination Points are associated with this connection (i.e. VP Network $CTP_{B\text{-}PON}$), the ATM connection cannot be deleted.

If applicable, the OLT must delete the corresponding History Data managed entities as well.

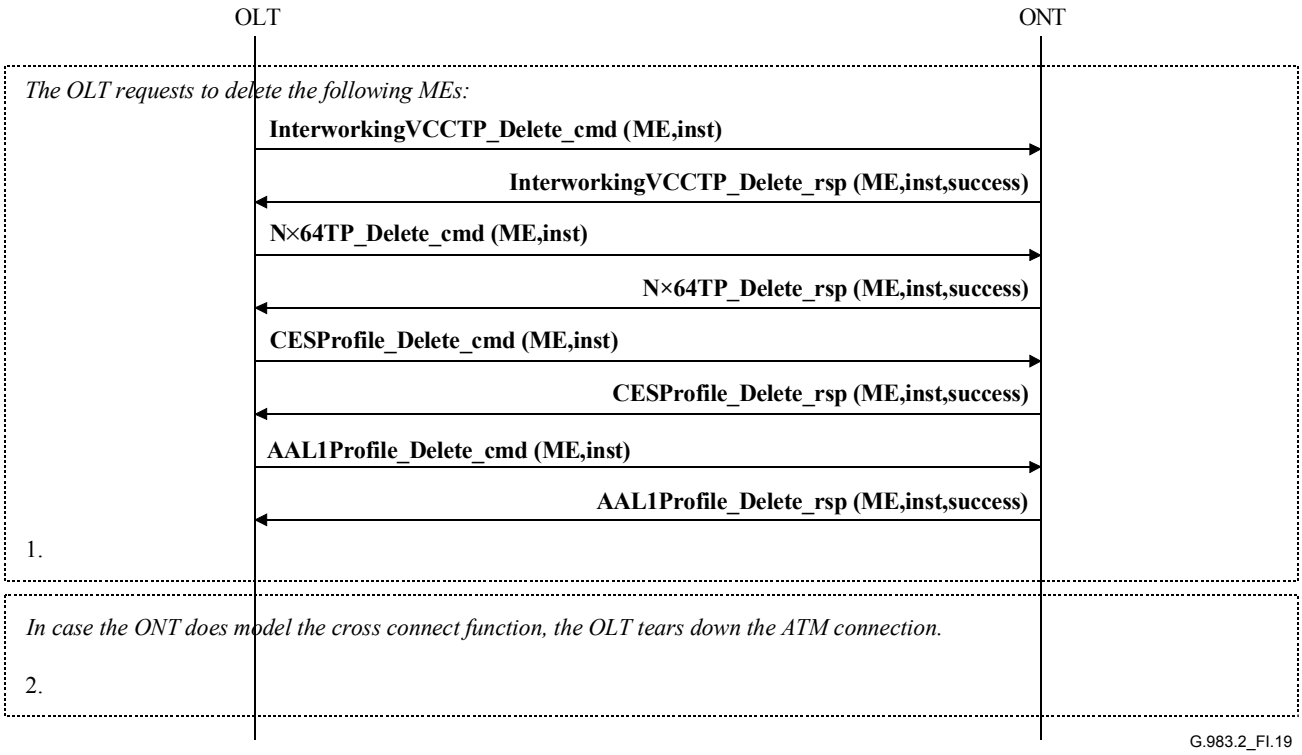


Figure I.19/G.983.2 – Connection tear-down of a structured CES

I.2.11 Unstructured CES service connection set-up

The following scenario, shown in Figure I.20, for unstructured CES service connection set-up is given for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side.

Note that the AAL 1 and CES profiles can be shared among multiple Interworking VCC Termination Points. No creation of profiles is needed if the Interworking VCC Termination Point is pointing to an existing profile.

Also, the OLT might want to create corresponding History Data managed entities for the connection.

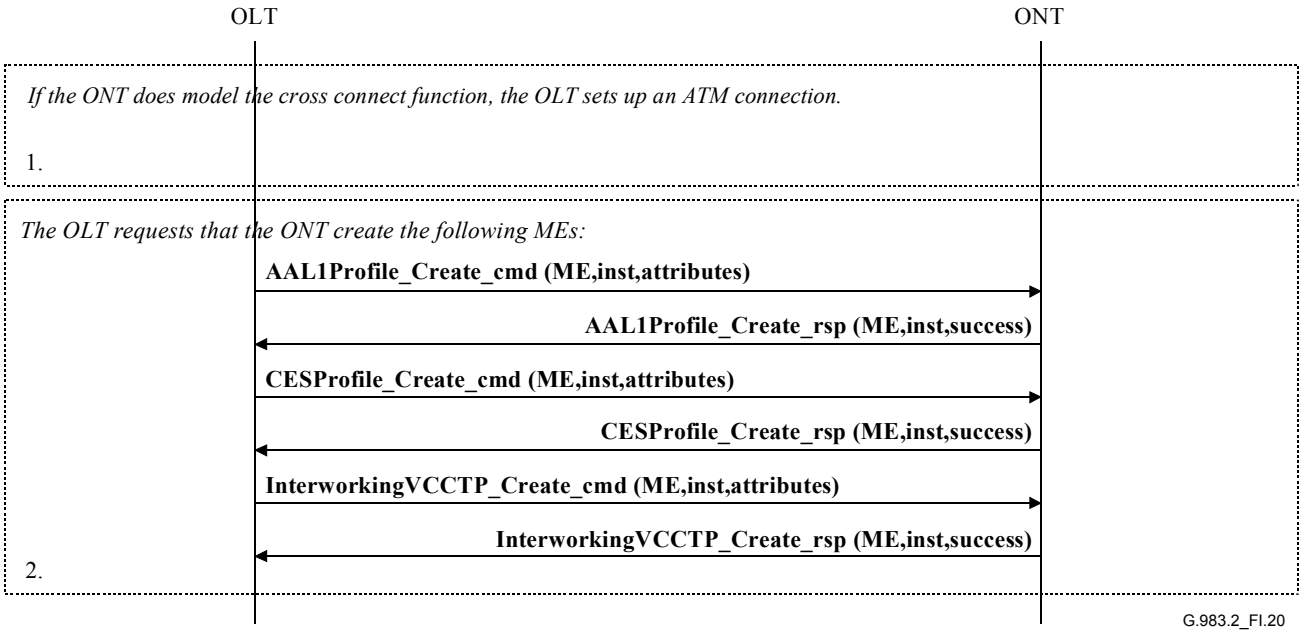


Figure I.20/G.983.2 – Connection set-up of an unstructured CES

I.2.12 Unstructured CES service connection tear-down

The following scenario, shown in Figure I.21, for an unstructured CES service connection tear-down is given for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side.

Note that the AAL 1 and CES profiles can be shared among multiple Interworking VCC Termination Points. If there are more Interworking VCC Termination Points associated with these profile managed entities, the OLT may not request to delete them. This holds also for the ATM connection used: if more Interworking VCC Termination Points are associated with this connection (i.e. VP Network $CTP_{B\text{-}PON}$), the ATM connection cannot be deleted.

If applicable, the OLT must delete the corresponding History Data managed entities as well.

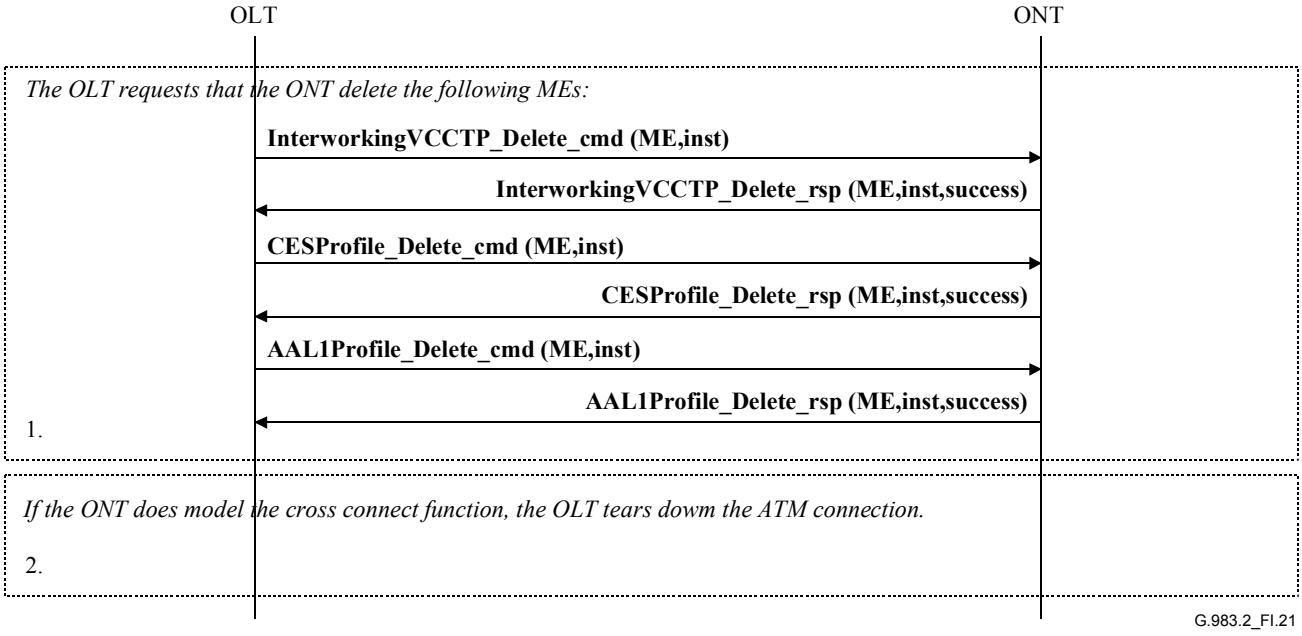


Figure I.21/G.983.2 – Connection tear-down of an unstructured CES

I.2.13 Ethernet connection set-up

Note that AAL 5 profiles can be shared among multiple Interworking VCC Termination Points. No creation of profiles is needed if the Interworking VCC Termination Point is pointing to an existing profile.

Also, the OLT might want to create corresponding History Data managed entities for the connection.

I.2.14 Ethernet connection tear-down

Note that AAL 5 profiles can be shared among multiple Interworking VCC Termination Points. If there are more Interworking VCC Termination Points associated with these profile managed entities, the OLT may not request to delete them. This holds also for the ATM connection used: if more Interworking VCC Termination Points are associated with this connection (i.e. VP Network $CTP_{B\text{-}PON}$), the ATM connection cannot be deleted.

If applicable, the OLT must delete the corresponding History Data managed entities as well.

I.2.15 Software image download

The download of a Software Image is based on a "segmented stop and wait" protocol; thus, the next segment can only be transmitted to the ONT if the previous segment is positively acknowledged. A Software Image segment (also named window) consists of one of more Software Image sections. Each section is transmitted in one OMCC message.

The number of sections in a segment is negotiated before the actual download. First the OLT proposes a segment size (not greater than 256). The ONT can propose a smaller segment size in the response. If the response indicates a smaller segment size, this is the size to be used in the download. Thus, an image segment consists of N image sections, with N being equal to the segment size. Only the last image section is acknowledged. If the ONT processed all sections of a segment properly, the acknowledgement will be positive, after which the OLT will download the next segment.

Note that the section numbering starts from 0 so that segments of precisely 8 kilobytes can be downloaded.

If an error occurred with a section of a segment (e.g. CRC error or missed section), the last section will be negatively acknowledged, which will result in an entire retransmission of the last segment.

When the last segment transferred is positively acknowledged, the OLT sends a CRC-32 to the ONT in the Software Image end download command. The ONT calculates the CRC-32 and compares it to the CRC received from the OLT. If they are equal, the image is considered valid. Figure I.22 gives the scenario for the software download.

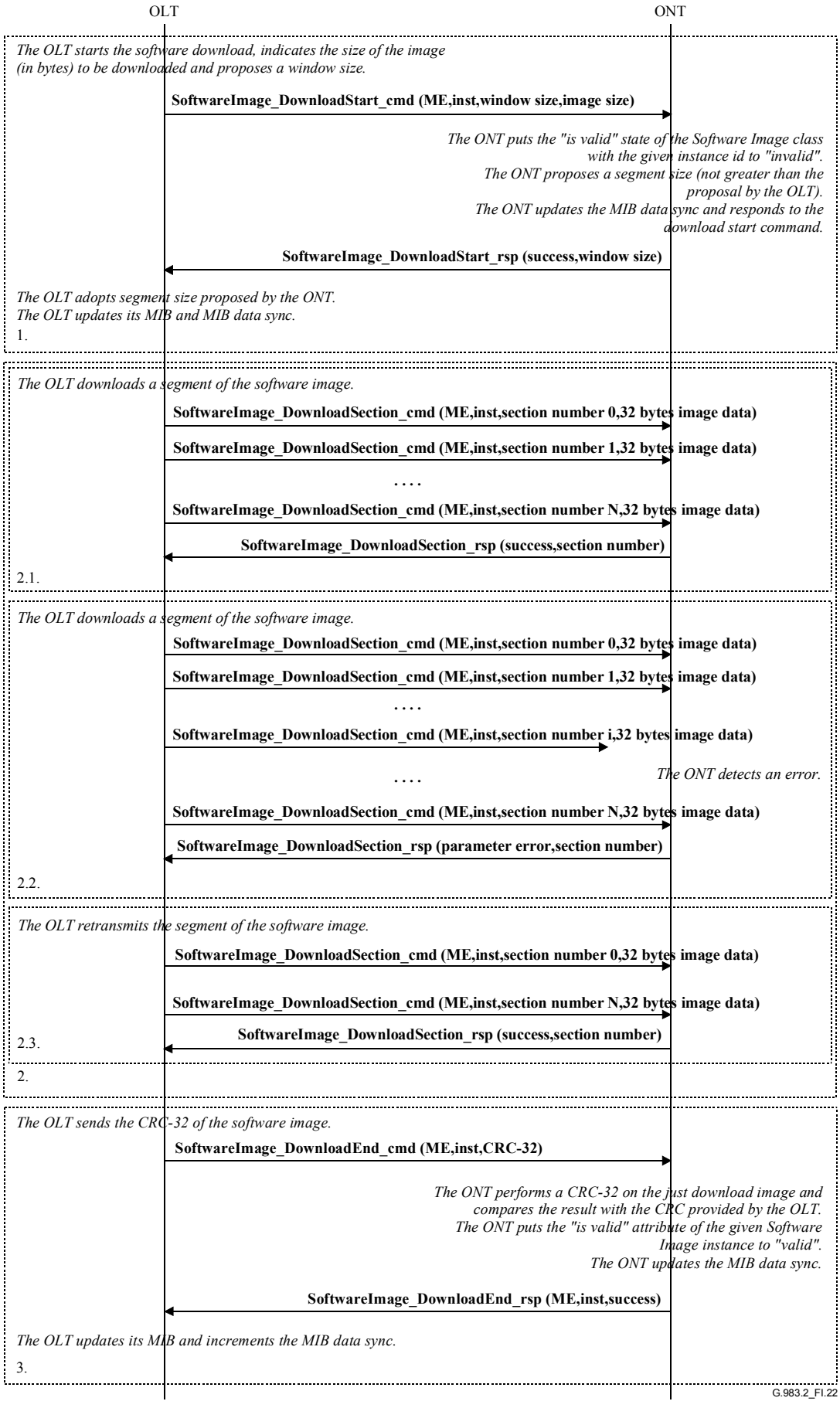


Figure I.22/G.983.2 – Software download

I.2.16 Software image activate and commit

See Figure I.23.

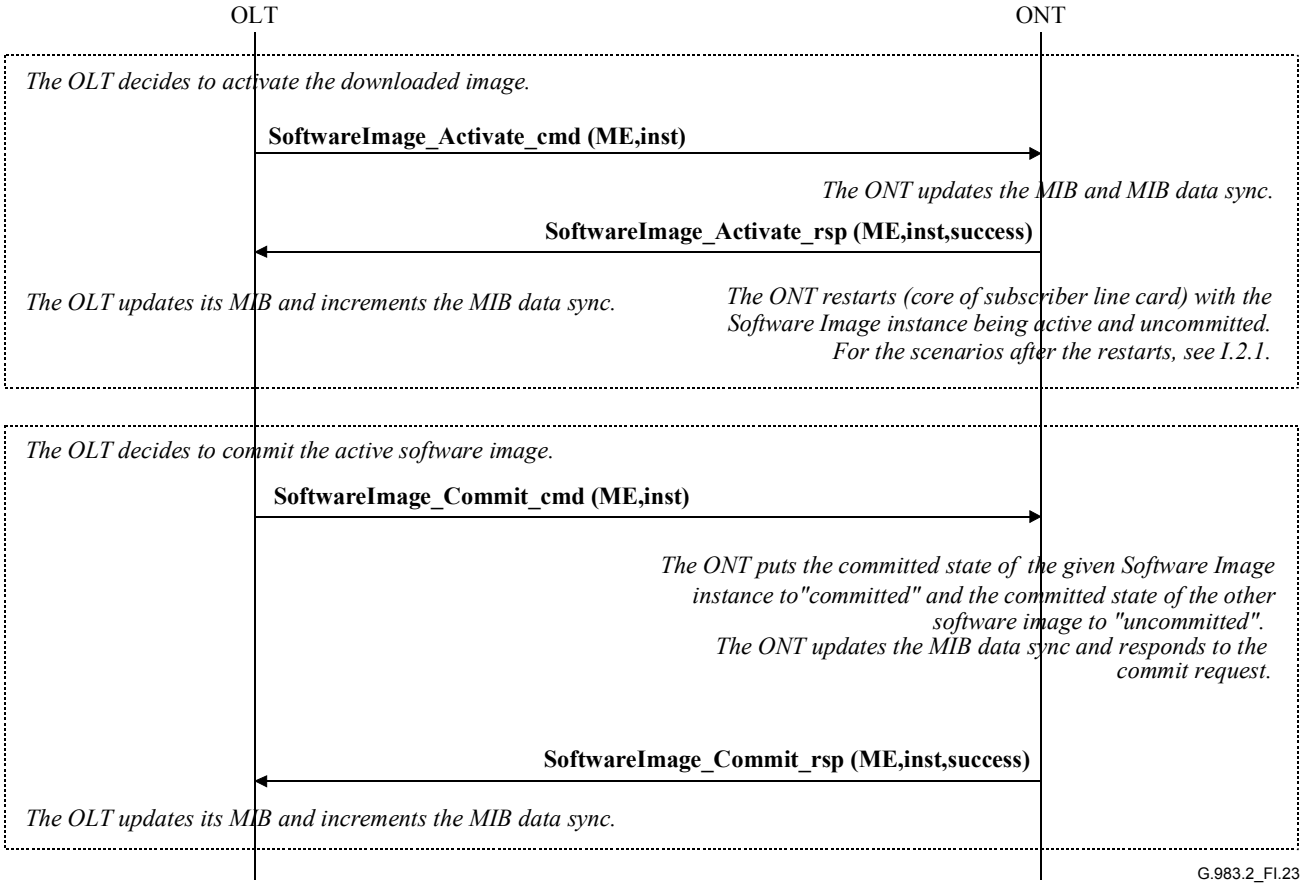


Figure I.23/G.983.2 – Software activate (above) and software commit (below)

I.2.17 MAC bridge service connection set-up

Figure I.24 shows the scenario for MAC bridge service connection set-up for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side. Note that the AAL 5 $Profile_{B\text{-}PON}$ can be shared among multiple Interworking VCC Termination Points. No creation of profiles is needed if the Interworking VCC Termination Point points to an existing profile. Also, the OLT may want to create corresponding History Data managed entities for the connection.

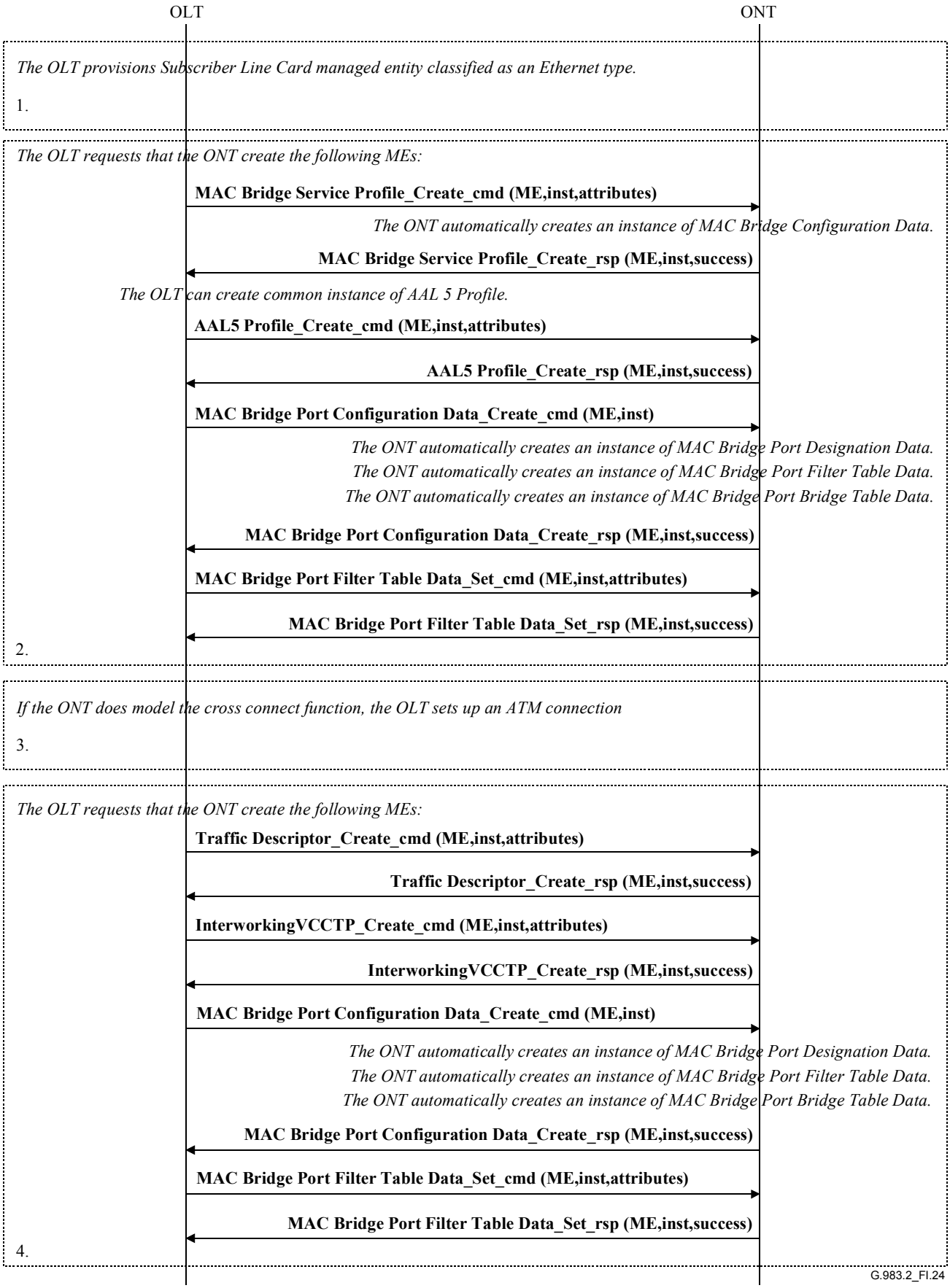


Figure I.24/G.983.2 – Connection set-up for MAC bridge service connection

I.2.18 MAC bridge service connection tear-down

The following scenario, Figure I.25, depicts MAC bridge service connection tear-down for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side. Note that the AAL 5 $Profile_{B\text{-}PON}$ can be shared among multiple Interworking VCC Termination Points. If there are more Interworking VCC Termination Points associated with this profile managed entity, the OLT may not request to delete it. This holds also for the ATM connection used: if more Interworking VCC Termination Points are associated to this connection (i.e. VP Network $CTP_{B\text{-}PON}$), the ATM connection cannot be deleted. If applicable, the OLT must delete the corresponding History Data managed entities as well.

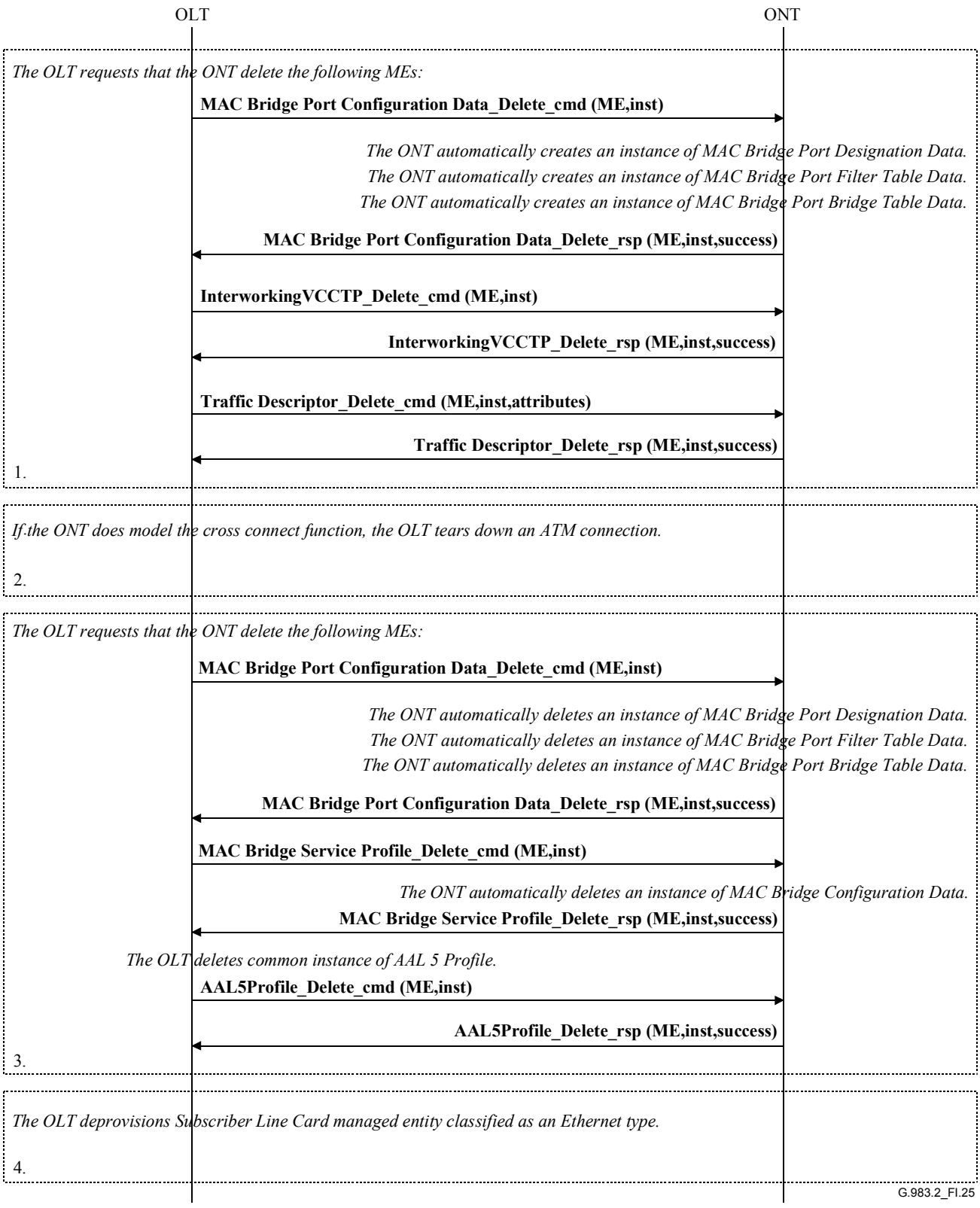


Figure I.25/G.983.2 – Connection tear-down for MAC bridge service connection

I.2.19 Addition of entries on MAC filter table

The following scenario, Figure I.26, depicts addition of entries to the MAC Filter Table for an ONT.

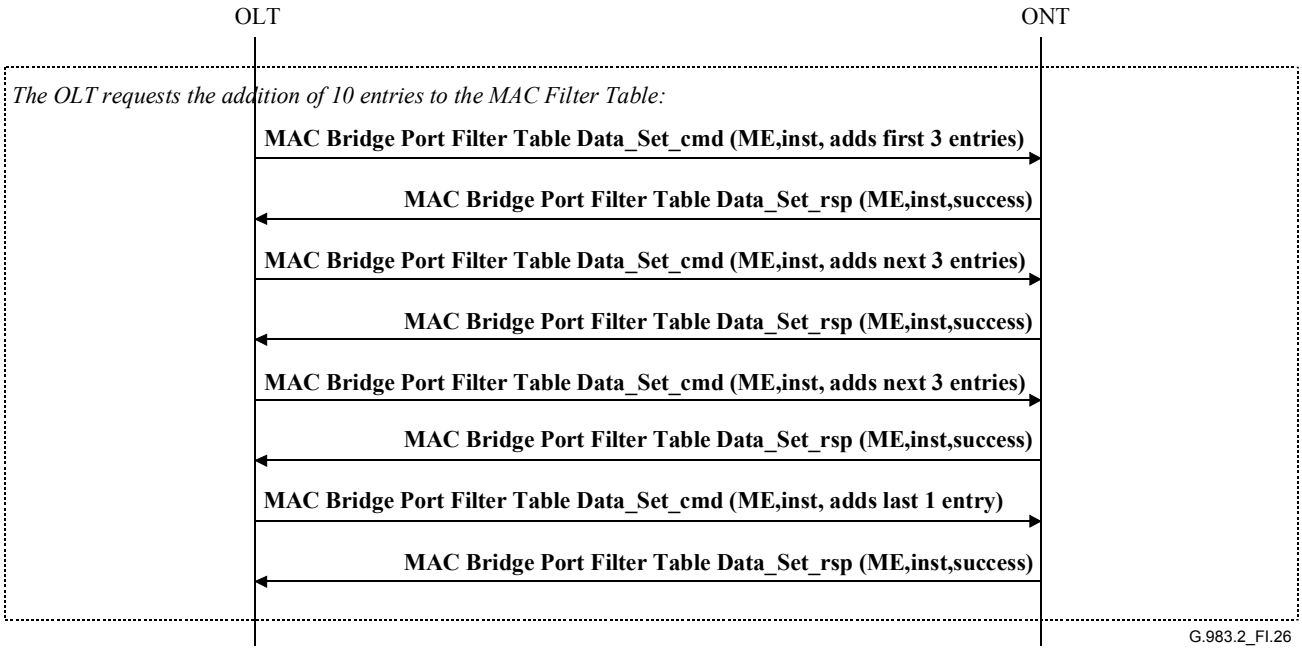


Figure I.26/G.983.2 – Addition of entries to the MAC filter table

I.2.20 Removal of entries from MAC filter table

The following scenario, Figure I.27, depicts the removal of entries from the MAC Filter Table for an ONT.

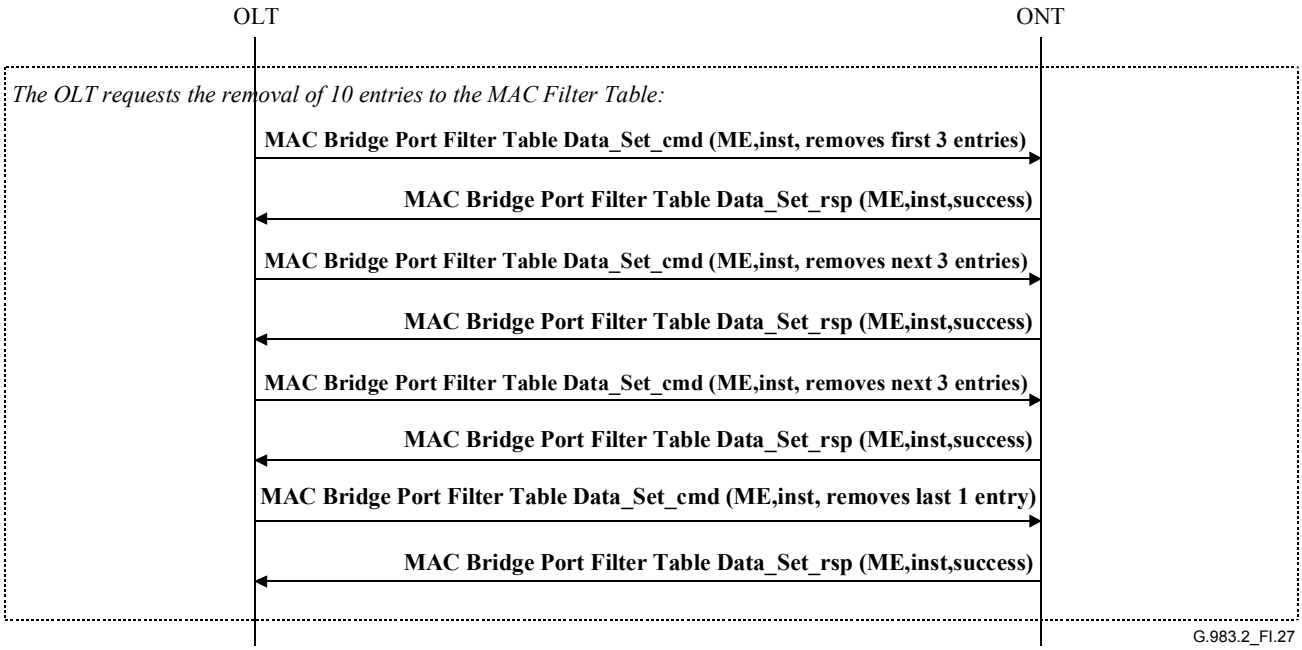


Figure I.27/G.983.2 – Removal of entries from MAC filter table

I.2.21 Voice over AAL 2 service connection set-up

The following scenario, Figure I.28, depicts Voice over AAL 2 service connection set-up for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side. Note that the Voice Service, LES Service, AAL 2 and AAL 2 PVC profiles can be shared among multiple Interworking VCC Termination Points. No creation of profiles is needed if the Interworking VCCTP points to an existing profile. Moreover, the SSCS Parameter1 and SSCS Parameter2 profiles can be shared among multiple AAL 2 $Profile_{B\text{-}PON}$s, so no creation of profiles is needed if the AAL 2 $Profile_{B\text{-}PON}$ points to an existing profile. Also, the OLT may want to create corresponding History Data managed entities for the connection.

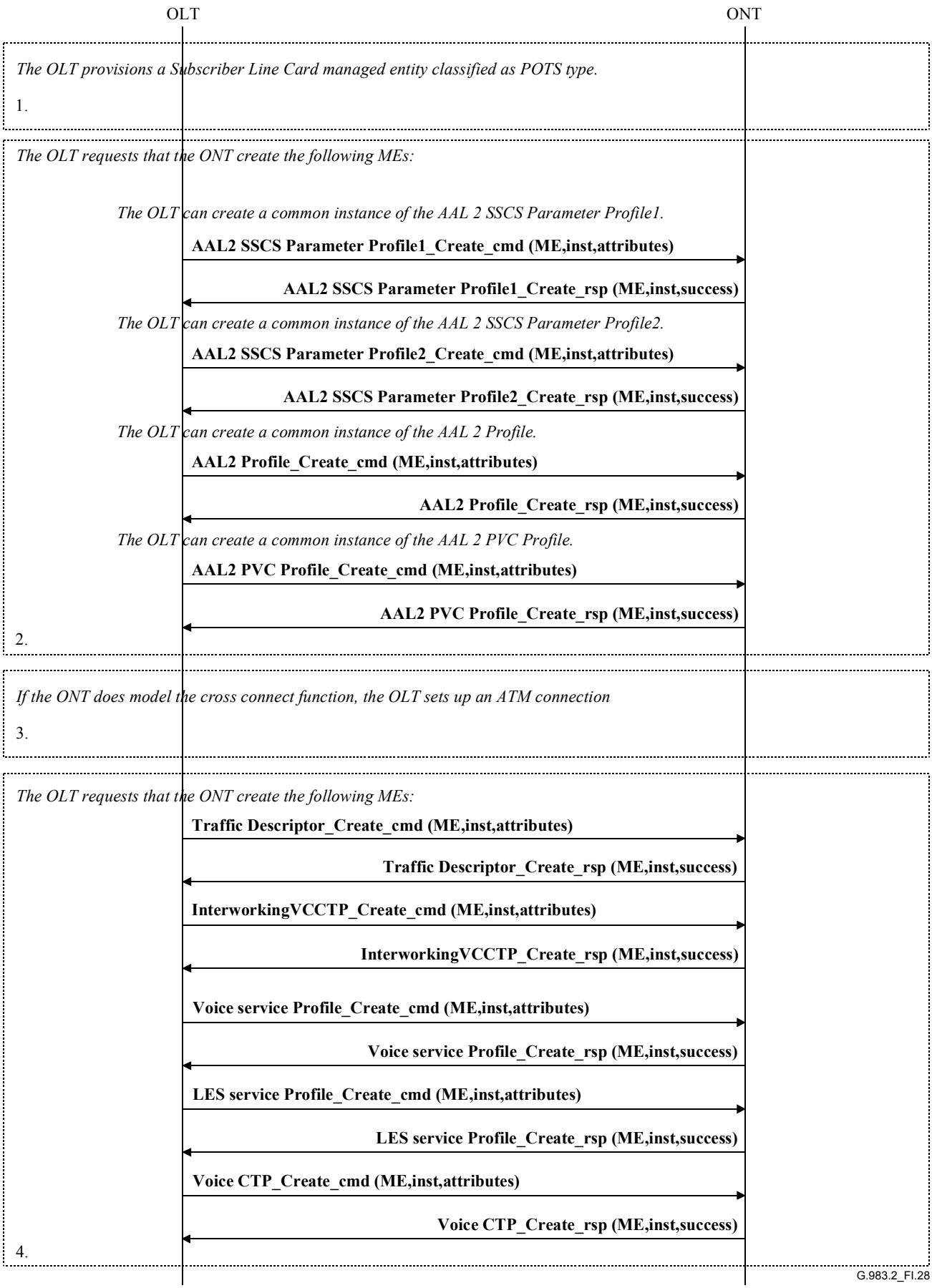


Figure I.28/G.983.2 – Connection set-up for voice over AAL 2 service connection

I.2.22 Voice over AAL 2 service connection tear-down

The following scenario, Figure I.29, depicts the Voice over AAL 2 service connection tear-down for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side. Note that the Voice Service, LES Service, AAL 2 and AAL 2 PVC profiles can be shared among multiple Interworking VCC Termination Points. If there are more Interworking VCC Termination Points associated with these profile managed entities, the OLT may not request to delete them. This holds also for the ATM connection used: if more Interworking VCC Termination Points are associated with this connection (i.e. VP Network $CTP_{B\text{-}PON}$), the ATM connection cannot be deleted. Moreover, the SSCS Parameter1 and SSCS Parameter2 profiles can be shared among multiple AAL 2 $Profiles_{B\text{-}PON}$. If there are more AAL 2 $Profiles_{B\text{-}PON}$ associated with these profile managed entities, the OLT may not request to delete them. If applicable, the OLT must delete the corresponding History Data managed entities as well.

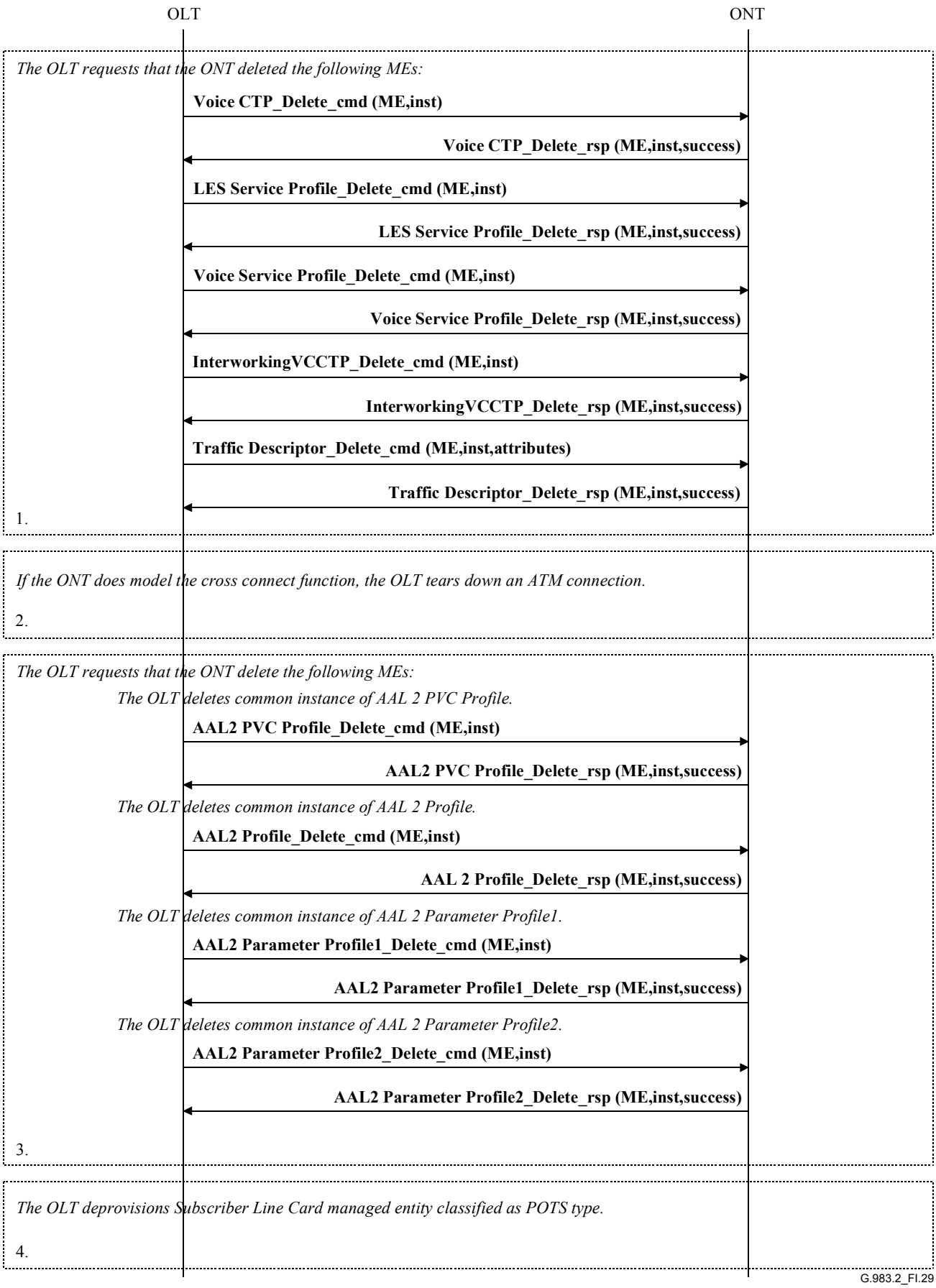


Figure I.29/G.983.2 – Voice over AAL 2 service connection tear-down

I.2.23 Voice over AAL 1 service connection set-up

The following scenario, Figure I.30, for Voice over AAL 1 service connection set-up is given for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side.

Note that the Voice Service and AAL 1 profiles can be shared among multiple Interworking VCC Termination Points. No creation of profiles is needed if the Interworking VCC Termination Point is pointing to an existing profile. Also, the OLT might want to create corresponding History Data managed entities for the connection.

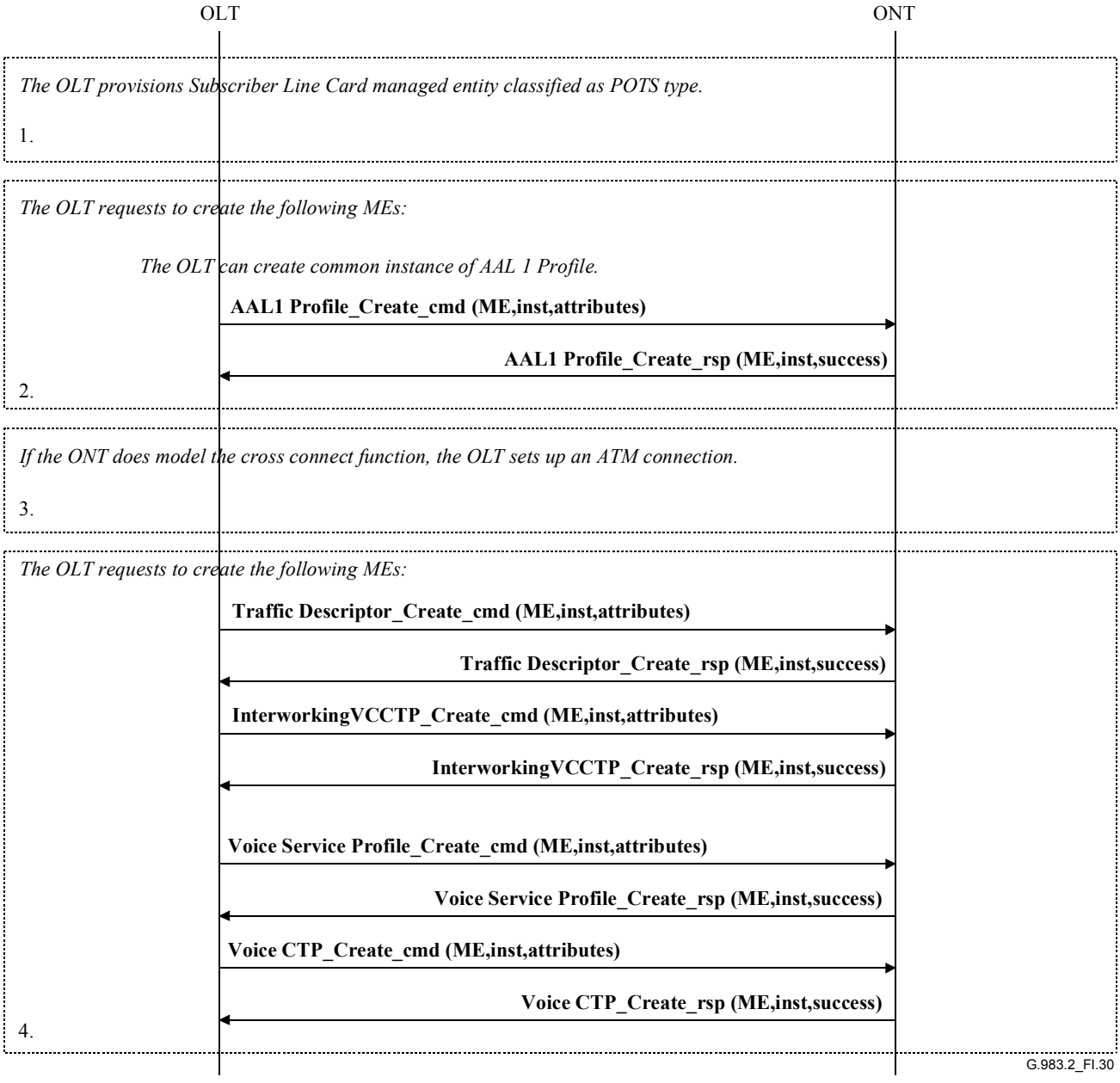


Figure I.30/G.983.2 – Connection set-up Voice over AAL 1 service connection

I.2.24 Voice over AAL 1 service connection tear-down

The following scenario, Figure I.31, for Voice over AAL 1 service connection tear-down is given for an ONT with cross-connect functionality. For an ONT that does not model cross-connect functionality, the Interworking VCC Termination Point is directly associated with the VP Network $CTP_{B\text{-}PON}$ on the ANI side.

Note that the Voice Service and AAL 1 profiles can be shared among multiple Interworking VCC Termination Points. If there are more Interworking VCC Termination Points associated with these profile managed entities, the OLT may not request to delete them. This holds also for the ATM connection used: if more Interworking VCC Termination Points are associated with this connection (i.e. VP Network $CTP_{B\text{-}PON}$), the ATM connection cannot be deleted. If applicable, the OLT must delete the corresponding History Data managed entities as well.

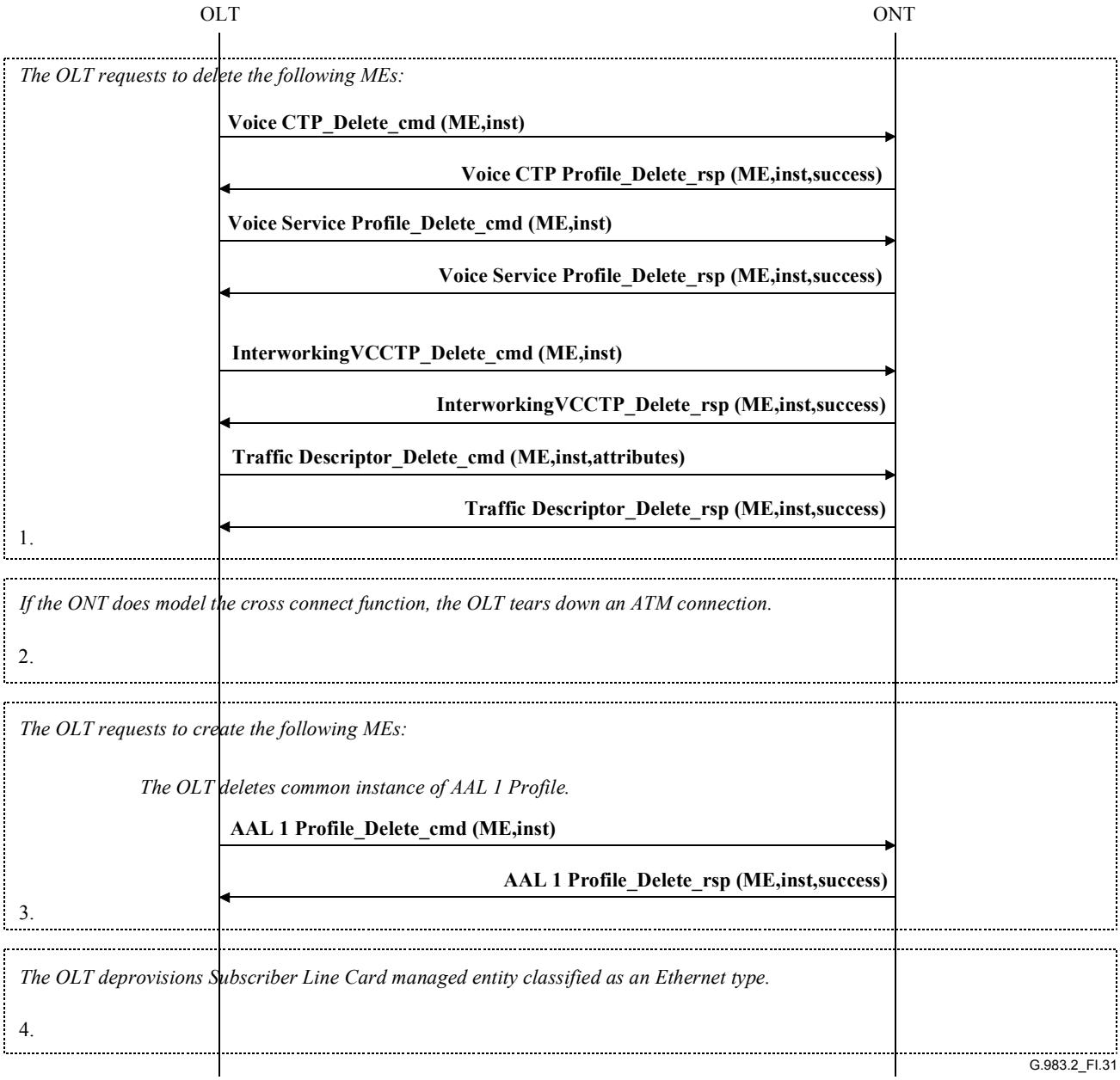


Figure I.31/G.983.2 – Connection tear-down for Voice over AAL 1 service connection

Appendix II

OMCI message set

II.1 General remarks

II.1.1 Message type identifier

In 9.1.4, the message types are given. This identifier is omitted in the message set below.

II.1.2 Entity class identifier

In 9.1.6, the entity class identifiers are given. This identifier is omitted in the message set below.

II.1.3 Result and reason

Responses to commands can indicate the result of the command. A value of "null" will indicate that the command was processed successfully. Non-null values will indicate the reason of the failure. If the result was "failure", the rest of the message contents will be filled with all 0x00s. The definition of each result and reason is as follows:

1) *Command processed successfully*

   There are two functions for command processing: command interpretation and command execution. This result means that the received command, such as Get/Set/Test/Reboot, was properly interpreted by the ONT's command interpretation function without errors and that the interpreted command was successfully transferred to the ONT's command execution function.

2) *Command processing error*

   This result means the command processing failed at the ONT due to some reason not described by item 3), 4), etc.

3) *Command not supported*

   This result means that the message type indicated in Byte 8 is not supported by the ONT.

4) *Parameter error*

   This result means that the command message received by the ONT was errored.

5) *Unknown managed entity*

   This result means that the managed entity class indicated in Byte 10 is not supported by the ONT.

6) *Unknown managed entity instance*

   This result means that the managed entity instance indicated in Bytes 11 and 12 does not exist in the ONT.

7) *Device busy*

   This result means that the command could not be processed due to process-related congestion at the ONT.

8) *Attribute(s) failed or unknown*

   This result means that an optional attribute is not supported by the ONT or that a mandatory/optional attribute could not be executed by the ONT, even if it is supported. In conjunction with this result, attribute masks are used to indicate which attributes failed or were unknown.

   The following two kinds of attribute masks are used when this result/reason is raised:

   – *optional attribute mask coding*, which indicates whether or not the optional attribute is supported. Bytes 14 and 15 are assigned to this mask.

– *attribute execution mask coding*, which indicates whether or not the mandatory/optional attribute was executed. Bytes 16 and 17 are assigned to this mask.

If one or more optional attributes are not supported by the ONT, the "optional attribute mask coding" for each *unsupported* optional attribute becomes 1 while the corresponding "attribute execution mask coding" remains 0.

If one or more mandatory or optional attributes were not executed by the ONT, the "optional attribute mask coding" remains 0, while the "attribute execution mask coding" becomes 1 for each *failed* attribute."

II.1.4 Get, Get response and Set messages

For an attribute mask, a bitmap is used in the "Get", "Get response" and "Set" messages. This bitmap indicates which attributes are requested (Get) or provided (Get response and Set). The bitmap is composed as follows (see Table II.1):

Table II.1/G.983.2 – Attribute mask coding

Byte	Bit							
	8	7	6	5	4	3	2	1
1	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Attribute 5	Attribute 6	Attribute 7	Attribute 8
2	Attribute 9	Attribute 10	Attribute 11	Attribute 12	Attribute 13	Attribute 14	Attribute 15	Attribute 16

The attribute numbers correspond to the ordering of the attributes in clause 7. Note that the Managed Entity identifier, which is an attribute of each managed entity, has no corresponding bit in the attribute mask. Thus, the attributes are counted starting from the first attribute after the Managed Entity identifier.

II.1.5 Alarm notifications

The ONT will send this notification each time an alarm has changed status for the entity indicated in the message identifier. The message shows the status of *all* alarms of this entity. It is up to the OLT to determine which alarms changed status.

The maximum number of alarms that is supported by the OMCI is 240; thus, the alarm bitmap uses 30 bytes. The bitmap is composed as follows (see Table II.2):

Table II.2/G.983.2 – Alarm mask coding

Byte	Bit							
	8	7	6	5	4	3	2	1
1	Alarm 0	Alarm 1	Alarm 2	Alarm 3	Alarm 4	Alarm 5	Alarm 6	Alarm 7
2	Alarm 8	Alarm 9	Alarm 10	Alarm 11	Alarm 12	Alarm 13	Alarm 14	Alarm 15
…								
30	Alarm 232	Alarm 233	Alarm 234	Alarm 235	Alarm 236	Alarm 237	Alarm 238	Alarm 239

The alarm numbers correspond to the alarm coding in clause 7. Bits in the alarm bitmap that correspond to non-existing alarms shall always be set equal to "0". Bits that correspond to an existing alarm are set to a value of "0" to indicate that the corresponding alarm is cleared or a value of "1" to indicate that the alarm has been raised.

Alarm message sequence numbers can obtain values in the interval 1 to 255. Zero is excluded in order to make this counter similar to the MIB data sync counter.

II.1.6 Test, Test response, and Test result

The descriptions below indicate how Test, Test response, and Test result are related.

Test: This message is used to initiate either a self test or an MLT test (or additional tests defined in future).

Test response: This message is an immediate reaction to a Test message. The "Test response" message reports the ability of the ONT to run the required test, but it does not contain any specific results.

Test result: This message is used to report the result of either a self test (requested by the OLT) or a MLT test (or additional test defined in future). In the case of an AUTONOMOUS self test, the Test result notification is not used. Instead, notification is sent to the OLT via an alarm ONLY if the managed entity fails its autonomous self test.

A test on a particular managed entity instance is invoked by sending a Test message to this instance. Each managed entity that supports tests needs to have an action "Test" defined for it. The type of test that is invoked by a Test message depends on the managed entity.

The "Test response" message is an indication to the OLT that the test request is received and is being processed. The results of a requested test will be sent to the OLT via a specific "Test result" message.

The "Test response" message will be sent immediately after the Test message is received (i.e. within the normal response time). The transaction identifier of the "Test response" message is identical to the transaction identifier of the Test message that requested the test.

II.2 Message layout

II.2.1 Create

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 = create
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									Attribute value of first attribute (size depending on the type of attribute)
										…
										Attribute value of last attribute (size depending on the type of attribute)
	xx-45	0	0	0	0	0	0	0	0	Padding

II.2.2 Create response

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 = 1 bits 5-1: action = create
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy 0111 = instance exists
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.3 Create complete connection

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 = create complete connection
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									msb ani VP Network $CTP_{B\text{-}PON}$ instance
	14									lsb ani VP Network $CTP_{B\text{-}PON}$ instance
	15									msb uni VP Network $CTP_{B\text{-}PON}$ instance
	16									lsb uni VP Network $CTP_{B\text{-}PON}$ instance
	17									msb uni/ani pointer (= msb corresponding uni instance)
	18									lsb uni/ani pointer (= lsb corresponding uni instance)
	19									msb vpi ani side

Field	Byte	8	7	6	5	4	3	2	1	Comments
	20									lsb vpi ani side
	21									msb vpi uni side (= 0x00)
	22									lsb vpi uni side
	23	0	0	0	0	0	0	x	x	Direction 01 = uni-to-ani 10 = ani-to-uni 11 = bidirectional
	24									msb priority queue pointer ani VP Network $CTP_{B\text{-}PON}$
	25									lsb priority queue pointer ani VP Network $CTP_{B\text{-}PON}$
	26									msb priority queue pointer uni VP Network $CTP_{B\text{-}PON}$
	27									lsb priority queue pointer uni VP Network CTP
	28									Padding
	29									Padding
	30									msb traffic descriptor profile pointer uni VP Network $CTP_{B\text{-}PON}$
	31									lsb traffic descriptor profile pointer uni VP Network $CTP_{B\text{-}PON}$
	32-45	0	0	0	0	0	0	0	0	Padding

II.2.4 Create complete connection response

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 = 1 bits 5-1: action = create complete connection
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.5 Delete

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	0	0						DB = 0, AR = 1, AK = 0 bits 5-1: action = delete
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.6 Delete response

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 = delete
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.7 Delete complete connection

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 = delete complete connection
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.8 Delete complete connection response

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 = 1 bits 5-1: action = delete complete connection
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.9 Set

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 = set
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									msb attribute mask
	14									lsb attribute mask
	15									Attribute value of first attribute to set (size depending on the type of attribute)
										…
										Attribute value of last attribute to set (size depending on the type of attribute)
	xx-45	0	0	0	0	0	0	0	0	Padding

II.2.10 Set response

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 = 1 bits 5-1: action = set
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy 1001 = attribute(s) failed or unknown
	14									"optional attribute" mask (attributes 1-8), used with "1001" encoding: 0 = default 1 = unsupported attribute
	15									"optional attribute" mask (attributes 9-16), used with "1001" encoding: 0 = default 1 = unsupported attribute
	16									"attribute execution" mask (attributes 1-8), used with "1001" encoding: 0 = default 1 = failed attribute
	17									"attribute execution" mask (attributes 9-16), used with "1001" encoding: 0 = default 1 = failed attribute
	18-45	0	0	0	0	0	0	0	0	Padding

II.2.11 Get

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 = get
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									msb attribute mask
	14									lsb attribute mask
	15-45	0	0	0	0	0	0	0	0	Padding

II.2.12 Get response

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 = 1 bits 5-1: action = get
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy 1001 = attribute(s) failed or unknown
	14									msb attribute mask
	15									lsb attribute mask
	16									Attribute value of first attribute included (size depending on the type of attribute)
										…
										Attribute value of last attribute included (size depending on the type of attribute)
	xx-41	0	0	0	0	0	0	0	0	Padding

Field	Byte	8	7	6	5	4	3	2	1	Comments
	42									"optional attribute" mask (attributes 1-8), used with "1001" encoding: 0 = default 1 = unsupported attribute
	43									"optional attribute" mask (attributes 9-16), used with "1001" encoding: 0 = default 1 = unsupported attribute
	44									"attribute execution" mask (attributes 1-8), used with "1001" encoding: 0 = default 1 = failed attribute
	45									"attribute execution" mask (attributes 9-16), used with "1001" encoding: 0 = default 1 = failed attribute

II.2.13 Get complete connection

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 = get complete connection
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.14 Get complete connection response

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 = 1 bits 5-1: action = get complete connection
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance

Field	Byte	8	7	6	5	4	3	2	1	Comments
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14									msb ani VP Network $CTP_{B\text{-}PON}$ instance
	15									lsb ani VP Network $CTP_{B\text{-}PON}$ instance
	16									msb uni VP Network $CTP_{B\text{-}PON}$ instance
	17									lsb uni VP Network $CTP_{B\text{-}PON}$ instance
	18									msb uni/ani pointer (= msb corresponding uni instance)
	19									lsb uni/ani pointer (= lsb corresponding uni instance)
	20									msb vpi ani side
	21									lsb vpi ani side
	22									msb vpi uni side (= 0x00)
	23									lsb vpi uni side
	24	0	0	0	0	0	0	x	x	Direction 01 = uni-to-ani 10 = ani-to-uni 11 = bidirectional
	25									msb priority queue pointer ani VP Network $CTP_{B\text{-}PON}$
	26									lsb priority queue pointer ani VP Network $CTP_{B\text{-}PON}$
	27									msb priority queue pointer uni VP Network $CTP_{B\text{-}PON}$
	28									lsb priority queue pointer uni VP Network $CTP_{B\text{-}PON}$
	29									Padding
	30									lsb padding
	31									msb traffic descriptor profile pointer uni VP Network $CTP_{B\text{-}PON}$ or padding
	32									lsb traffic descriptor profile pointer uni VP Network $CTP_{B\text{-}PON}$ or padding
	33-45	0	0	0	0	0	0	0	0	Padding

II.2.15 Get all alarms

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 = get all alarms
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.16 Get all alarms response

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 = 1 bits 5-1: action = get all alarms
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13									msb of the number of subsequent commands
	14									lsb of the number of subsequent commands
	15-45	0	0	0	0	0	0	0	0	Padding

II.2.17 Get all alarms next

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 = get all alarms next
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13									msb of the command sequence number
	14									lsb of the command sequence number
	15-45	0	0	0	0	0	0	0	0	Padding

The command sequence numbers shall start from 0x00 onwards.

II.2.18 Get all alarms next response

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 = 1 bits 5-1: action = get all alarms next
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13									Entity class on which the alarms are reported
	14									msb entity instance on which the alarms are reported
	15									lsb entity instance on which the alarms are reported
	16-45	x	x	x	x	x	x	x	x	Bitmap alarms

The bitmap that is used in the Get All Alarms Next response for a given managed entity class is identical to the bitmap that is used in the alarm notifications for that managed entity class.

In the case the ONT has received a Get All Alarms Next request message in which the command sequence number is out of range, the ONT shall respond with a message in which bytes 13 to 45 are all set to 0x00. This corresponds to a response with entity class 0x00, entity instance 0x0000, and bitmap all 0x00s.

II.2.19 MIB upload

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 = MIB upload
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.20 MIB upload response

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 = 1 bits 5-1: action = MIB upload
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13									msb of the number of subsequent commands
	14									lsb of the number of subsequent commands
	15-45	0	0	0	0	0	0	0	0	Padding

II.2.21 MIB upload next

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 = MIB upload next
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13									msb of the command sequence number
	14									lsb of the command sequence number
	15-45	0	0	0	0	0	0	0	0	Padding

The command sequence numbers shall start from 0x00 onwards.

II.2.22 MIB upload next response

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 = 1 bits 5-1: action = MIB upload next
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13									Entity class of object
	14									msb entity instance of object
	15									lsb entity instance of object
	16									msb attribute mask
	17									lsb attribute mask
	18									Value of first attribute (size depending on the type of the attribute)
										...
										Value of the last attribute (size depending on the type of the attribute)
	xx-45	0	0	0	0	0	0	0	0	Padding

If the ONT receives a MIB Upload Next request message in which the command sequence number is out of range, it shall respond with a message in which bytes 13 to 45 are all set to 0x00. This corresponds to a response with entity class 0x00, entity instance 0x0000, attribute mask 0x0000, and padding from byte 18 to byte 45.

Note that, if all attributes of a managed entity do not fit within one MIB Upload Next response message, the attributes will be split over several messages. The OLT can use the information in the attribute mask to determine which attribute values are reported in which MIB upload Next response message.

II.2.23 MIB reset

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 = MIB reset
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.24 MIB reset response

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 = 1 bits 5-1: action = MIB reset
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = ONT Data
	11	0	0	0	0	0	0	0	0	msb entity instance
	12	0	0	0	0	0	0	0	0	lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.25 Alarm

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 = alarm
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									Alarm mask
										…
	42									Alarm mask
	43-44	0	0	0	0	0	0	0	0	Padding
	45									Alarm sequence number

II.2.26 Attribute value change

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 = attribute value change
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									msb attribute mask
	14									lsb attribute mask
	15									Attribute value of first attribute changed (size depending on the type of attribute)
										...
										Attribute value of last attribute changed (size depending on the type of attribute)
	xx-45	0	0	0	0	0	0	0	0	Padding

II.2.27 Test

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									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	xxxx = select test 0000 = all MLT tests 0001 = hazardous potential 0010 = foreign EMF 0011 = resistive faults 0100 = receiver off-hook 0101 = ringer 0110 = network termination 1 dc signature test 0111 = self test
	14-45	0	0	0	0	0	0	0	0	Padding

Note that a single message can be used to initiate multiple tests (if desired). Additionally, the Test message can be modified to support future extensions by adding additional encodings to any byte with a number higher than 13. This allows new tests that might be defined in the future to be supported without changing the principle of operation.

II.2.28 Test response

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 = 1 bits 5-1: action = test
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

The Test response message is an indication to the OLT that the test request is received and is being processed.

II.2.29 Start software download

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 = start software download
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13									Window size – 1
	14-17									Image size in bytes
	18-45	0	0	0	0	0	0	0	0	Padding

II.2.30 Start software download response

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 = 1 bits 5-1: action = start software download
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14									Window size – 1
	15-45	0	0	0	0	0	0	0	0	Padding

II.2.31 Download section

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	x	0						DB = 0, AR = x, AK = 0 x = 0: no response expected (section within the window) x = 1: response expected (last section of a window) bits 5-1: action = sw download section
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13									Download section number
	14-45									Data

II.2.32 Download section response

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 = 1 bits 5-1: action = sw download section
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14									Download section number
	15-45	0	0	0	0	0	0	0	0	Padding

II.2.33 End software download

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 = end software download
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13-16									CRC-32
	17-20									Image size in bytes
	21-45	0	0	0	0	0	0	0	0	Padding

II.2.34 End software download response

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 = 1 bits 5-1: action = end software download
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully (CRC correct) 0001 = command processing error (CRC incorrect) 0010 = command not supported (not applicable) 0011 = parameter error (not applicable) 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.35 Activate image

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 = activate image
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.36 Activate image response

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 = 1 bits 5-1: action = activate image
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.37 Commit image

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 = commit image
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.38 Commit image response

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 = 1 bits 5-1: action = commit image
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class = software image
	11									msb entity instance 0 = $ONT_{B\text{-}PON}$ 1, 2, ... , 127 = UNI card 129, 130, ... , 255 = ANI card
	12	0	0	0	0	0	0	x	x	lsb entity instance 00 = first instance 01 = second instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.39 Synchronize time

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	1	0						DB = 0, AR = 0, AK = 1 bits 5-1: action = synchronize time
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.40 Synchronize time response

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 = 1 Bits 5-1: action = synchronize time
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45	0	0	0	0	0	0	0	0	Padding

II.2.41 Reboot

Field	Byte	8	7	6	5	4	3	2	1	Comments
Transaction identifier	6-7									
Message type	8	0	1	0						DB = 0, AR = 0, AK = 1 bits 5-1: action = reboot
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13-45	0	0	0	0	0	0	0	0	Padding

II.2.42 Reboot response

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 = 1 bits 5-1: action = reboot
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14-45									Padding

II.2.43 Get next

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 = get next
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13									msb attribute mask
	14									lsb attribute mask
	15									msb of the command sequence number
	16									lsb of the command sequence number
	17-45	0	0	0	0	0	0	0	0	Padding

The command sequence numbers shall start from 0x00 onwards.

II.2.44 Get next response

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 =1 bits 5-1: action = get next
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	0	0	x	x	x	x	Result, reason 0000 = command processed successfully 0001 = command processing error 0010 = command not supported 0011 = parameter error 0100 = unknown managed entity 0101 = unknown managed entity instance 0110 = device busy
	14									msb attribute mask
	15									lsb attribute mask
	16									Attribute value of first attribute included (size depending on the type of attribute)
										…
										Attribute value of last attribute included (size depending on the type of attribute)
	xx-45	0	0	0	0	0	0	0	0	Padding

If the ONT receives a "Get next request" message in which the command sequence number is out of range, the ONT shall respond with a message in which bytes 13 to 45 are all set to 0x00. This corresponds to a response with entity class 0x00, entity instance 0x0000, attribute mask 0x0000, and padding from byte 16 to byte 45.

II.2.45 Test result

The "Test result" message is used to report the result of a test. Currently, it is used to report the result of a self test or the result of an MLT test. If a new test is defined in the future, the corresponding test results can be reported by the "Test result" message by extending the layout. The transaction identifier of the "Test result" message is identical to the transaction identifier of the Test message that initiated the corresponding test.

Byte 13 is used to report an MLT test result. The result is limited to the two values of "test passed" or "test failed".

Byte 14 is used to report the result of a self test. Three different results can be reported: "test passed", "test failed" and "test not completed".

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 =1 bits 5-1: action = test result
Device identifier type	9	0	0	0	0	1	0	1	0	OMCI = 0x0A
Message identifier	10									Entity class
	11									msb entity instance
	12									lsb entity instance
Message contents	13	0	0	a	b	c	d	e	f	MLT test result: 0 = fail test a/b/c/d/e/f 1 = pass test a/b/c/d/e/f a = hazardous potential b = foreign EMF c = resistive faults d = receiver off-hook e = ringer f = network termination 1 dc signature test
	14	0	0	0	0	0	0	x	x	Self test result: xx = 00: failed xx = 01: passed xx = 10: not completed
	15-45	0	0	0	0	0	0	0	0	Padding

Appendix III

Support of F4/F5 maintenance flows in the ONT

III.1 General principle

The general principle regarding F4 and F5 maintenance flows in the ONT is to use the I.610 [8] procedures wherever possible and to restrict the OMCI requirements to the strictly essential ones. The use of these procedures is largely independent of OMCI. The objective of this appendix is to clarify OMCI related aspects.

III.2 Definition of the F4/F5 segment and end-to-end applicability

III.2.1 Support of F4/F5 maintenance flows with respect to ATM-UNIs

Segment F4 maintenance flow

The ONT always behaves as a Segment end point for the F4 segment maintenance flow towards the OLT.

The VP Network $CTP_{B\text{-}PON}$ located at the UNI side is by default the Segment end point.

End-to-end F4 maintenance flow

By definition the ONT is not involved.

Segment F5 and end-to-end F5 maintenance flows

By definition the ONT is not involved.

III.2.2 Support of F4/F5 maintenance flows with respect to non-ATM-UNIs

Segment F4 and end-to-end F4 maintenance flow

The ONT always behaves as a segment end point for the F4 Segment and End-to-end maintenance flow towards the OLT.

The VP Network $CTP_{B\text{-}PON}$ that supports the Interworking VCC Termination Point is by default the Segment end point.

Segment F5 and end-to-end F5 maintenance flows

The ONT always behaves as a segment end point for the F5 Segment and End-to-end maintenance flow towards the OLT.

The Interworking VCC Termination Point is by default a Segment and End-to-end point.

III.3 OMCI support of F4/F5 flows in the ONT

III.3.1 OMCI support of AIS and RDI fault management

Report of End-to-end VP-AIS and VP-RDI, VC-AIS, VC-RDI receiving and generation alarms on the VP Network $CTP_{B\text{-}PON}$ and the Interworking VCC Termination Point respectively.

III.3.2 OMCI support of F4/F5 continuity check procedures

The activation and deactivation of the Continuity Check from the OLT as well as towards the OLT is done via in-band I.610 [8] activation and deactivation procedures. OMCI supports the reporting of Loss of Continuity alarm on the VP Network $CTP_{B\text{-}PON}$ and the Interworking VCC Termination Point.

III.3.3 OMCI support of F4/F5 loopback procedures

The ONT supports loopback point functionality. The insertion of the loopback cell and the reporting of the loopback result are not required in the ONT. The OMCI supports setting of the loopback location identifier.

III.3.4 OMCI support of F4/F5 performance monitoring

This is for further study.

Appendix IV

Traffic management options

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 7 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 impacts the OMCI. In fact, it is difficult for the specification given in this Recommendation to keep up with the 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.

IV.1 Priority queue$_{B\text{-}PON}$

When the focus is on low complexity implementation, the ONT uses the priority controlled upstream traffic method. 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 VP/VC connections to ensure that the agreed parameters are not violated and to deploy a cell 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. The MAC manages all connections from an ONT as a whole. Essentially, the MAC isolates ONTs from each other.

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

OMCI requirements

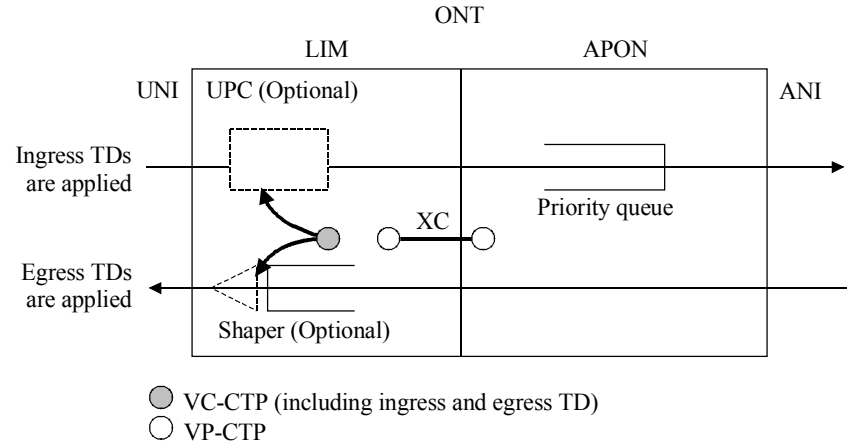
The traffic management option in the ONT$_{B\text{-}PON}$ managed entity is set to 0x00.

For the VP Network CTP$_{B\text{-}PON}$ at the ANI side

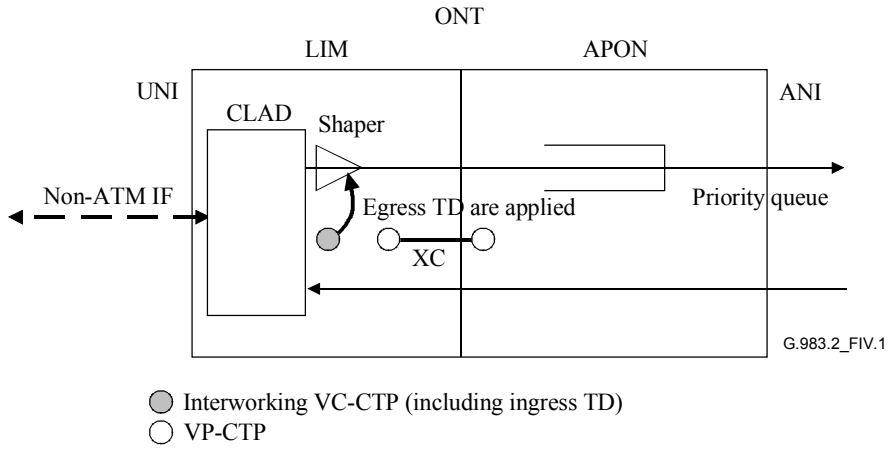
Priority Queue Pointer for Upstream: using priority Queue$_{B\text{-}PON}$ managed entity id.

IV.2 Clarification of ONT functional blocks

Figures IV.1 and IV.2 show the ONT functional blocks for the ATM UNI case and for the non-ATM UNI case.

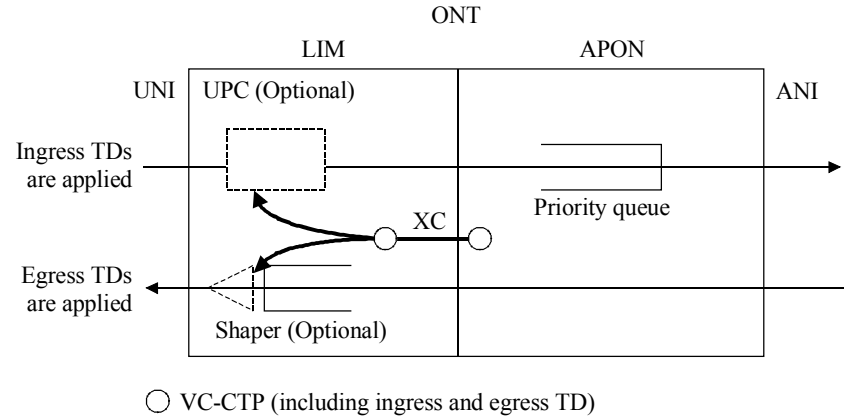


a) ATM UNI case

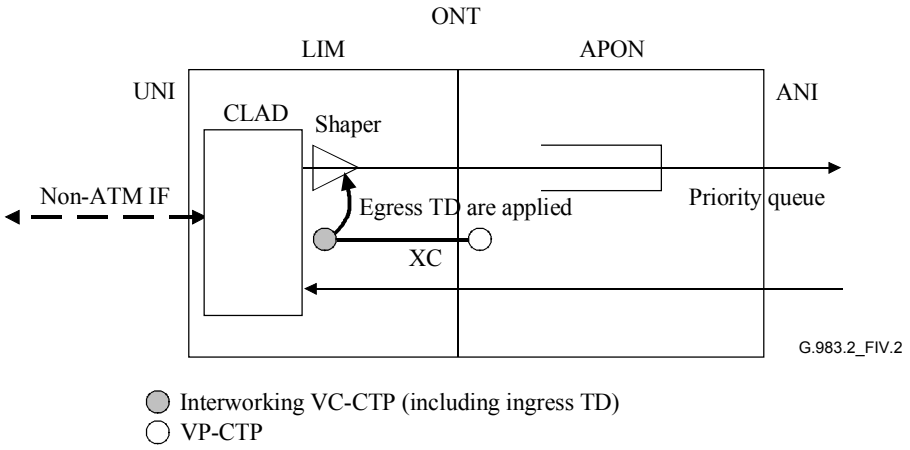


b) Non-ATM UNI case

Figure IV.1/G.983.2 – ONT functional block diagrams for VC service



a) ATM UNI case



b) Non-ATM UNI case

Figure IV.2/G.983.2 – ONT functional block diagrams for VP service

Appendix V

Bibliography

[App.V-1] ATM Forum af-nm-0020.001 (1998), *M4 Interface Requirements and Logical MIB: ATM Network Element View.*

[App.V-2] ATM Forum af-phy-0016.000 (1994), *DS1 Physical Layer Specification*.

[App.V-3] ATM Forum af-phy-0064.000 (1996), *E-1 Physical Layer Interface Specification*.

[App.V-4] ATM Forum af-phy-0029.000 (1995), *6,312 Kbps UNI Specification Version 1.0.*

[App.V-5] ATM Forum af-phy-0040.000 (1995), *Physical Interface Specification for 25.6 Mb/s over Twisted Pair Cable*.

[App.V-6] ATM Forum af-phy-0034.000 (1995), *E3 UNI*.

[App.V-7] ATM Forum af-phy-0054.000 (1996), *DS3 Physical Layer Interface Specification*.

[App.V-8] ATM Forum af-uni-0010.002 (1994), *ATM User-Network Interface Specification, Version 3.1*.

[App.V-9] ATM Forum af-tm-0056.000 (1996), *Traffic Management Specification, Version 4.0*.

[App.V-10] ITU-T Recommendation I.371.1 (2000), *Guaranteed frame rate ATM transfer capability*.

[App.V-11] ATM Forum af-vtoa-0113.000 (1999), *ATM Trunking using AAL 2 for Narrowband Services*.

[App.V-12] ATM Forum af-vmoa-0145.000 (2000), *Voice and Multimedia Over ATM – Loop Emulation Service Using AAL 2*.

[App.V-13] ATM Forum (2002), *ATM Forum well-known addresses and assigned codes.*

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
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	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
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 and open system communications
Series Y	Global information infrastructure and Internet protocol aspects
Series Z	Languages and general software aspects for telecommunication systems

23384

Printed in Switzerland
Geneva, 2003