

TR-280
ITU-T PON in the context of TR-178

Issue: 1 Amendment 1
Issue Date: April 2020

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Issue History

Issue Number	Approval Date	Release Date	Issue Editor	Changes
1	17 October 2016	14 December 2016	Vincent Buchoux, LAN Gilles Samson, LAN Hugues Le Bras, ORANGE	Original
1 Amendment 1	10 April 2020	10 April 2020	Vincent Buchoux, LAN	Added features : Extended OMCI Messages Format support, Multicast Channel White List clarifications & new requirements, Traffic Class addition and deletion, Additional counter requirements

Comments or questions about this Broadband Forum Technical Report should be directed to info@broadband-forum.org.

Editor: Vincent Buchoux, Laboratoire des Applications Numeriques (LAN)

Work Area Director(s): Marta Seda, CALIX
Samuel Chen, BROADCOM

Project Stream Leader(s): Vincent Buchoux, Laboratoire des Applications Numeriques (LAN)

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Executive Summary

Technical Report TR-280 provides architectural and network element requirements necessary to support multi-service network PON systems. Requirements from TR-280 address the business needs of operators for Enhanced QoS, Tagging operations, Enhanced Multicast Services, Alarm and Performance Statistics Management, and Enhanced Security for both business and residential markets.

TR-280 Issue 1 Amendment 1 adds the following additional requirements and clarifications:

- Extended OMCI Messages Format support
- Multicast Channel White List clarifications & new requirements
- Traffic Class addition and deletion
- Additional counter requirements and clarifications related to:
 - VID/P-bit-based statistics
 - PPTP UNI-based statistics

1 Purpose and Scope

1.1 Purpose

TR-178 [18] documents a set of architectures for a broadband multi-service network, addressing typical infrastructures, topologies and deployment scenarios, and specifies associated nodal requirements. These include copper and fibre access architectures to support business and residential, fixed and mobile, wholesale and retail markets.

TR-178 [18] specifies multiservice capabilities beyond the layer 2 based architecture of TR-101 [16] and the associated TR-156 [17], which specifies the requirements for deploying G-PON within a TR-101 [16] architecture.

Taking a similar approach to TR-101 [16] and its TR-156 derivative [17], the purpose of TR-280 [19] document is to specify the requirements for deploying G-PON [1][2][3][4], XG-PON [5][6], XGS-PON [7] and NG-PON2 [11][12][13][14] in the context of a TR-178 [18] architecture.

This Technical Report TR-280 especially aims at addressing a new set of requirements to TR-280 [19], completing its existing sets with newly added requirements and also adding new sections dealing with Enhanced functionalities.

1.2 Scope

This document specifies new PON requirements both for OLTs and ONUs and specifies updates for existing requirements within the following sections of TR-280 [19]:

- 4.2 Enhanced Multicast
- 4.3 Alarms and counters

It also revises a limited set of existing requirements TR-280 [19] : R-27, R-28.

It adds a new section to TR-280 [19] adding the support of Enhanced Functionalities (OMCI version report, Extended OMCI Messages Format, Traffic Class addition and deletion) within a new added section:

- 4.9 Enhanced functionalities

2 References and Terminology

2.1 Conventions

In this Technical Report, several words are used to signify the requirements of the specification. These words are always capitalized. More information can be found in RFC 2119 [15].

MUST	This word, or the term “REQUIRED”, means that the definition is an absolute requirement of the specification.
MUST NOT	This phrase means that the definition is an absolute prohibition of the specification.
SHOULD	This word, or the term “RECOMMENDED”, means that there could exist valid reasons in particular circumstances to ignore this item, but the full implications need to be understood and carefully weighed before choosing a different course.
SHOULD NOT	This phrase, or the phrase “NOT RECOMMENDED” means that there could exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications need to be understood and the case carefully weighed before implementing any behavior described with this label.
MAY	This word, or the term “OPTIONAL”, means that this item is one of an allowed set of alternatives. An implementation that does not include this option MUST be prepared to inter-operate with another implementation that does include the option.

2.2 References

The following references are of relevance to this Technical Report. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this Technical Report are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below.

A list of currently valid Broadband Forum Technical Reports is published at www.broadband-forum.org.

Document	Title	Source	Year
[1] G.984.2	Gigabit-capable Passive Optical Networks (G-PON): Physical Media Dependent (PMD) layer specification	ITU-T	2003
[2] G.984.2 Amd1	Gigabit-capable Passive Optical Networks (G-PON): Physical Media Dependent (PMD) layer specification Amendment 1	ITU-T	2006
[3] G.984.2 Amd2	Gigabit-capable Passive Optical Networks (G-PON): Physical Media Dependent (PMD) layer specification Amendment 2	ITU-T	2008
[4] G.984.3	Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification	ITU-T	2014
[5] G.987.2	10-Gigabit-capable passive optical networks (XG-PON): Physical media dependent (PMD) layer specification	ITU-T	2016
[6] G.987.3	10-Gigabit-capable passive optical networks (XG-PON): Transmission convergence (TC) layer specification	ITU-T	2014
[7] G.9807.1	10-Gigabit-capable symmetric passive optical network (XGS-PON)	ITU-T	2016
[8] G.988 (2017)	ONU management and control interface (OMCI)	ITU-T	2017

	specification		
[9]	G.988 (2017) Amd1 (2018)	ONU management and control interface (OMCI) specification Amendment 1	ITU-T 2018
[10]	G.988 (2017) Amd2 (2019)	ONU management and control interface (OMCI) specification Amendment 2	ITU-T 2019
[11]	G.989.2	40-Gigabit-capable passive optical networks 2 (NG-PON2): Physical media dependent (PMD) layer specification	ITU-T 2019
[12]	G.989.3	40-Gigabit-capable passive optical networks (NG-PON2): Transmission convergence layer specification	ITU-T 2015
[13]	G.989.3 Amd 1	40-Gigabit-capable passive optical networks (NG-PON2): Transmission convergence layer specification Amendment 1	2016
[14]	G.989.3 Amd 2	40-Gigabit-capable passive optical networks (NG-PON2): Transmission convergence layer specification Amendment 1	2018
[15]	RFC 2119	Key words for use in RFCs to Indicate Requirement Levels	IETF 1997
[16]	TR-101 Issue 2	Migration to Ethernet-Based Broadband Aggregation	BBF 2011
[17]	TR-156 Issue 4	Using G-PON Access in the context of TR-101	BBF 2017
[18]	TR-178 Issue 2	Multi-service Broadband Network Architecture and Nodal Requirements	BBF 2017
[19]	TR-280	ITU-T PON in the context of TR-178	BBF 2016

2.3 Definitions

The following terminology is used throughout this Technical Report.

dual-managed ONU	Per G.988 [8], « A dual-managed ONU is defined as two management domains that may control the same physical device. The VEIP ME is the data plane demarcation point between the two management domains, with the OMCI managing everything from the VEIP to the ANI. The management protocol on the other side is not specified. »
ODN	Optical Distribution Network: The physical medium that connects an OLT to its subtended ONUs. The ODN is comprised of various passive components, including the optical fiber, splitter or splitters, and optical connectors.
OLT	Optical Line Terminal (OLT): A device that terminates the common (root) endpoint of an ODN, implements a PON protocol, and adapts PON PDUs for uplink communications over the provider service interface. The OLT provides management and maintenance functions for the subtended ODN and ONUs.
ONU	Optical Network Unit (ONU): A generic term denoting a functional element that terminates any one of the distributed (leaf) endpoints of an ODN, implements a PON protocol, and adapts PON PDUs to subscriber service interfaces. In some contexts an ONU supports interfaces for multiple subscribers.
Single User port ONU	An integrated Single User port ONU device is an ONU integrating and implementing Ethernet type user interface connections (that is, the U-interface of TR-156 [17]) that operates exclusively on and below Layer 2 of the protocol stack. In particular, a Single User port ONU excludes any IP routing or NAT functionality.

Residential Gateway ONU	An integrated Residential Gateway ONU device is an ONU that combines the Layer 2 functionality with that of the residential gateway, i.e. that includes additional Layer-3 (IP routing) functionality as defined as “RG” below. The connection between the ONU subcomponent and RG subcomponent is made through a virtual (VEIP or PPTP) managed entity.
PON	Passive Optical Network. A PON includes the OLT, ONU, and Optical Distribution Network (ODN).
Residential Gateway (RG)	A Residential Gateway is a device that interfaces between the WAN and LAN IP environment for a consumer broadband customer. It may route or bridge traffic, depending on its configuration and specifications.

2.4 Abbreviations

The abbreviations from TR-280 [19] are used throughout this Technical Report and are enriched with the following new abbreviations:

ARP	Address Resolution Protocol
CRC	Cyclic Redundancy Check
DHCP	Dynamic Host Configuration Protocol
IGMP	Internet Group Management Protocol
ME	Managed Entity
MIB	Management Information Base
PM	Performance Monitoring
VID	Virtual local area network Identifier
VLAN	Virtual Local Area Network

3 Technical Report Impact

3.1 Energy Efficiency

TR-280 has no impact on energy efficiency.

3.2 Security

TR-280 has no impact on security.

3.3 Privacy

TR-280 has no impact upon privacy.

4 Amended TR-280 sections

4.2 Enhanced Multicast

4.2.1 Addition of new requirements to section “§4.2 Enhanced Multicast”

This amendment modifies the content of §4.2 *Enhanced Multicast* from TR-280 [19] by adding the following requirements below:

----- *beginning of added text* -----

[R-75] The ONU MUST support the deletion of an entry into the Dynamic Access Control List table in the Multicast Operation Profile ME without causing any reboot, or MIB reset.

[R-76] The ONU MUST support the deletion of entries into the Dynamic Access Control List table in the Multicast Operation Profile ME without causing any packet loss on existing traffic flows from all the traffic classes and existing active Multicast Groups (as defined in TR-156, R-76).

[R-77] The ONU MUST support the addition of an entry into the Dynamic Access Control List table in the Multicast Operation Profile ME without causing any reboot, or MIB reset.

[R-78] The ONU MUST support the addition of entries into the Dynamic Access Control list table in the Multicast Operation Profile ME without causing any packet loss on existing traffic flows from all the traffic classes and existing active Multicast Groups (as defined in TR-156, R-76).

[R-79] The ONU MUST support the modification of the Maximum Simultaneous Groups in the Multicast Subscriber Config Info ME without causing any reboot, or MIB reset.

[R-80] The ONU MUST support the modification of the Maximum Simultaneous Groups in the Multicast Subscriber Config Info ME without causing any packet loss on existing traffic flows from all the traffic classes and existing active Multicast Groups (as defined in TR-156, R-76).

Note: If the Maximum Simultaneous Groups value is decreased, no packet loss is expected on the existing active Multicast Groups until the Multicast Channel Subscriber leaves the channel. For example, at the beginning 4 channels are allowed and the Multicast Channel Subscriber receives 4 channels, then the Maximum Simultaneous Groups is reconfigured to 3. If the Multicast Channel Subscriber leaves a channel, then the associated Multicast Channel is stopped. If the Multicast Channel Subscriber wants to subsequently join a 4th channel, the ONU MUST deny joining the 4th channel because the Maximum Simultaneous Groups is already reached.

[R-81] The ONU MUST support the modification of the Maximum Multicast Bandwidth in the Multicast Subscriber Config Info ME without causing any reboot, or MIB reset.

[R-82] The ONU MUST support the modification of the Maximum Multicast Bandwidth in the Multicast Subscriber Config Info ME without causing any packet loss on existing traffic flows from all the traffic classes and existing active Multicast Groups (as defined in TR-156, R-76).

Note: If the Maximum Multicast Bandwidth value is decreased, no packet loss is expected on the existing active Multicast Groups until the Multicast Channel Subscriber leaves the channel. For example at the beginning 50Mbit/s for multicast traffic is allowed and the Multicast Channel Subscriber reaches the 50Mbit/s, then the Maximum Multicast Bandwidth is set to 45Mbit/s. If the Multicast Channel Subscriber leaves a channel of 5Mbit/s then the associated Multicast Channel is

stopped. If the Multicast Channel Subscriber wants to join another channel, the ONU MUST deny the joining as the Maximum Multicast Bandwidth is already reached.

[R-83] The ONU MUST support 1024 entries in the Dynamic Access Control list table in the Multicast Operation Profile ME when the Multicast Access Control table is used for admission control.

----- end of added text -----

4.3 Alarms and counters

4.3.1 Addition of an introductory text to section “§4.3 Alarms and counters”

The following text is introduced after the first sentence of section “§4.3 Alarms and counters”:

----- beginning of added text -----

The VLAN ID (VID) and VLAN priority (P-bit) in the following text refer to the outermost (first) VLAN tag, if a frame carries more than one VLAN tag.

----- end of added text -----

4.3.2 Modification of requirements [R-27], [R-28]

The requirements [R-27] & [R-28] from section “§4.3 Alarms and counters” are updated and replaced by the following text below:

----- beginning of replacing text -----

- [R-27] Ethernet counters (32 bit) MUST report
- received frames
 - sent frames
 - dropped received upstream frames due to MAC layer CRC errors
 - received multicast frames
 - sent multicast frames

- [R-28] [R-28] Ethernet counters (64 bit) SHOULD report
- received frames
 - sent frames
 - dropped received upstream frames due to MAC layer CRC errors
 - received multicast frames
 - sent multicast frames

Note:

- Received frames and received multicast frames are counted at the UNI in upstream direction and at the GEM port level in downstream direction.
- Dropped frames due to MAC layer CRC errors are reported only on the UNI in upstream direction and not per VID or P-bit. Counting dropped frames is not applicable in the downstream direction.

----- end of replacing text -----

4.3.3 Addition of new requirements to section “§4.3 Alarms and counters”

This amendment modifies the content of §4.3 *Alarms and counters* from TR-280 [19] by adding the following requirements below:

----- beginning of added text -----

[R-84] The ONU MUST support that counters belonging to Ethernet Frame Extended PM ME instances with a matching criterion be incremented for one of the following scenarios: (all frames and VID) or (all frames and VID+P-bit) or (all frames and P-bit).

Note: An OLT may create two or more Extended PM ME instances on a monitoring point: one Extended PM ME instance to count all received frames without regard to VID or P-bit, other Extended PM ME instances to filter the collected PM data based on the matching VID, or P-bit, or VID + P-bit. If a received Ethernet frame matches the specific filtering criteria defined in one of the other Extended PM ME instances, the ONU needs to increment the corresponding counters in the Extended PM ME instance with the matching filtering criteria, and in the Extended PM ME instance that counts all received frames.

[R-85] The OLT MUST support the instantiation of at least 16 Ethernet Frame Extended PM Managed Entity instances when the ONU is provisioned.

Note: The use case that explains the 16 Extended PM ME instances is the following. Consider an ONU that has 4 bidirectional traffic flows and 4 GEM ports, each traffic flow corresponds to a traffic class (as per [R-46] in TR-156 [17]), and one GEM port per traffic class (as per [R-7] in TR-156 [17]). Such ONU is required to support:

- 8 Extended PM ME instances on the U-interface (i.e., 1 ME instance per traffic class per upstream/downstream direction).
- 8 Extended PM ME instances on the R/S interface (i.e., 1 ME instance per GEM port per upstream/downstream direction).

[R-86] The ONU MUST support the instantiation of at least 16 Ethernet Frame Extended PM Managed Entity instances.

Note: Refer to the note in [R-85] for the example use case.

----- end of added text -----

4.9 Enhanced functionalities

This amendment extends the content of TR-280 [19] by adding a new sub-section *4.9 Enhanced functionalities* as described below.

The following text below is added to TR-280 [19] after section 4.8:

----- beginning of added text -----

4.9 Enhanced functionalities

[R-87] The ONU MUST report the supported OMCI version with the ONU2-G ME.

- [R-88] The OLT SHOULD support Extended OMCI Message format.
- [R-89] The ONU MUST support Extended OMCI Message format if ME ONU2-G reports support of Extended OMCI Message format.
- [R-90] The ONU MUST support traffic class deletion (traffic class as described in TR-156 Section 5) without causing any reboot, or MIB reset.
- [R-91] The ONU MUST support the deletion of a traffic class (traffic class as described in TR-156 Section 5) without causing any packet loss on existing traffic flows from other traffic classes.
- [R-92] The ONU MUST support traffic class addition (traffic class as described in TR-156 Section 5) without causing any reboot, or MIB reset.
- [R-93] The ONU MUST support the addition of a traffic class (traffic class as described in TR-156 Section 5) without causing any packet loss on existing traffic flows from other traffic classes when the addition does not cause any congestion in the ONU.

----- end of added text -----

End of Broadband Forum Technical Report TR-280